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Comparative effects of aerobic walking and resistance exercise on cognitive function in older adults: A quasi-experimental study

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ABSTRACT

Background: Cognitive decline poses a major threat to independence and quality of life in older adults. Exercise is widely recognized as a non-pharmacological approach to preserve cognition, yet many studies overlook baseline cognitive status and seldom compare aerobic and resistance modalities. This gap limits clarity on which type of exercise is more effective in maintaining cognitive health. **Research Objectives:** This study aimed to determine the effects of aerobic walking exercise (AWE) and resistance exercise (RE) on cognitive function in older adults. **Methods:** A quasi-experimental pre-test/post-test design was conducted with 45 participants (23 males, 22 females; aged 60–69 years). Using ordinal pairing to balance baseline scores, participants were assigned to AWE (n = 22) or RE (n = 23). Both groups completed 24 exercise sessions over eight weeks (three sessions per week). Cognitive function was assessed with the Indonesian version of the Montreal Cognitive Assessment (MoCA-Ina) under single-blind conditions. Statistical analyses included paired t-tests (within-group) and one-way ANCOVA (between-group) at a 5% significance level. **Findings/Results:** Both interventions significantly improved cognitive function ($P < 0.001$). However, RE produced greater gains (mean increase 2.21 points, 11.99%) than AWE (mean increase 1.27 points, 7.06%), with a moderate effect size ($\eta p^2 = 0.110$; $P < 0.05$). **Conclusion:** Resistance exercise yields superior improvements in cognitive function compared to aerobic walking among older adults. These findings highlight the importance of incorporating resistance-based programs in community health initiatives, provided safety principles are ensured. Future research should extend to larger and more diverse populations, examine long-term effects through longitudinal designs, and evaluate applicability in individuals with comorbid conditions.

Keywords: Aerobic exercise; cognitive function; resistance exercise; older adults

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Authors' Contribution: a – Study Design; b – Data Collection; c – Statistical Analysis; d – Manuscript Preparation; e – Funds Collection

INTRODUCTION

The Strengthening Responses to Dementia in Developing Countries (STRiDE) report in 2020 estimated more than 4.2 million older adults in Indonesia were living with dementia (Farina et al., 2023). This figure places Indonesia ninth globally in the number of older adults with cognitive impairment (Sari et al., 2024). This growing public health challenge has drawn increasing attention from researchers, particularly in exercise physiology and sports health science, to developing effective strategies aimed at preventing the progression of cognitive impairment in older adults.

Although cognitive impairment is a common feature of normal aging (Cegolon & Jenkins, 2022), global cognitive deterioration can progress to pathological conditions such as dementia (Riani & Halim, 2019; Zhang, 2023). These alterations are intimately associated with senescence processes, encompassing the accumulation of beta-amyloid and tau proteins, diminished neuronal connectivity, and inflammaging in the brain tissue (Heilman & Nadeau, 2020; Mori, 2022).

Brain aging and cognitive impairment are irreversible processes (Dodig et al., 2019; Fekete et al., 2022). This occurs as a result of a decline in higher-order cognitive processes, including reasoning, decision-making, problem solving, judgment, abstract thinking, and logic, which ultimately contributes to the deterioration of overall cognitive abilities (Baumard et al., 2021; Orona et al., 2025). Nevertheless, there is growing recognition that physical exercise has been widely proposed as a potential intervention to help preserve and enhance cognitive function in aging populations (Sullivan & Pomidor, 2024).

Furthermore, it is crucial to acknowledge that older adults need to be supported by an optimal level of physical work capacity to effectively engage in physical exercise (Garcia et al., 2025). Physical work capacity is the result of aerobic metabolic processes and is consistently supported by mechanisms derived from primary anaerobic metabolism (Zoladz, 2019). Consequently, physical exercise should be systematically designed to yield physiological and psychological benefits, as well as provide protective effects against cognitive impairment (Key & Szabo-Reed, 2023).

Older adults are generally better suited to simple and non-fatiguing physical exercise (Song et al., 2018). Accordingly, aerobic walking exercise is widely recommended for older adults owing to its simplicity and safety (Cassilhas et al., 2012; McDonald et al., 2019). In addition, aerobic exercise also has the potential to preserve brain health. A study with the intervention walking was performed for 16 weeks, with three sessions per week and 50-70 min per session (Wong et al., 2023), proved to involves cognitive integration, and when performed in natural environments (Huang et al., 2023; Tao et al., 2019; Trammell et al., 2023).

