INTERNASIONAL CONFERENCE ON
MULTIDISCIPLINARY APPROACHES IN HEALTH SCIENCE
VOLUME 3, No 1. Tahun 2025 , ISSN 3032-4408 (Online)
https://ejournal.poltekkes-denpasar.ac.id/index.php/icmahs

Community-Based Exercise Intervention to Promote Balance in Older Adults with Rheumatoid Arthritis

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Article history
Posted : 2025-09-20
Reviewed : 2025-12-05
Received : 2025-12-13

ABSTRACT

Rheumatoid arthritis (RA), a prevalent non-communicable disease (NCD) among older adults, often results in reduced musculoskeletal function and impaired balance, thereby increasing vulnerability to mobility limitations and compromising community resilience. Community-based exercise interventions may provide a sustainable and low-cost strategy to improve health outcomes in this population. This study examined the effect of elderly fitness exercise on balance among older adults with RA in Banjar Anyar Village, Kediri, Tabanan Regency, Bali, Indonesia. A pre-experimental one-group pretest–posttest design was applied to 30 purposively selected participants. Balance was measured using the Berg Balance Scale (BBS) before and after the intervention. Data normality was confirmed using the Shapiro–Wilk test ($p = 0.540$), and differences were analyzed using a paired sample t-test. The results demonstrated a significant improvement in balance following the intervention, with the mean BBS score increasing from 34.50 (SD = 5.507) at pretest to 42.77 (SD = 5.661) at posttest. The mean difference was -8.267 (SD = 3.205), $t(29) = -14.128$, $p < 0.001$, with a very large effect size (Cohen's $d = 2.58$). These findings highlight that elderly fitness exercise is an effective and feasible community health practice to enhance balance among older adults with RA. Integrating such programs into community health strategies may strengthen resilience against NCD-related functional decline. Further research with larger samples and randomized designs is recommended.

Keywords: rheumatoid arthritis, elderly balance, elderly fitness exercise

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INTRODUCTION

Globally, Rheumatoid arthritis (RA) is one of the most common autoimmune diseases, with an estimated prevalence of 0.5–1% of the adult population, disproportionately affecting women and older adults (Smolen et al., 2016; Sparks, 2019). RA represents an escalating global health burden, with disability-adjusted life years increasing from 26.37 to 30.71 per 100,000 population between 1990 and 2021, disproportionately affecting elderly populations. The clinical ramifications are profound, such as as progressive joint destruction and postural instability predispose patients to elevated fall risk, culminating in hip fractures, functional impairment, loss of independence, and premature mortality (Wei et al., 2025; Zhang et al., 2025). Moreover, fear of falling and loss of confidence often discourage physical activity, creating a negative cycle that further deteriorates mobility and psychosocial well-being.

Despite global RA prevalence estimates of 0.5-1%, Indonesia faces a disproportionately high burden of joint diseases at 11.9% nationally, with Bali province exhibiting the highest prevalence at 19.3%, underscoring the critical need for targeted interventions among the Indonesian elderly (Kemenkes RI, 2018). Beyond the increasing prevalence, the consequences of RA extend beyond joint inflammation to include musculoskeletal, psychological, and social domains that profoundly affect older adults' functional independence and quality of life.

One of the significant complications observed among older adults with RA is impaired balance, which contributes to mobility limitations and a higher risk of falls (Wiegmann e t al., 2022; Yesim et al., 2017). Objective assessments further corroborate this vulnerability, demonstrating significantly higher fall risk scores in RA patients versus healthy individuals, with this susceptibility being compounded by advanced age, heightened disease activity, and progressive functional disability (Ergül & Melikoğlu, 2022). Given projections forecasting persistent escalation of RA cases through 2050, with age-standardized prevalence rates and years lived with disability demonstrating continuous upward trajectories, urgent implementation of evidence-based interventions to mitigate balance dysfunction represents a

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critical imperative for reducing disability trajectories and healthcare expenditures in this vulnerable cohort (Black et al., 2023; Ma et al., 2025).

