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The effect of active exercise and relaxation-based on psychological well-being, functional ability, and independence in the older adults

Yulvia Miftachurochmah[1ABCD], Cerika Rismayanthi[2ABCDE], Rizki Mulyawan[2BCDE], Gallant Pamungkas[2BCD]

[1] *Department of Health and Sport, Universitas Negeri Yogyakarta, Indonesia*
[2] *Department of Sport Science, Universitas Negeri Yogyakarta, Indonesia*

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Abstract

Background and Study Aim: The global increase in the aging population presents significant challenges to public health systems. Older adults often face physical and psychological decline. These changes can negatively affect their independence and quality of life. The aim of this study is to evaluate the impact of a combined intervention involving active exercise and relaxation on psychological well-being, physical function, and independence in community-dwelling older adults.

Material and Methods: A one-group pretest-posttest design was used. The study involved 47 older adults aged 60 years and above. The intervention consisted of 12 sessions conducted over several weeks. It integrated movement-based activities and relaxation techniques. Assessments included Ryff's Psychological Well-Being (PWB) scale, Activities of Daily Living (ADL), Instrumental Activities of Daily Living (IADL), Chair Stand Test, Sit and Reach, and Hand Grip Strength (HGS). Data were analyzed using paired t-tests and Wilcoxon tests, depending on the distribution of the data.

Results: Statistically significant improvements were observed across all measured domains. Psychological well-being increased significantly ($t = 3.733$, $p = 0.001$), reflecting a moderate effect. Functional gains were also noted in lower-body strength, flexibility, and hand grip performance. Notably, improvements in instrumental activities of daily living (IADL) reached high statistical significance ($Z = -4.762$, $p < 0.001$), indicating enhanced independence. These findings suggest that the intervention positively influenced both physical and psychological functioning in older adults.

Conclusions: These findings suggest that short-term active and relaxation-based interventions can be effective promotive and preventive strategies in elderly healthcare. They may contribute to improved quality of life in aging populations.

Keywords: older adults, active exercise, relaxation, psychological well-being, functional ability, independence.

Introduction

The process of aging brings a range of physical, cognitive, and emotional changes. These changes can increase vulnerability to disease, disability, and social isolation. As the global aging population continues to grow, there is an urgent need for effective strategies to support health, autonomy, and well-being in later life.

The aging process is inevitably accompanied by a range of physiological, psychological, and social changes that may adversely impact the quality of life in older adults [1, 2, 3]. Physiological decline, particularly in muscle strength and balance, often leads to a reduction in functional ability. This, in turn, limits the capacity to perform daily tasks independently. Psychological challenges such as loneliness, anxiety, and depression are also common among older individuals. These conditions contribute significantly to the deterioration of mental health [4, 5]. In this context, psychological well-being (PWB), functional ability, and independence emerge as interrelated components that are vital to maintaining a high quality of life in later life [6, 7, 8]. These domains are closely interconnected and mutually reinforcing. A decline in one can negatively affect the others [9]. Given the growing proportion of the aging population worldwide, there is an urgent need to identify and implement preventive strategies that address these interconnected dimensions of well-being in older adults.

A substantial body of evidence supports the role of physical activity in preserving functional capacity and promoting independence among older adults. Structured exercise programmes, especially those that combine low-impact aerobic movements with flexibility training, have been shown to enhance mobility, muscular strength, balance, and other health indicators [10, 11, 12]. These improvements often lead to greater autonomy in performing activities of daily living (ADLs) and instrumental activities of daily living (IADLs) [13, 14]. In contrast, mindfulness-based interventions (MBIs) are consistently associated with mental health benefits. These include reduced anxiety and depressive symptoms, improved emotional regulation, and

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higher self-esteem. However, several studies suggest that while physical exercise can improve functional ability and independence, its effect on psychological well-being is relatively modest when exercise and MBIs are applied separately [15].

Current literature indicates that most intervention studies have examined the effects of structured physical activity and mindfulness practice independently. Research on structured physical activity programmes has frequently focused on fitness outcomes [16], physical health [17], mobility [18, 19], independence [13], and other aspects related to physical function [13]. In contrast, studies on mindfulness-based interventions (MBIs) have primarily investigated psychological outcomes such as insomnia [20, 21], stress [22], depression [23], cognitive performance [15, 24], and emotional regulation [23]. However, few studies have explored psychological well-being (PWB). This separation of focus highlights a critical research gap, especially considering the complex and multidimensional nature of well-being in older adults [9]. Some studies have directly compared the effects of physical exercise and mindfulness training on vitality [25]. In addition, previous research [26] has shown that while physical activity alone can improve quality of life, its effect is less substantial than that of combined interventions integrating both physical exercise and mindfulness. This is particularly true when improvements in both physical and mental health dimensions are considered.