In contrast, exercise modalities that rely on anaerobic glycolytic metabolism in muscle cells, such as resistance exercise, also provide benefits to the cognitive health of older adults (Draper & Marshall, 2024; Son et al., 2020). Furthermore, a study by Cho and Roh (2022) which provided an intervention resistance exercise in 40 minute sessions, 3 times per week for 3 months, proved that it engages higher cognitive focus to execute movement techniques, thereby offering potential benefits for cognitive reserve (Beckers & Buck, 2021; Gooijers et al., 2024; Kisner & Colby, 2012).

This study introduces several methodological and analytical innovations that distinguish it from previous research, particularly in terms of the study design, measurement instruments, and subject characteristics. Unlike the experimental approaches of (Adriani et al., 2020; Kang et al., 2021), which emphasized aerobic exercise with complex movements conducted in indoor settings, the present study implemented a group-based aerobic walking intervention carried out in an outdoor environment. Moreover, while Tsai et al. (2024) investigated resistance exercise using modalities such as whole-body vibration and blood flow restriction, their study did not attempt to balance treatment allocation based on baseline cognitive scores.

International evidence strongly supports the role of exercise in promoting cognitive health; however, many studies have overlooked baseline cognitive scores as indicators of cognitive reserve capacity, thus limiting the validity of group comparisons. Direct comparisons between aerobic walking and resistance exercise remain scarce, particularly among older Indonesian adults. To address these gaps, the present study compareds the effects of aerobic walking and resistance exercise on cognitive function in older adults using an experimental design that controlleds for baseline cognitive capacity. These findings are expected to enhance precision, reveal overlooked factors, and provide evidence-based recommendations for community health programs to help maintain cognitive function in older adults.

METHOD

Research Design

This study used a quasi-experimental design with a pre-test/post-test group and a single-blind scheme. The independent variables were (aerobic and resistance exercises), and the dependent variable was cognitive function. This was assessed using the Indonesian version of the Montreal Cognitive Assessment (MoCA-Ina) by external expert using a single-blind procedure. The MoCA-Ina was adapted from a textbook and validated in Indonesia (Mahajudin et al., 2022). The validity test was performed using a reliability analysis test-retest using the K (Kappa) statistic. The validity test was performed using a reliability analysis test-retest using the K (Kappa) statistic. The total kappa value between two physicians (inter-rater) is 0.820, with details for each section as follows: Visuospatial/Executive 0.817; Naming 0.985; and Attention 0.969. Furthermore, for language it was 0.990; abstraction, 0.957; memory, 0.984; and orientation, 1.00. MoCA-Ina was a valid test instrument based on transcultural and reliable validation principles. The high Cronbach's alpha value (0.976) for the MoCA-Ina indicates that the items within the assessment are measuring the same underlying construct (cognitive function).Therefore, it can be used as a cognitive screening tool in Indonesia (Rambe & Fitri, 2017).

The research protocol was approved by the Ethics Committee of the Faculty of Medicine, Universitas Sebelas Maret (number 39/UN27.06.11/KEP/EC/2025). This study was conducted between April and June 2025. The research activities were conducted weekly, with a total of 24 sessions comprising the treatment. The participants of the study were healthy older adults actively participating in the Lansia Sehat Metro Ceria Program (LSMC) at the Metro Health Center, Metro Central District, Metro City, Lampung Province.

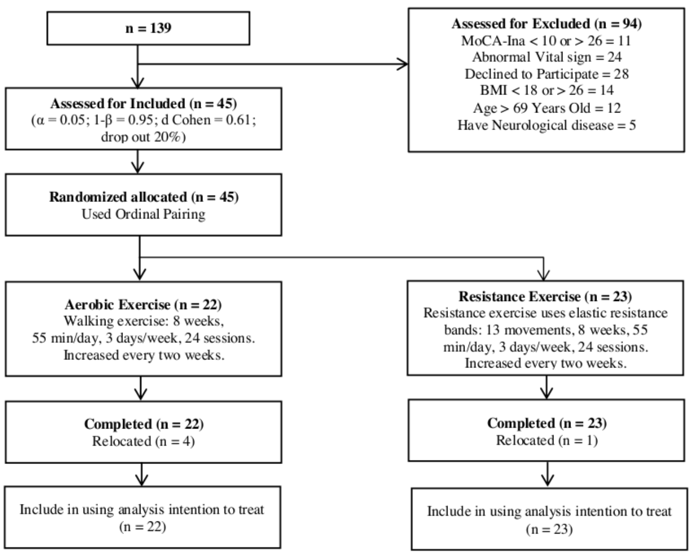

Figure 1. Research Procedure

Research Participants

There were 45 participants completed the study (22 female and 23 male). The sample size was calculated using GPower version 3.1.9 based on a previous study Krootnark et al. (2024) with a power (1-β) of 95%, an alpha (α) of 5%, an effect size of 0.61, and a 20% anticipated dropout rate.