Balance dysfunction in RA is multifactorial, one of which is reduced physical activity. Older adults commonly experience a decline in physical activity levels due to age-related changes in connective tissue, including reduced collagen integrity and joint elasticity. The type and intensity of physical activity in this population have a significant impact on the structure and functional capacity of musculoskeletal tissues. In individuals with RA, prolonged engagement in high-intensity physical tasks involving repetitive loading or pressure on the joints may exacerbate joint stress and contribute to the frequent complaints reported by patients (Cahyati et al., 2023; Narmi & Evi, 2017). Thus, identifying effective strategies to improve balance among older adults with RA is an urgent public health priority. Given the multidimensional burden of RA and its associated balance impairments, exercise-based interventions have gained increasing recognition as safe, effective, and sustainable approaches to maintain function and independence among older adults.

Exercise has been widely recognized as a safe and effective non-pharmacological intervention for people with RA (Katz et al., 2020). Evidence shows that exercise programs aligned with public health recommendations significantly improve cardiovascular fitness, muscle strength, and physical activity behavior, with moderate effect sizes observed in individuals with spondyloarthritis, RA, and osteoarthritis (Rausch Osthoff et al., 2018). To maximize effectiveness, the implementation of physical activity programs for people with RA should be pragmatically led by rheumatology healthcare professionals and supported through social innovations that promote adherence and long-term engagement (Metsios & Kitas, 2018). In Indonesia, a recent study also found that the implementation of the Balance Exercise Movement (Gelase) program significantly reduced fall risk among older adults in Banjar Kulu, Tampaksiring Village, demonstrating the feasibility of balance-focused exercise interventions within community settings (Ariati et al., 2021).

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Despite this evidence, there remains limited research focusing on community-based exercise interventions targeting balance outcomes in older adults with RA, particularly in low- and middle-income countries where access to rehabilitation services may be constrained. In Indonesia, community-based health programs facilitated by community health workers have been proven effective in improving health outcomes and sustaining community participation in rural areas (Susanto et al., 2022). Building upon this successful model, the present study introduces elderly fitness exercise as a feasible, low-cost, and community-driven intervention aimed at promoting balance among older adults living with RA. However, evidence remains scarce on how these exercise programs can be effectively adapted and sustained within community settings, particularly in rural Indonesia.

A preliminary study revealed that among the 15 older adults with RA living in Banjar Anyar Village, Kediri, Tabanan interviewed, nine reported experiencing joint pain related to RA, seven had a history of falls, ten were unable to stand without assistance, twelve could not maintain a one-leg stance, and thirteen found it difficult to pick up objects from the floor. These findings indicate that mobility limitations and balance impairments are prevalent among older adults with RA in this community. Furthermore, those with a history of falling are at risk of recurrent falls, as the experience of falling often leads to fear, decreased confidence, and avoidance of physical activity—factors that exacerbate functional decline.

The present study aims to address this gap by evaluating the effectiveness of a community-based elderly fitness exercise program on balance performance, measured using the Berg Balance Scale (BBS), among older adults with RA. Accordingly, this study seeks to answer the following research question: Does participation in a community-based elderly fitness exercise program improve balance performance among older adults with RA? The findings are expected to strengthen the evidence base for community-based rehabilitation practices, enhance community resilience in managing chronic musculoskeletal conditions, and support the advancement of healthy aging strategies in low- and middle-income settings.

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METHOD

This study was conducted on August 2024 at Senapahan Kaja and Senapahan Kelod, Banjar Anyar Village, Tabanan, Bali, Indonesia. The participants were 30 older adults aged 60 years and above who had been diagnosed with RA and registered in the Posyandu program. Participants were recruited using purposive sampling based on specific inclusion and exclusion criteria. Eligible participants were those who were able to communicate effectively, physically capable of performing exercise, and willing to participate, while those with severe cognitive impairment, acute illness, or disabling physical conditions were excluded.

This study employed a one-group pretest–posttest design to examine the effect of elderly fitness exercise on balance. Participants underwent an initial balance assessment (pretest), followed by an intervention consisting of elderly fitness exercise sessions conducted 3 times per week for 2 weeks. Each session lasted approximately 20 minutes and was supervised by community health workers. After completing the intervention, participants were reassessed using the same balance measurement instrument (posttest).