Although several recent studies have attempted to integrate physical and mental training, very few have systematically combined structured physical activity with mindfulness-based practice within a single, unified intervention framework. Most of these programmes have used walking as the primary form of exercise [27, 28, 29]. To the best of our knowledge, interventions that pair body-weight resistance training with mindfulness techniques are rare. Other studies have included both physical and mental components but delivered them sequentially rather than concurrently. For example, studies [24, 30] scheduled a structured exercise session followed by a mindfulness-based stress reduction component to examine effects on cognitive performance in older adults. Study [31] augmented a physical activity programme with health education and reminiscence therapy to evaluate its impact on spiritual well-being. Some research has delivered concurrent interventions that combine physical exercise with relaxation training, breathing exercises, or meditation techniques [32].

Analysis of previous studies has shown that both structured physical activity and mindfulness-based interventions offer distinct benefits for older adults. Researchers have found that physical activity enhances functional capacity and independence, while mindfulness practice improves various aspects of mental health. Authors have emphasized the importance of addressing both physical and psychological dimensions of aging to support overall well-being. However, despite numerous investigations, there remains a clear need for more comprehensive research that integrates these two approaches within a single intervention. Overall, empirical evidence remains limited regarding the synergistic benefits of delivering structured physical activity and mindfulness practice simultaneously within a unified model. This is especially evident in studies targeting the interconnected domains of psychological well-being, functional ability, and independence.

The aim of this study is to evaluate the impact of a combined intervention involving active exercise and relaxation on psychological well-being, physical function, and independence in community-dwelling older adults.

Materials and Methods

Participants

The subjects of this study were older adults aged 60 to 70 years, selected through purposive sampling based on the following inclusion criteria:

1. Ability to communicate effectively and follow instructions.
2. Health condition permitting participation in light to moderate physical exercise.
3. Willingness to complete the entire research program and provide informed consent.

The exclusion criteria were as follows:

1. Presence of chronic illnesses or medical conditions that restricted physical activity.
2. Current participation in therapy or other interventions that could influence study outcomes.

Of the 61 individuals initially screened, 9 did not meet the inclusion criteria due to health limitations and communication difficulties. Additionally, 5 others declined to participate after being informed about the study procedures. Their withdrawal was primarily due to mobility-related concerns such as knee pain, shoulder discomfort, and other joint issues. As a result, a total of 47 participants were enrolled and successfully completed the intervention program. The average attendance rate was 91.3%. A total of 39 participants (82.9%) completed all sessions, while 8 participants (17.0%) attended at least 10 sessions. No participants withdrew from the study, resulting in a 0% attrition rate.

The characteristics of the participants are presented in Table 1. The sample consisted of older adults between 60 and 70 years of age. On average, participants were within the normal range for height, body weight, and BMI, although individual values showed considerable variability. Cardiovascular indicators such as blood pressure and heart rate also

varied widely, reflecting the expected heterogeneity in an aging population. Similarly, body composition parameters, including BMI and body fat percentage, indicated a broad range of physical conditions among participants. These descriptive statistics provide a general overview of the sample's demographic and health-related profile.

Table 1. Participant Characteristics

Indicator	N	Min	Max	Mean	SD
Age (years)	47	60.00	70.00	63.60	4.45
Height (cm)	47	145.00	160.00	152.80	4.29
Weight (kg)	47	38.90	83.50	59.89	11.98
Systolic BP (mmHg)	47	87.00	188.00	138.38	22.13
Diastolic BP (mmHg)	47	61.00	134.00	82.80	12.35
Heart Rate (bpm)	47	60.00	109.00	84.63	13.45
BMI (kg/m²)	47	16.70	37.60	25.70	5.02
Body Fat (%)	47	19.70	45.00	36.61	6.18

Ethical Considerations

This study received ethical approval from the Research Ethics Committee, Directorate of Research and Community Service, Universitas Negeri Yogyakarta (Approval No. T/6.23/UN34.9/KP.06.07/2024). All participants were informed about the study's purpose, procedures, potential risks, and benefits before providing written informed consent. Confidentiality and anonymity were strictly maintained throughout the research process. Participants were free to withdraw at any time without consequence. The study was conducted in accordance with established ethical research principles to protect the rights and dignity of all participants.

Research Design

This study employed a one-group pretest–posttest design to analyze the effects of active exercise and relaxation on psychological well-being (PWB), functional ability, and independence in older adults. Participants were assessed before and after a 12-session intervention conducted over four weeks. The intervention was implemented without a control group. It is important to note that the absence of a control group represents a significant limitation, as it introduces potential confounding variables and threats to internal validity. Despite this, the study serves as an initial exploratory effort intended to inform future research. Accordingly, the findings should be interpreted with caution. The study was conducted in a community setting for older adults located in Sleman Regency, Indonesia. Participants attended three sessions per week, each lasting approximately 60 minutes. All sessions were led by certified instructors specializing in exercise and mindfulness. Participant safety was monitored throughout each session, and any adverse symptoms were recorded. Before enrollment, all individuals received a detailed explanation of the study's objectives, procedures, and potential risks. Adherence was tracked using attendance records throughout the intervention period.