All subjects met the inclusion criteria for the study sample, which included: (i) young elderly individuals aged 60-69 years, (ii) having a body mass index (BMI) within the range of 18.5 to 26 (kg/m²), (iii) MoCA-Ina score between 11 and 25 points, (iv) able to stand and walk independently (with or without an assistive device), (v) Able to communicate effectively, (vi) Have normal vital signs (pulse rate, blood pressure, respiratory rate, oxygen saturation).

Participants were excluded if they met the following criteria: (i) diagnosis of neurological diseases, such as stroke or traumatic brain injury, (ii) A history or diagnosis of cardiovascular diseases, (iii) A resting blood pressure > 160/100 mmHg, (iv) Severe musculoskeletal conditions that interfered or limited compliance with the exercise program, (v) Visual and/or hearing impairments that could not be corrected with a lens and/or hearing aid, (vi) inability to communicate, or (vii) Able to participate in other exercise programmes.

Table 1. Research Participants Criteria

Inclusion Criteria	Exclusion Criteria
1. Young elderly individuals aged 60-69 years.	1. Diagnosis of neurological diseases (e.g., stroke or traumatic brain injury).
2. Body mass index (BMI) within 18.5-26 kg/m².	2. History or diagnosis of cardiovascular diseases.
3. MoCA-Ina score between 11 and 25 points.	3. Resting blood pressure > 160/100 mmHg.
4. Able to stand and walk independently (with or without an assistive device).	4. Severe musculoskeletal conditions that interfered or limited compliance with the exercise program.
5. Able to communicate effectively.	5. Visual and/or hearing impairments not correctable with a lens and/or hearing aid.
6. Normal vital signs (pulse rate, blood pressure, respiratory rate, oxygen saturation).	6. Inability to communicate.
	7. Participation in other exercise programs.

Notes: MoCA-Ina = Montreal Cognitive Assessment Indonesian version, used as a cognitive screening instrument. The BMI range (18.5–26 kg/m²) was chosen to ensure normal to slightly overweight nutritional status, which is considered safer for exercise interventions. The blood pressure threshold of > 160/100 mmHg was applied to minimize cardiovascular risks during exercise participation. Normal vital signs were defined as: pulse rate 60-100 bpm, blood pressure < 160/100 mmHg, respiratory rate 12–20 breaths/min, and oxygen saturation ≥ 96%.

The ordinal pairing technique was employed to allocate participants to aerobic walking exercise (AWE) and resistance exercise (RE) groups. The pairing was primarily based on the participants baseline MoCA-Ina scores, which reflect their initial cognitive reserve capacity. Participants were first ranked in ascending order according to their MoCA-Ina scores. Subsequently, every two adjacent participants in the rank were paired to form a comparable unit. Within each pair, one participant was randomly assigned to the AWE group and the other to the RE group. The sex distribution was checked to confirm that no significant imbalance occurred between the groups.

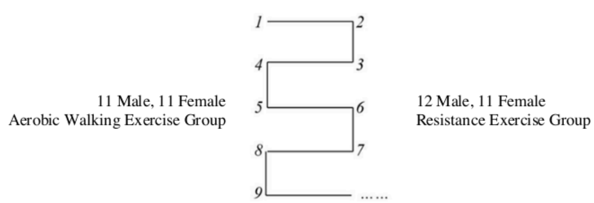

Figure 2. The Following of Ordinal Pairing for Group Allocate

This approach ensured that both groups had comparable baseline cognitive score, thereby minimizing the bias in group allocation. An ordinal pairing technique was used to allocate participants, resulting in 22 participants (11 males and 12 females) in the AWE group and 23 participants (12 males and 11 females) in the RE group.

All participants provided informed consent through their family members prior to participation. Considering that older adults are a vulnerable and high-risk population in terms of health status, additional measures were taken to ensure ethical compliance and safeguard participant well-being throughout the study.