Data were collected through structured observation and standardized tests. Participant demographic and clinical data were obtained using a questionnaire. Balance ability was measured using the Berg Balance Scale, a validated instrument widely used in geriatric populations (Miranda & Tiu, 2025).

Data were analyzed using SPSS version 22. Descriptive statistics (mean, standard deviation, minimum and maximum) were used to summarize participant characteristics. The paired t-test was applied to determine differences in balance scores before and after the intervention. A significance level of $p < 0.05$ was considered statistically significant.

This study was granted by the Health Research Ethics Committee of STIKES Bina Usada Bali (Approval Number: 271/EA/KEPK-BUB-2024).

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RESULTS

A total of 30 older adults with RA participated in the study. The mean age of participants was 71.17 years (SD = 6.68), ranging from 60 to 88 years.

Table 1. Descriptive Statistics of Balance Scores

Variables	Mean (±SD)	Min-Max
Pre Test	34.50 (±5.507)	26-45
Post Test	42.77 (±5.661)	32-56

Table 1 presents the descriptive statistics of balance scores measured using the BBS. The mean pre-test score was 34.50 (SD = 5.51), while the post-test mean increased to 42.77 (SD = 5.66). The mean difference between pre- and post-test scores was 8.27 (SD = 3.21), ranging from 1 to 14 points.

Table 2. Paired-sample t-test results

Variables	Mean Difference	t	df	p	Cohen's d
Pre Test - Post Test	8.267	-14.128	29	0.000	2.58

The Shapiro–Wilk test indicated that the distribution of difference scores was normal ($p = 0.540$). Therefore, a paired-samples t-test was performed. The analysis revealed a statistically significant improvement in balance scores following the intervention, $t(29) = -14.128$, $p < 0.001$ (Table 2). The effect size was very large (Cohen's d = 2.58), indicating that the community-based elderly fitness exercise intervention had a substantial positive impact on balance among older adults with RA.

DISCUSSION

This community-based study investigated the effectiveness of a structured elderly fitness exercise program in improving balance among older adults with RA. The primary finding was a substantial and statistically significant improvement in balance performance following the intervention. Participants' Berg Balance Scale scores increased by an average of 8.267 points with baseline scores of 34.50 (indicating moderate impairment) rising to 42.77 (low fall risk) post-intervention. The magnitude of this change is reflected in the very large

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effect size (Cohen's d = 2.58), which substantially exceeds typical effect sizes reported in balance intervention studies and suggests that the program produced robust functional gains. These findings confirm the study hypothesis and demonstrate that structured, community-delivered exercise can meaningfully enhance postural stability and functional capacity in this high-risk population.

The very large effect size observed suggests that the intervention produced clinically meaningful gains in balance rather than only small statistical changes. Several plausible mechanisms can explain this outcome. First, targeted balance and multicomponent exercise (combining strength, flexibility, and balance tasks) directly address the neuromuscular deficits that underlie postural instability in older adults and in people with RA, namely muscle weakness, impaired proprioception, and reduced joint range of motion. Trials and reviews indicate that multimodal and task-specific balance training produce greater improvements in static and dynamic balance than single-component programs, likely by improving sensorimotor integration and lower-limb strength. This general pattern is consistent with meta-analytic evidence on balance interventions in older populations and clinical groups (Wang et al., 2025).

Second, the community-based delivery model probably enhanced adherence and dose received. Interventions implemented in familiar, local settings and supervised by trained personnel or community health workers reduce barriers such as transportation and increase perceived relevance, which can raise attendance and engagement, key determinants of treatment effect. Studies of group and community programs report better acceptance and comparable effectiveness to clinic-based programs for balance outcomes in older adults (Alqahtani et al., 2019).

Third, baseline BBS scores in our sample (mean 34.50) indicated moderate impairment, leaving substantial room for improvement. Interventions often yield the largest absolute gains when starting from a lower baseline (greater potential for change), which could partly explain the magnitude of the observed effect. This aligns with rehabilitation literature showing larger absolute gains in participants with greater initial deficits (Wiegmann et al., 2022).

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Finally, regular, supervised training can reduce pain, fatigue, and fear of movement, factors that limit participation and performance in RA. Improved symptom control may have allowed participants to execute balance tasks more effectively during post-testing. Increasing evidence supports the role of regular physical activity in improving clinical symptoms and function in RA, which indirectly benefits balance (Bearne, 2023).