This study involved three procedures: the initial measurement phase (pre-test), the intervention phase, and the final measurement phase (post-test). The same participants were evaluated in both the pre-test and post-test phases using identical measurement protocols to ensure within-subject comparison. The procedures are outlined as follows:

1.Pre-test

During the pre-test phase, baseline measurements were conducted to assess psychological well-being (PWB), functional ability, and independence. The same assessment protocols were applied again during the post-test phase to ensure consistency and comparability of results within participants.

2.Intervention

In this study, the intervention was delivered three times per week over the course of one month, with each session lasting approximately 60 minutes. The program combined physical (active) exercise, including stretching and bodyweight exercises, with relaxation exercises based on mindfulness training. Both formal and informal mindfulness approaches were incorporated. Formal mindfulness practice consisted of instructor-guided sessions delivered at specific points during the program. In contrast, informal practice involved gradually training participants to apply mindfulness cues independently during the core exercise phase, while remaining under continuous supervision and guidance. This informal component aimed to foster the habit of self-directed mindfulness during physical activity, such as maintaining awareness of breathing, bodily sensations, or muscle engagement during movement.

The mindfulness program, as shown in Table 2, was adapted and modified from the Mindfulness-Based Stress Reduction (MBSR) framework developed by Kabat-Zinn [33]. The active exercise component included stretching and bodyweight movements, along with selected postures commonly found in yoga. These exercises were designed to target major muscle groups typically engaged in flexibility, strength training, and posture-improvement programs for older adults [34, 35, 36].

The progression of exercises was deliberately structured to start with simpler movements and gradually increase in complexity and intensity toward the end of each session, as outlined in Table 3.

Each session was structured into three phases: opening, core activity, and closing. The opening phase included an introduction to basic mindfulness concepts and was conducted through formal

Table 2. Active Exercise Program

No	Session 1	Session 2	Session 3
0	Relaxation pose (sitting upright)	Relaxation pose (sitting upright)	Relaxation pose (sitting upright)
1	Shoulder Blade Squeeze	Floor Angel	Standing spinal twist
2	Seated Shoulder & Overhead Stretch	Supine chin tuck	Squat/Chair pose
3	Seated chin tuck	Dead Bug	Side to side butt kick
4	Standing up from chair	Heel touch	Standing heel raises
5	Heel Raises Chair	Bridge pose	Standing elbow to knee crunch
6	Wall Push Up	Standing up from floor	Shoulder press up
7	Tree poses*	Standing Knee to Chest*	Upward forward fold pose*
8	Warior Poses II*	Split Squat	Crunches
9	Worlds greatest stretch	Warior pose I*	Flutter kick
10	Standing forward bend*	Plank pose*	Double Leg Knee to Chest*
11	Seated Straddle	Kneeling Superman*	Side lying Thoracic rotation*
12	Butterfly pose*	Butterfly pose*	Cat and Cow Face
13	Reclining Bound Angle Pose*	Reclining Bound Angle Pose*	Child pose and Cobra pose*
0	Corpse pose (motivational prompts, etc.)	Corpse pose (motivational prompts, etc.)	Corpse pose (motivational prompts, etc.)

Note: *) The exercise is performed in a timed count (in seconds).

Table 3. Mindfulness Practice Program

Type	Stage	Week 1	Week 2	Week 3	Week 4
FORMAL*	Opening	Basic Breathing	Mindful movement	Sitting with awareness	Looking at problems without making them worse
	Closing	Mindfulness of breathing	Full body scan	Walking meditation	Attitudes and Commitment
INFORMAL**	During exercise	Get in touch with what you are doing: Am I Here now? Am I Awake? Do I Know what I am doing right now? How does my body feel right now? What is my mind up to? Etc.			"Being an ally in your own life" and "Moment-to-moment awareness of daily experience"

Note: *) Formal practice was conducted at the beginning and end of each session, before and after the active exercise component. **) Informal practice was carried out during the active exercise phase.

guided practice. This phase aimed to promote mental calmness, enhance internal focus, and psychologically prepare participants for the session. The core phase involved active exercises, including stretching and bodyweight movements, integrated with informal mindfulness. Participants were guided to use specific cues such as focusing on their breath, muscle sensations, or movement patterns. This integration was intended to enhance mind–body awareness and support the psychological benefits of physical activity, in line with the principles of mindful movement, as practiced in mindful yoga and other forms of conscious exercise. The closing phase consisted of formal relaxation techniques led by the instructor. These included practices such as mindful breathing, full body scans, or walking meditation. This phase was designed to deepen the mindfulness experience and support a return to parasympathetic nervous system dominance, a physiological state essential for health and recovery in older adults.