Intervention

Participants were divided into two treatment groups (Table 1) using ordinal pairing based on their initial cognitive function scores. The aerobic walking exercise (AWE) group consisted of 22 participants (11 males and 11 females) who walked on a pedestrian path in Merdeka Park, Metro City. The average walking speed during the exercise was approximately 3.0-4.4 kilometers per hour (km/h), performed for 55 minutes per session, three times per week. The exercise was conducted at a moderate intensity, corresponding to 55% to 70% of the maximum heart rate, approximately ± 3.3-4.4 kcal/min. The resistance exercise (RE) group was designed to engage muscles in working against an external load, such as elastic resistance bands. The RE group consisted of 23 participants (12 males and 11 females) who performed 12 varied movements using elastic resistance bands ranging from 2 to 6 lbs. Each exercise was performed at a moderate pace with 6-10 repetitions within one minute, with an intensity of 75% to 80% HRmax, and completed in 3-4 sets per session. A rest period of 3 minutes was provided between sets, resulting in a work-to-rest ratio of 1:3. To ensure exercise safety, especially for high-risk populations, rest intervals were adjusted according to individual heart rate responses. This approach ensured adequate cardiovascular recovery and minimized physiological stress before the initiation of the subsequent set.

Table 2. Exercise Prescription Guidelines

Period	Treatment Groups	
	AWE	RE
	Aerobic Walking Exercise	Resistance exercise used tools elastic resistance band varied movement: (1) Lateral Pull Down, (2) Front Shoulder Raise, (3) Lateral arm raise, (4) Biceps curls, (5) Wood choppers, (6) Triceps curl overhead, (7) Diagonal arm raise, (8) Diagonal leg raise, (9) Calf raise, (10) Knee extension, (11) Leg raise, (12) Diagonal leg raise, (13) Lateral band.
	Intensity of Treatment Prescriptions	
Weeks 1-2	± 3 km/h	3 sets of 6 repetitions/minute, Rest between sets: 3 minutes.
Weeks 3-4	± 3.3 km/h	3 sets of 8 repetitions/minute, Rest between sets: 3 minutes.
Weeks 5-6	± 4 km/h	3 sets of 10 repetitions/minute, Rest between sets: 3 minutes.
Weeks 7-8	± 4.4 km/h	4 sets of 10 repetitions/minute, Rest between sets: 3 minutes.

*Progression was adjusted every 2 weeks.

Data Measurement and Analysis

Data collection, including participant characteristics and baseline MoCA-Ina scores, was performed by external assessors to ensure objectivity. These analyses included all participants according to the intent-to-treat principle. The intention-to-treat (ITT) principle analyzes data from a clinical trial in which all participants were included in the group they were originally assigned to, regardless of whether they followed the treatment protocol or completed the study. This approach is crucial for preserving the benefits of randomization and for providing a realistic assessment of treatment effectiveness in a real-world setting.

The data were analyzed using SPSS version 26. Descriptive statistics were used to summarize participant characteristics, and assumption tests, including the Shapiro-Wilk test [$W(45) = 0.99$, $P = 0.96$], deviation from linearity [$F(12.44) = 0.91$, $P = 0.54$], and homogeneity using Levene's test [$F(3.41) = 0.527$, $P = 0.66$], show *a P-value* greater than $\alpha = 0.05$ ($P > 0.05$).

Data were analyzed using ANCOVA to compare post-test cognitive function scores between groups while controlling for baseline MoCA-Ina scores as a covariate. In addition, a paired t-test was employed to evaluate the effect of physical exercise on cognitive function within the group by comparing pre-test and post-test scores. The statistical significance of this study was set at α = 0.05. Effect sizes were calculated to estimate the magnitude of differences in outcome variables between groups using Cohen's d to improve clinical interpretation as small, medium, and large effects.

RESULTS AND DISCUSSION

Researchers measured baseline characteristics before the intervention to ensure equality between groups.