Our positive findings are consistent with several lines of recent evidence. Alqahtani et al. (2019) found that group exercise interventions improved standing balance and lower-extremity muscle function in community settings, supporting the effectiveness of community group formats for balance enhancement. Wiegmann et al. (2022) reported that postural control measures are closely related to prospective falls in RA populations, underlining that improvements in balance (as measured by BBS) are relevant clinically for fall risk reduction, although our study did not prospectively measure falls. Systematic reviews in older adults demonstrate that exercise reduces fall risk and improves balance across community samples (e.g., Cochrane evidence summarized by Sherrington and colleagues), which supports the plausibility that a balance-focused community program would yield clinically important gains (Wang et al., 2025).

More specifically in RA, recent reviews and guidance emphasize that physical activity is safe and beneficial for people with RA, improving function, reducing symptoms, and improving quality of life; however, balance-specific endpoints remain less consistently reported in RA trials, creating a niche for our study's focus on BBS outcomes. This study therefore adds primary data to a relatively sparse area: community-delivered balance programming for older adults with RA (Bearne, 2023).

Key strengths include the real-world, community-based delivery (high ecological validity), use of a validated balance instrument (BBS), and comprehensive pre–post measurement with normality testing that justified parametric analysis. The large effect size strengthens the case that the intervention had a substantial impact rather than a marginal one.

Several limitations temper the conclusions. The one-group pretest–posttest design lacks a control or comparator arm, so causal inference is limited by potential confounders, regression

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to the mean, and time-related effects. Although the magnitude of change is large, without randomization or a control group we cannot fully exclude alternative explanations such as natural recovery, seasonal activity changes, or tester effects. The sample size (n = 30) and single-site rural setting limit generalizability to other populations and settings. Follow-up was immediate post-intervention only; therefore, durability of gains is unknown. Finally, we measured balance but not downstream outcomes such as falls, activities of daily living, or health-related quality of life, which constrains claims about broader functional benefit.

Despite limitations, the findings have practical implications. Community health programs that incorporate structured balance and strength training can be a feasible strategy to address balance impairments in older adults with RA, particularly in resource-limited rural contexts. Embedding such programs into existing community health platforms may increase reach and sustainability and align with non-communicable disease prevention and community resilience priorities. Importantly, training community health workers or local facilitators to deliver standardized protocols could support scale-up while retaining affordability and accessibility. Evidence from community interventions and implementation science supports this pathway, but implementation should be accompanied by evaluation of fidelity, adherence, and outcomes (Alqahtani et al., 2019).

To strengthen causal inference and policy relevance, future work should use randomized controlled designs with adequate sample sizes and longer follow-up to evaluate both balance maintenance and clinical endpoints (falls, functional independence, health-related quality of life). Hybrid effectiveness–implementation trials could help determine the program's scalability and identify facilitators and barriers in different community contexts. Additionally, collecting objective adherence data, measures of lower-limb strength and proprioception, and economic evaluations would provide a more complete evidence base for policymakers and funders. Finally, combining balance training with strategies to reduce pain and fatigue (e.g., tailored exercise dose, symptom monitoring) may optimize participation and outcomes in RA cohorts (Wiegmann et al., 2022).

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In summary, the present study demonstrates that a community-based elderly fitness exercise program can produce substantial short-term improvements in balance among older adults with RA. While findings are encouraging and align with broader evidence on exercise and balance, definitive conclusions about long-term clinical benefit and causality require randomized, larger-scale studies with extended follow-up.

CONCLUSIONS

The findings demonstrated a significant improvement in BBS scores after the intervention, with a very large effect size, confirming that the program produced substantial clinical benefits. These results highlight that elderly fitness exercise, when delivered in a community setting, is an effective and feasible health practice to address balance impairments in this population. Integrating such programs into existing community health initiatives may strengthen non-communicable disease management and promote resilience among older adults in rural settings.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest related to this study.

ACKNOWLEDGMENT

The authors gratefully acknowledge the assistance of all organizations and community members who contributed to the implementation of this study.

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