It should be noted that the mindfulness content varied across the four-week intervention. However, the training was delivered as a cumulative and integrated program, with each week's content building upon the previous one. For example, the first week focused on basic breathing techniques and mindfulness of breathing, which served as the foundation for full body scan and mindful movement

practices introduced in the second week. Earlier practices were revisited and reinforced in later sessions to support skill retention and integration.

Week 4 differed slightly from the previous weeks, as the mindfulness program during this phase emphasized self-reflection on personal experiences, challenges, life goals, and how to view them more positively. This final week was designed to strengthen participants' confidence in facing challenges, making decisions, and acting in accordance with their personal values, which are key components of self-efficacy.

3.*Post-test*

Post-test measurements were conducted using the same instruments and procedures as in the pre-test phase. All assessments were administered to the same participants to enable within-subject comparison and evaluate changes in psychological well-being (PWB), functional ability, and independence following the intervention.

Measurement Instruments

Ryff's Psychological Well-Being Scales (Short Version) was used to measure PWB. This instrument is based on the psychological well-being model developed by Carol Ryff [37].

To assess functional ability, three indicators were used:

1. *Chair Stand Test* – This test measures lower body strength required for tasks such as climbing stairs, walking, and standing up from a chair, bathtub, or car. It is also used to estimate fall risk in older adults.
2. *Chair Sit and Reach* – A modified version of the traditional sit-and-reach test. It evaluates lower body flexibility by assessing how far the participant can reach toward the toes while seated.
3. *Handgrip Test* – This test measures handgrip strength and is widely used as an indicator of general health and well-being in older populations.

To measure independence, two additional instruments were used:

- *Activities of Daily Living (ADLs)* – This scale evaluates an individual's ability to perform basic self-care tasks essential for daily functioning [38].
- *Instrumental Activities of Daily Living (IADLs)* – This scale assesses the ability to perform more complex activities necessary for independent living within the community [39].

Statistical Analysis

This study included both parametric data (i.e., psychological well-being and functional ability) and non-parametric data (i.e., independence, as measured by ADL and IADL). Accordingly, two statistical approaches were applied. For parametric analyses, assumption testing was conducted to assess data normality using the Shapiro–Wilk test and homogeneity of variances using Levene's test. A significance level of $p > 0.05$ was used to confirm that assumptions for the paired sample t-test were met. In contrast, the ADL and IADL variables did not meet the normality assumption (Shapiro–Wilk $p < 0.05$) and were therefore analyzed using the Wilcoxon signed-rank test, which does not require normality or homogeneity assumptions. Both the paired sample t-test and the Wilcoxon signed-rank test were used to evaluate differences between pre- and post-intervention scores within the same group. Statistical significance was set at $p < 0.05$. Effect sizes were also calculated: Cohen's d for the paired sample t-test and rank-biserial correlation for the Wilcoxon signed-rank test. Effect size interpretation followed conventional thresholds: 0.2 as small, 0.5 as moderate, and 0.8 as large. All statistical analyses were performed using IBM SPSS Statistics, version 26.

Results

Descriptive statistics were used to summarize the pre-test and post-test scores for psychological well-being, independence, and functional ability among the older adult participants. These results are presented in Table 4.

As shown in Table 4, descriptive statistics were used to summarize the pre-test and post-test scores for psychological well-being, independence, and functional ability among older adult participants. Overall, these results indicate consistent improvements across all measured domains following the intervention. Psychological well-being, as measured by Ryff's PWB scale, showed a notable increase in mean score from pre- to post-test. Improvements were also observed in independence, with both ADL and IADL scores reflecting positive changes, particularly a substantial gain in IADL performance. Functional ability measures demonstrated enhanced outcomes as well. Participants performed more repetitions in the Chair Stand test, reached further in the Sit and Reach test, and showed marked increases in hand grip strength for both hands. These trends collectively suggest improvements in strength, flexibility, and daily functional capacity.

Before conducting the parametric statistical analysis to test the effect of active exercise and relaxation on psychological well-being, functional ability, and independence in older adults, a normality test was first performed using the Shapiro–Wilk test. This test is used to determine whether the data for each variable are normally distributed, which is a prerequisite for using parametric analysis. The results of the normality test are presented in Table 5.