Table 3. The Subject Characteristics

Variable	AWE Group Mean (SD)	RE Group Mean (SD)	*P*-Value
Male	11	12	-
Female	11	11	
Age (years)	61.50 (2.82)	63.58 (2.72)	0.93
Years of education	11.27 (3.84)	13.65 (2.43)	0.71
BMI (kg/m^2)	21.28 (2.53)	23.01 (1.91)	0.44
Heart rate resting (bpm)	70.48 (5.30)	71.29 (6.30)	0.81
Sistole (mmhg)	122.33 (6.57)	125.38 (8.02)	0.91
Diastole (mmhg)	77.76 (5.71)	79.12 (8.02)	0.51
Oxygen Saturation (%)	97.67 (0.80)	97.88 (0.95)	0.70
Blood Glucose Level (mg/dl)	140.52 (48.35)	147.33 (44.15)	0.62
Total cholesterol (mg/dl)	196.52 (30.99)	210.62 (42.34)	0.21
Uric acid (mg/dl)	6.16 (1.85)	6.05 (1.48)	0.83
Baseline MoCA-Ina Score	18.00 (3.63)	18.43 (3.01)	0.67

Notes: Values are presented as mean (SD). AWE = Aerobic Walking Exercise, RE = Resistance Exercise, BMI = Body Mass Index, bpm = beats per minute, mmHg = millimeters of mercury, % = percentage, mg/dl = milligrams per deciliter, and MoCA-Ina = Montreal Cognitive Assessment-Indonesian version.

Table 3 shows the participant characteristics at baseline, and no statistically significant differences were observed between the AWE and RE groups across demographic variables (age, sex distribution, and years of education), anthropometric measures (BMI), and clinical indicators including resting heart rate, systolic and diastolic blood pressure, oxygen saturation, blood glucose, total cholesterol, and uric acid levels (all $P > 0.05$). Similarly, baseline cognitive function, as assessed by the MoCA-Ina, did not differ significantly between groups ($p = 0.67$).

The balanced distribution of participant characteristics strives to enhance confidence that any observed post-treatment differences in cognitive outcomes are attributable to the exercise modality itself rather than to pre-existing disparities in health status or baseline cognitive capacity. Statistical analyses for within-group comparisons of MoCA scores in the AWE and RE groups were conducted using paired t-tests. Both the AWE group ($t(21) = 7.21$, $P < 0.001$, $d = 0.36$) and the RE group ($t(22) = 8.50$, $P < 0.001$, $d = 0.58$) demonstrated statistically significant improvements in global cognitive function, as assessed by the MoCA, from pre-test to post-test.

Table 4. Comparison of Cognitive Function Scores Within Groups Effect

Outcome Measures	AWE Group Mean (SD)	AWE Group Δ Poin	AWE Group *P*-Value	AWE Group Effect Size	RT Group Mean (SD)	RT Group Δ Poin	RT Group *P*-Value	RT Group Effect Size
				MoCA-Ina				
Pre-test	18.00 (3.63)	1.27	0.001*	0.36	18.43 (3.20)	2.21	0.001*	0.58
Post-test	19.27 (3.31)				20.26 (3.01)			

Notes: Values are presented as mean (Standard Deviation). P-values were obtained using paired-sample t-tests. Effect size was calculated using Cohen's d. AWE = Aerobic Walking Exercise, RE = Resistance Exercise, Δ = Delta score, MoCA-Ina = Indonesian version of the Montreal Cognitive Assessment* = $P < 0.001$, Significance level at $P < 0.05$.

Table 4 presents the within group effects of AWE and RE on global cognitive function as measured by MoCA-Ina. In the AWE group, the mean score increased from 18.00 (SD = 3.63) at pre-test to 19.27 (SD =

3.31) at posttest, representing a mean change of 1.27 points. This improvement was statistically significant ($P < 0.001$) with a small-to-moderate effect size ($d = 0.36$). Similarly, the RE group showed an increase from 18.43 (SD = 3.20) at pretest to 20.26 (SD = 3.01) at posttest, with a mean change of 2.21 points. The improvement was also statistically significant ($P < 0.001$) and demonstrated a moderate effect size ($d = 0.58$). These data are presented in the form of graph in Figure 3.

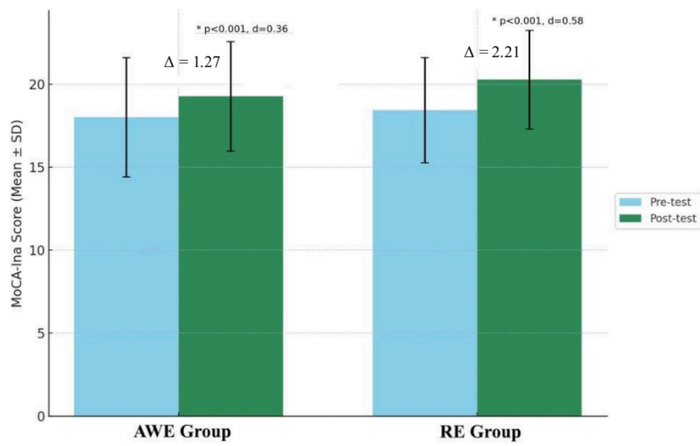

Figure 3. The Changes in Cognitive Function Within AWE and RE Group; (*) $P < 0.001$; (Δ) Delta Score

An ANCOVA test was conducted to determine the difference in the adjusted mean between the AWE and RE group. After controlling for baseline scores, ANCOVA revealed a statistically significant difference $F_{(1.42)} = 5.17$, $P = 0.028$, $\eta p^2 = 0.110$, indicating an 11% improvement in cognitive function across both groups. Resistance exercise had a greater effect (Table 4).

Table 5. Adjusted Post-test MoCa-Ina Scores and Pairwise Comparison Between Groups

Variable	95% CI (Upper-Lower)	Δ %	Adjusted Mean (SE)	Mean Difference (RE-AWE)	Effect Size	P-Value	Interpretation
AWE	19.09-19.85	7.06%	19.47 (0.19)	-	0.11	0.028	RE > AWE (significant)
RE	19.70-20.44	11.99%	20.07 (0.18)	+ 0.60			

Note: MoCA-Ina = Montreal Cognitive Assessment–Indonesian version, AWE = Aerobic Walking Exercise, RE = Resistance Exercise, SE = Standard Error, CI = Confidence Interval, adjusted means are estimated marginal means from ANCOVA controlling for baseline MoCA-Ina scores, Δ% = Delta Percentage, Significance level at $P < 0.05$.

After adjusting for baseline MoCA-Ina scores, the estimated post-test means were 19.47 (95% CI: 19.09-19.85) for the aerobic walking exercise group and 20.07 (95% CI: 19.70-20.44) for the resistance exercise group (Table 5). Pairwise comparisons further revealed a significant difference between groups, with the RE group scoring on average 0.60 points higher than the AWE group (mean difference = 0.598, SE = 0.263, $P = 0.028$, 95% CI: 0.067-1.128). These findings indicate that while both interventions improved global cognitive function, RE resulted in significantly greater post-test cognitive gains than AWE. The intervention effect or the difference between groups showed a significant impact with $P = 0.028$, although it did not fall into the category of a large effect. The analysis showed a partial eta squared (ηp^2) value of 0.11, which was classified as medium effect size (Meyers et al., 2020). This indicates that approximately 11% of the variation in the cognitive scores can be explained by the type of exercise provided. The following graph presents the average pre-test and post-test scores of the MoCA-Ina for both the aerobic walking and resistance training groups, as described above.

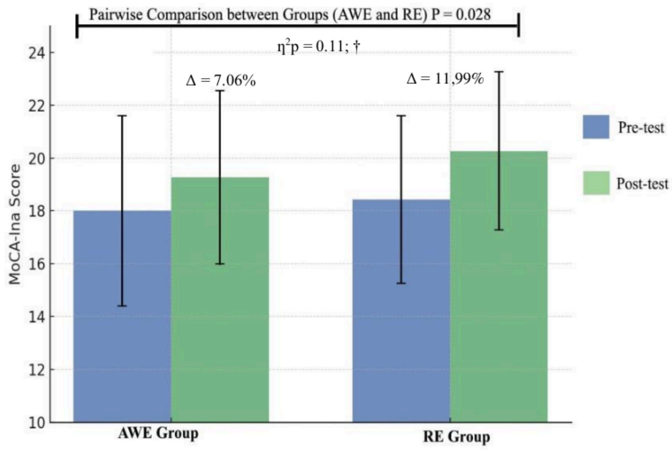

Figure 4. The Changes in Cognitive Function Between Groups of AWE and RE, (†) Significant Difference, (Δ%) Delta Percentage

The graph of the MoCA scores indicate improvements in cognitive function in both groups following the intervention. Although both exercise modalities were effective, resistance training produced more robust gains, reaching statistical significance (P = 0.028). Specifically, the RE group demonstrated an 11.99% improvement, whereas the AWE group showed a modest improvement of 7.06%. The smaller effect of aerobic walking may be attributed to its relatively limited cognitive engagement compared with the more complex motor and perceptual demands of resistance exercise (Chang et al., 2017; de Sousa Ferreira et al., 2022; Mack et al., 2022). These findings confirm that challenging psychomotor abilities will have cognitive effects on older adults with mild cognitive impairment (Liu et al., 2024). Similarly, previous studies suggest that RE in 1h of independent exercises was carried out twice per week for 12 weeks and the use of elastic exercise bands may be particularly effective for improving cognitive function, physical function and muscle strength (Yoon et al., 2017).