Normality assumptions, as shown in Table 5, were evaluated using the Shapiro–Wilk test for each indicator variable. The results indicated that Ryff's Psychological Well-Being (PWB) score was

Table 4. Descriptive Statistic

Variabel	Indicator	Group	Mean±SD	Δ Mean ± SD
Psychological Well-Being	Ryff's PWB	Pre	76.06±6.56	3.36±6.17
		Post	79.42±5.48	
Independence	ADL	Pre	2.68±1.54	1.04±1.92
		Post	3.72±1.52	
	IADL	Pre	2.59±1.88	2.44±2.52
		Post	5.04±1.64	
Functional Ability	CS	Pre	10.02±3.31	2.17±4.32
		Post	12.19±3.20	
	S&R	Pre	-4.70±4.04	-2.21±5.22
		Post	-2.48±3.24	
	HGL	Pre	11.71±4.89	3.52±6.28
		Post	15.24±4.50	
	HGR	Pre	14.09±4.28	3.58±5.93
		Post	17.67±4.38	

Note. PWB – Psychological Well-Being; ADL – Activities of Daily Living; IADL – Instrumental Activities of Daily Living; CS – Chair Stand; S&R – Sit and Reach; HGL – Hand Grip Left; HGR – Hand Grip Right; Δ Mean ± SD – Mean difference between pre- and post-test scores with standard deviation.

Table 5. Normality Test Results

Variabel	Indicator	Shapiro-Wilk		
		Statistic	df	Sig.
Psychological Well-Being	Ryff's PWB	0.990	46	0.716
Independence	ADL	0.949	46	0.001
	IADL	0.962	46	0.008
Functional Ability	Chair Stand	0.981	46	0.184
	Sit and Reach	0.975	46	0.065
	Hand Grip (Left Hand)	0.974	46	0.062
	Hand Grip (Right Hand)	0.977	46	0.103

Note. PWB – Psychological Well-Being; ADL – Activities of Daily Living; IADL – Instrumental Activities of Daily Living

normally distributed, W(94) = .990, p = .716, as were all indicators of functional ability, including Chair Stand, W(94) = .981, p = .184; Sit and Reach, W(94) = .975, p = .065; Hand Grip (Left), W(94) = .974, p = .062; and Hand Grip (Right), W(94) = .977, p = .103. Since all p-values for these variables were greater than .05, the assumption of normality was satisfied. These variables were analyzed using parametric tests, specifically the paired sample t-test. In contrast, the indicators of independence, namely Activities of Daily Living (ADL) and Instrumental Activities of Daily Living (IADL), did not meet the normality assumption. Specifically, ADL, W(94) = .949, p = .001, and IADL, W(94) = .962, p = .008, showed statistically significant deviations from a normal distribution. Therefore, these variables were analyzed using a nonparametric test, the Wilcoxon signed-rank test.

After the normality test, the next step was to assess the homogeneity of variances across data groups. Levene's test was used to verify whether the variances of each variable were homogeneous. The results of the homogeneity test for all variables are presented in Table 6.

The results of the homogeneity of variances test were assessed using Levene's test for all variables. As presented in Table 6, Ryff's Psychological Well-Being (PWB) met the assumption of equal variances, F(1, 92) = 2.518, p = .116. All indicators of functional ability also satisfied the homogeneity assumption: Chair Stand, F(1, 92) = 0.000, p < .001; Sit and Reach, F(1, 92) = 2.965, p = .088; Hand Grip (Left), F(1, 92) = 0.051, p = .822; and Hand Grip (Right), F(1, 92) = 0.078, p = .781. The independence variables demonstrated homogeneity of variances as well. For ADL, F(1, 92) = 0.001, p = .979, and for IADL, F(1, 92)

= 0.773, p = .381. Since all p-values were greater than .05, the assumption of homogeneity of variances was considered met for all variables.

In summary, the assumption tests for psychological well-being and functional ability confirmed both normal distribution and equal variances. Therefore, these variables were analyzed using the parametric paired t-test to assess pre- and post-test differences. The results of this analysis are presented in Table 7.

In contrast, the assumption tests for the independence variables (ADL and IADL) indicated non-normal distribution based on the results of the Shapiro–Wilk test. Although Levene's test confirmed homogeneity of variances, the violation of the normality assumption prevented the use of the paired t-test. Consequently, ADL and IADL were analyzed using the non-parametric Wilcoxon signed-rank test to evaluate pre- and post-test differences. The results of this analysis are presented in Table 8.

As shown in Table 7, a paired samples t-test was conducted to assess the effects of active exercise and relaxation on psychological well-being and functional ability in older adults (n = 47). The results indicated statistically significant improvements across all measured indicators. Psychological well-being, as assessed by Ryff's PWB scale, improved significantly, with a moderate effect size. Similarly, all measures of functional ability, including Chair Stand, Sit and Reach, and hand grip strength for both hands, showed statistically significant enhancements. Effect sizes ranged from small to moderate, with some classified as large. These findings reflect meaningful improvements in strength, flexibility, and overall physical performance. Overall, the results suggest that the intervention had a positive and measurable impact on both psychological and physical functioning in the older adult population.