This phenomenon is influenced by various factors, including exercise frequency, intensity, and duration (Fragala et al., 2019). Furthermore, physical exercise involving complex and coordinated movements may stimulate proprioceptive feedback and activate the brain regions responsible for supporting cognitive resilience through adaptive neuroplastic changes (Fakontis et al., 2023; Pagan et al., 2024). It activates brain networks involved in motor function, predominantly located in the frontal and parietal lobes, encompassing the inferior frontal gyrus, anterior cingulate gyrus/additional motor area, and hippocampus (Koevoets et al., 2023; Nauer et al., 2020; Stephen et al., 2019).

The uniqueness of this study lies in its direct comparison of the effects of AWE and RE on cognitive function in older adults, while controlling for baseline cognitive scores. This approach provides a higher level of precision in the interpretation of the results. Within group analyses demonstrated an effect size of d = 0.36

for AWE and d = 0.58 for RE. Based on the findings of this study, incorporating resistance exercise into community or clinical programs for older adults may represent a strategic approach to enhancing cognitive health, provided exercise safety principles are carefully observed. At the same time, aerobic walking remains a safe, accessible option with modest but meaningful cognitive benefits, particularly when performed regularly (Kim & Ju, 2017).

While this study employed a global cognitive assessment, similar studies comparing aerobic and resistance exercises have shown that certain types of exercises can selectively enhance specific cognitive domains (Krootnark et al., 2024; Vidoni et al., 2021). Resistance exercise has demonstrated stronger effects on working memory, and processing speed such as attention, inhibition, and cognitive flexibility which mediated by increases in IGF-1 and BDNF that influence the frontal lobe (Coelho-Júnior et al., 2020; Landrigan et al., 2020). In contrast, aerobic exercise has been more closely linked to improvements in executive function and capacity (Huang et al., 2023; Kang et al., 2021). This differentiation underscores the importance of tailoring exercise prescriptions for specific cognitive outcomes.

Future research should employ domain-specific cognitive assessments to clarify the exercise modalities that most effectively target cognitive domains. Additionally, studies including older adults with comorbidities are warranted to improve the generalizability of the findings and strengthen the basis of clinical recommendations.

Additionally, this study did not focus on potential confounding factors such as eating habits, and sleep quality. Another important limitation concerns external validity. The participants in this study were relatively healthy older adults without major comorbidities, which may restrict the generalizability of our findings. In real-world community and clinical settings, older adults often present with multiple chronic conditions, polypharmacy, or functional impairments that could influence exercise tolerance and cognitive outcomes. Alhough the present results highlight the potential cognitive benefits of aerobic walking and resistance exercise in a relatively healthy population, caution is warranted when extrapolating these findings to populations with significant comorbidities.

CONCLUSION

This study demonstrates that both aerobic walking and resistance exercise are effective in improving cognitive function among older adults, with resistance exercise yielding greater gains compared to aerobic walking. These results provide empirical support for the role of structured exercise as a non-pharmacological strategy to mitigate age-related cognitive decline. Importantly, the superiority of resistance exercise suggests that incorporating strength-based training into community health initiatives may offer a practical and impactful approach to preserving cognitive function and promoting healthy ageing. The use of a quasi-experimental design with baseline cognitive control further enhances the robustness of these findings, making them relevant for application in real-world public health settings. Nevertheless, further investigations are needed to confirm the effectiveness of these interventions in broader populations, including non-exercising individuals, diverse cultural contexts, and older adults with comorbidities. Future research with larger sample sizes, extended intervention periods, and longitudinal follow-up is also warranted to better understand the sustainability of cognitive benefits over time. Collectively, these findings highlight the importance of integrating resistance training into preventive health strategies and provide a foundation for evidence-based exercise recommendations for ageing populations.

ACKNOWLEDGEMENTS

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CONFLICT OF INTEREST

The authors declare that there are no commercial or financial relationships that could be construed as a potential conflict of interest.

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