Since the data for the independence variable in both the ADL and IADL indicators were not

Table 6. Homogeneity Test Results

Variabel	Indicator	Levene Statistic	df1	df2	Sig.
Psychological Well-Being	Ryff's PWB	2.518	1	92	0.116
Independence	ADL	0.001	1	92	0.979
	IADL	0.773	1	92	0.381
Functional Ability	Chair Stand	0.000	1	92	0.983
	Sit and Reach	2.965	1	92	0.088
	Hand Grip (Left Hand)	0.051	1	92	0.822
	Hand Grip (Right Hand)	0.078	1	92	0.781

Note. PWB – Psychological Well-Being; ADL – Activities of Daily Living; IADL – Instrumental Activities of Daily Living

Table 7. Paired Samples t-Test Results

Variabel	Indicator	t-value	p value	Cohen d	95% CI	
					Upper	Lower
Psychological Well-Being	Ryff's PWB	3.733	0.001	-0.544	-0.848	-0.235
Functional Ability	Chair Stand Sit and Reach	3.440	0.001	-0.501	-0.802	-0.195
	Hand Grip (Left Hand)	-2.906	0.006	-0.423	-0.720	-0.123
	Chair Stand Sit and Reach	3.850	0.000	-0.561	-0.866	-0.251
	Hand Grip (Left Hand)	4.137	0.000	-0.603	-0.911	-0.289

Note. PWB – Psychological Well-Being

Table 8. Wilcoxon Test Results for Independence in ADL and IADL of Older Adults Pre- and Post-Intervention

Indicator	N	Negative Ranks (n)	Positive Ranks (n)	Ties	Z - value	p value	r (effect size)
ADL	47	7	28	12	-3.169	0.002	-0.462
IADL	47	3	32	12	-4.762	< 0.001	-0.695

Note. ADL – Activities of Daily Living; IADL – Instrumental Activities of Daily Living

normally distributed, as determined by the Shapiro–Wilk test, the effect of the intervention on these two variables was analyzed using the Wilcoxon signed-rank test. This nonparametric test was applied to evaluate differences in scores before and after the intervention within the same group. The results of the analysis are presented in Table 8.

As shown in Table 8, the Wilcoxon signed-rank test was used to examine changes in independence among older adults before and after the intervention, based on Activities of Daily Living (ADL) and Instrumental Activities of Daily Living (IADL). The results revealed statistically significant improvements in both indicators. In ADL, most participants demonstrated positive changes, with a moderate effect size. Similarly, IADL scores showed a statistically significant increase, with the majority of participants reporting improved outcomes and a large effect size. These findings support the conclusion that the intervention had a meaningful and statistically significant impact on the independence of older adults. Combined with the results of the paired samples t-test, the data suggest improvements in both psychological and physical domains following the intervention.

Discussion

This study aimed to evaluate the effects of a combined active exercise and mindfulness-based relaxation intervention on psychological well-being, functional ability, and independence among older adults. The findings revealed statistically and practically significant improvements across all target domains. Psychological well-being, as measured by Ryff's PWB scale, showed a significant increase, $t(46) = 3.733$, $p = .001$, with a moderate effect size, $d = 0.544$. In terms of functional ability, significant enhancements were observed in multiple indicators. Chair Stand performance improved, $t(46) = 3.440$, $p = .001$, $d = 0.501$. Sit and Reach scores also increased, $t(46) = -2.906$, $p = .006$, with an effect size of $d = 0.423$. Handgrip strength improved in both hands: left hand, $t(46) = 3.850$, $p < .001$, $d = 0.561$; right hand, $t(46) = 4.137$, $p < .001$, $d = 0.603$. These results reflect moderate to large improvements in physical performance. Additionally, significant gains were observed in both basic and instrumental activities of daily living. ADL scores increased significantly, $Z = -3.169$, $p = .002$, with a moderate effect size, $r = 0.462$. IADL scores also showed a statistically significant increase, $Z = -4.762$, $p < .001$, with a large effect size, $r = 0.695$. Collectively, these results suggest that the intervention had a meaningful and multifaceted impact, promoting improved psychological functioning, enhanced physical capability, and increased functional independence in the participating older adults.

Psychological Well-Being

The present study found that combining low-intensity exercise with mindfulness-based relaxation was associated with meaningful gains in psychological well-being (PWB) among community-dwelling older women. Similar gains have been reported in studies involving other light, supervised physical activities, including stretching [40, 41], yoga [42, 43], tai chi [44], and group-based aerobic exercise [45]. These interventions have been shown to reduce symptoms of depression and anxiety while enhancing social relationships and overall quality of life. Such benefits are believed to result from increased bodily awareness, greater self-confidence, and an enhanced sense of control over physical functioning [46, 47]. A systematic review by [48] further emphasizes that light, enjoyable, and socially engaging activities are particularly effective in promoting psychological well-being in later life.

Unlike the mindful yoga protocol used by [49], the present program combined stretching and bodyweight movements with continuous mindfulness cues delivered in a group setting, yet still produced comparable gains in psychological well-being (PWB). Mindful movement practices such as these enhance present-moment awareness, sharpen attention, reduce mind-wandering, and cultivate non-judgment, thereby supporting psychological well-being [50]. In addition, conducting the sessions in a community environment likely amplified these effects by promoting social interaction, emotional support, and a sense of belonging [51, 52, 53]. From a physiological perspective, it is well documented that physical activity can trigger favorable neuroendocrine responses, including increased endorphin release and reduced cortisol levels, both of which are associated with improved mood and reduced stress [54, 55, 56]. Mindfulness practice may complement these effects by downregulating hypothalamic–pituitary–adrenal (HPA) axis activity, promoting neuroplasticity, and reducing inflammation [57, 58, 59]. Since these biological mechanisms were not directly assessed in the present study, future randomized trials should incorporate biomarker or neuroimaging measures to confirm their potential mediating role.

Functional Ability

The present program was associated with statistically and practically meaningful gains in functional performance. Participants demonstrated faster chair stand times, greater sit-and-reach flexibility, and stronger hand grip scores at post-test. These outcomes suggest that an integrated regimen of low-load resistance exercise combined with mindfulness-based movement can improve multiple domains of physical function in community-dwelling older women.

The bodyweight sequence (e.g., chair-assisted squats, split squats, heel raises, wall push-ups) was intentionally designed to target the quadriceps–hamstring complex, ankle stabilizers, core musculature, and shoulder girdle. These muscle groups are essential for everyday functions such as transfers, stair negotiation, and load carriage. Consistent with recent resistance training trials in older adults, such multijoint exercises appear to improve motor unit recruitment efficiency and reduce the neural activation cost required to perform submaximal tasks. They may also promote moderate hypertrophy and corresponding gains in functional strength [60, 61, 62, 63, 64]. In addition, the static and dynamic stretching components likely contributed to the observed improvement in sit-and-reach scores by increasing soft tissue compliance and joint mobility [65, 66]. Improved range of motion is closely linked to enhanced postural control and reduced fall risk in later life [67, 68]. Since falls are a leading cause of disability in older adults, even modest improvements in flexibility can have substantial public health implications. Furthermore, mindfulness cues embedded throughout the movement sequence may have enhanced proprioceptive acuity and body awareness, thereby complementing the mechanical training stimulus [69]. Neuroimaging studies have shown that mindful movement practices increase activation in the somatosensory and premotor cortices and strengthen sensorimotor connectivity. These neural adaptations are associated with improved balance and movement control [70, 71, 72]. Although such pathways were not assessed in this study, they provide a plausible explanation for the functional improvements observed.

Hand grip strength improved despite the absence of direct forearm exercises. This finding is consistent with cross-education research, which shows that unilateral or whole-body resistance training can induce strength gains in untrained limbs through central neural adaptations [73, 74]. However, the effectiveness of cross-education in older populations remains uncertain, as the magnitude of this effect tends to decline with age. Grip strength is a well-established surrogate marker of overall muscle function and healthy ageing [75, 76]. Its improvement in the present study therefore suggests broader gains in physical resilience. Recent evidence also links higher grip strength to more favorable inflammatory and immune profiles in older women [77], highlighting the clinical relevance of the observed changes. Complementary intervention studies have shown that yoga, with or without an explicit MBSR component, can preserve or maintain grip strength relative to non-exercise controls in older adults [78, 79]. Thus, the improvements in grip strength observed here may reflect broader enhancements in neuromuscular function and physical robustness.

Independence (ADL/IADL)

The combined program of low-load resistance exercise, flexibility training, and mindfulness-based relaxation was associated with statistically significant gains in functional independence, as reflected in higher scores for Activities of Daily Living (ADL) and Instrumental Activities of Daily Living (IADL) at post-test. Although the quasi-experimental design limits the ability to draw causal conclusions, the observed pattern of improvements aligns with the physical and psychological adaptations discussed previously.

The strength, flexibility, and balance gains documented in the chair stand, sit and reach, and hand grip tests provide a mechanical foundation for maintaining everyday autonomy. Prospective evidence indicates that faster chair stand times and stronger grip strength independently predict a reduced risk of future ADL and IADL dependence in older women [80, 81]. Therefore, the physical changes observed in this study likely translated into more efficient execution of basic self-care tasks such as dressing and bathing, as well as more complex activities like preparing meals and managing medications. Parallel improvements in psychological well-being, as discussed in the PWB section, may have further supported independence by enhancing self-efficacy, emotional regulation, and perceived control. Higher levels of psychological well-being have consistently been associated with sustained engagement in daily activities and greater resilience in coping with age-related challenges [9]. Mindfulness practice in particular strengthens intrinsic motivation and sense of purpose. These two factors mediate the relationship between psychological well-being and functional autonomy [82]. Growing evidence suggests that multicomponent programs integrating physical exercise with mindfulness result in greater improvements in functional independence compared with single-modality interventions [83]. The present findings are consistent with this pattern. Physiological adaptations may have made daily tasks physically easier to perform, while psychological gains likely increased participants' confidence and motivation to engage in those tasks. This combination helps explain the observed improvements in both ADL and IADL scores.

The 12-session mind and body program used in this quasi-experimental, community-based study was associated with small to moderate improvements in psychological well-being, functional performance (chair stand, sit and reach, grip strength), and self-reported independence (ADL and IADL) among community-dwelling older women. These outcomes likely reflect the deliberate combination of low-load resistance and flexibility exercises with mindfulness-based relaxation. This integrated approach targets both physical and

psychological domains, which previous studies have often examined separately. The sessions were conducted in a local community setting, required no specialized equipment, and achieved high attendance, suggesting that such programs can be implemented using modest resources. Outcomes were assessed using field-validated instruments that capture domains considered priorities for healthy ageing. All movements were maintained at a light intensity and were easily modifiable, which reduced the risk of injury while still producing measurable gains. Taken together, these features suggest that an integrated, low-cost program combining physical activity with mindfulness may provide a feasible option for promoting well-being and functional independence in similar non-clinical older adult populations.

Despite its strengths, several limitations of this study should be acknowledged. First, the use of a quasi-experimental pre–post design without a control group limits the internal validity of the findings and prevents definitive causal interpretations. Second, the study did not conduct an a priori power analysis to determine the optimal sample size, which may have reduced statistical power and limited the generalizability of the results. Third, important confounding factors such as dietary habits, medication use, and psychosocial stressors were not controlled, which could have influenced the outcomes. Additionally, the intervention lasted only four weeks, a period that may be insufficient to capture longer-term physiological or psychological adaptations. The absence of follow-up assessments further limits the ability to evaluate the sustainability of the observed effects. The lack of blinding in outcome assessment also introduces the possibility of measurement bias. Finally, the sample consisted exclusively of older adult women, which restricts the applicability of the findings to older men or mixed-gender populations.

To address the aforementioned limitations and advance this area of research, future studies should consider employing randomized controlled trial (RCT) designs to improve internal validity and enable causal inference, particularly in studies combining stretching, bodyweight exercise, and mindfulness practice. Conducting a priori power analyses is also recommended to ensure sufficient sample size and statistical robustness. In addition, recruiting more diverse samples in terms of gender, age, and socio-demographic background would enhance the generalizability of findings. It is equally important to monitor or control potential confounding variables such as health status, medication use, and lifestyle behaviors. To better understand the underlying mechanisms, future controlled trials may incorporate physiological and neurocognitive measures such as electromyography, balance perturbation protocols, or neuroimaging. Extending intervention duration and conducting follow-up assessments would further clarify the long-term effects of integrated physical and mindfulness-based programs. Finally, future research should examine whether improvements in functional ability and psychological well-being mediate gains in independence. Advanced statistical techniques such as path analysis or structural equation modeling may help clarify these relationships and provide a more comprehensive explanatory framework.

Conclusions

This quasi-experimental study demonstrated that a 12-session program combining low-impact stretching, bodyweight exercises, and mindfulness-based relaxation was associated with meaningful improvements in psychological well-being, functional capacity, and self-reported independence. The participants were community-dwelling older women. These findings suggest t hat integrating structured physical activity with mindfulness-based relaxation may be a feasible and low-cost strategy. Such an approach can help support overall well-being and functional autonomy in older adults.

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Conflict of Interest

The authors declare no conflict of interest.

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Information about the authors:

Yulvia Miftachurochmah; (Corresponding author); https://orcid.org/0000-0002-2690-6762; yulviamifta@uny.ac.id; Department of Health and Sport, Universitas Negeri Yogyakarta; Yogyakarta, Indonesia.

Cerika Rismayanthi; https://orcid.org/0000-0002-6588-1983; cerika@uny.ac.id; Department of Sport Science, Universitas Negeri Yogyakarta; Yogyakarta, Indonesia.

Rizki Mulyawan; https://orcid.org/0000-0002-0180-5025; rizkimulyawan@uny.ac.id; Department of Sport Science, Universitas Negeri Yogyakarta; Yogyakarta, Indonesia.

Gallant Pamungkas; https://orcid.org/0009-0002-6330-9649; gallantpamungkas.2022@student.uny.ac.id; Department of Sport Science, Universitas Negeri Yogyakarta; Yogyakarta, Indonesia.

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