

Brain Gym and Cognitive Function in Older Women: A Quasi Experimental Study

Elisabeth Ivonia Age¹, Luh Putu Ayu Vitalistyawati², Ni Putu Dwi Larashati³, Ni Luh Made Reny Wahyu Sari⁴

^{1,3}Physiotherapy Study Program, Faculty of Medicine, Dhyana Pura University, Bali, Indonesia

^{2,4}Physiotherapy Professional Program, Faculty of Medicine, Dhyana Pura University, Bali, Indonesia

Corresponding author:

Name: Luh Putu Ayu Vitalistyawati

E-mail: ayuvita@undhirabali.ac.id

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Abstract

Background: Cognitive decline is common in later life and may be particularly relevant among postmenopausal women. Brain Gym is a simple movement-based intervention, but evidence focused specifically on older women remains limited.

Objective: To examine the effectiveness of Brain Gym for improving cognitive function in older women.

Methods: This quasi-experimental study used a non-equivalent control group pretest posttest design. Forty older women were recruited by purposive sampling and allocated by residential area to an intervention group (n = 20) or a control group (n = 20). The intervention group performed Brain Gym three times weekly for four weeks, totaling 12 sessions. Cognitive function was assessed using the Mini Mental State Examination. Paired and independent sample t tests were used.

Results: MMSE scores in the intervention group increased from 17.25 ± 4.575 to 21.95 ± 4.796 , with a mean change of 4.70 ± 2.130 (95% CI 3.703 to 5.697; $t = 9.868$; $df = 19$; $p < 0.001$). The control group showed a mean change of 0.15 ± 3.167 (95% CI -1.332 to 1.632; $t = 0.212$; $df = 19$; $p = 0.834$). The between group difference was 4.550 points (95% CI 2.822 to 6.278; $p < 0.001$), with Cohen's d of 1.686 (95% CI 0.952 to 2.404).

Conclusion: Brain Gym was associated with greater cognitive improvement than usual daily activity. Interpretation should consider the nonrandomized design and limited sample size.

Keywords

Exercise; Cognition; Aged; Female

Introduction

Population ageing is accompanied by a growing burden of health conditions that affect physical independence and cognitive function. In Indonesia, the number of older adults reached approximately 33 million in 2025, representing about 11.93% to 12% of the national population.¹ Bali has an even larger proportion of older residents, at approximately 14.9%, indicating an advanced stage of population ageing.¹ This demographic transition increases the importance of strategies that preserve functional independence and cognitive health in later life.

Cognitive function encompasses mental processes involved in memory, attention, orientation, language, learning, judgement, and problem solving.² Age related changes in the nervous system may contribute to reduced neural plasticity, slower information processing, and impaired memory, thereby increasing vulnerability to cognitive impairment. Cognitive decline can affect everyday functioning, quality of life, and safety, including fall risk.³ Because cognitive impairment may progress along a continuum from mild dysfunction to more severe impairment, accessible preventive and rehabilitative approaches are clinically relevant.⁴

Older women may have specific vulnerabilities related to both ageing and postmenopausal hormonal changes. Symptoms occurring after menopause, including sleep disturbance and fatigue, may affect daily functioning and quality of life.⁵ Reduced estrogen exposure has also been associated with changes in neural processes involved in synaptic plasticity, hippocampal function, and memory.⁶ These considerations provide a rationale for examining interventions that may support cognitive function in older women rather than assuming that evidence from mixed sex populations is directly transferable.

Brain Gym consists of simple coordinated movements intended to engage sensory and motor processes. Recent studies have reported potential benefits of Brain Gym or related movement based cognitive stimulation for older adults, although the available evidence is heterogeneous in design, population, and intervention content.^{7,8,9,10,11,12,13} Proposed mechanisms include the contribution of coordinated bilateral movement, attention, repeated motor practice, and general physical activity to neural activation and cognitive performance. Exercise and cognitive interventions may also support executive function and other cognitive domains through mechanisms involving neuroplasticity and cognitive reserve.^{14,15}

Several studies cited in the present evidence base have reported improvements in cognitive outcomes after Brain Gym in older populations.^{10-13,16,17} However, many studies have involved mixed populations or have not specifically examined older women who had undergone menopause. In addition, variation in intervention protocols and study designs limits direct comparison across findings. The present study therefore addressed a more specific population by evaluating whether a four week Brain Gym program was associated with improved cognitive function in older women.

Accordingly, this study aimed to compare changes in Mini Mental State Examination scores between older women who received Brain Gym and a control group that continued usual daily activities. The study was designed as a quasi experimental comparison and therefore evaluated between group differences in observed change rather than establishing definitive causality. Accessible interventions are particularly relevant in community settings where specialized cognitive rehabilitation resources may be limited. A program that combines simple movement, repeated practice, and group participation could be feasible within existing older adult activities. At the same time, claims regarding Brain Gym require careful interpretation because improvement in a global screening score does not identify which cognitive domains changed or whether benefits persist. A focused quasi experimental

evaluation can therefore provide preliminary evidence while also clarifying the methodological limitations that should guide subsequent confirmatory research.

The rationale for the present study was consequently both clinical and methodological. Older women represent a population in which cognitive health deserves focused attention, while the community setting provides an opportunity to examine a low resource intervention under routine conditions. By comparing change scores between groups rather than relying only on within group improvement, the study sought to provide a clearer estimate of the difference observed over the intervention period. The primary objective was to determine whether the change in MMSE score differed between older women receiving Brain Gym and those continuing their usual daily activities.

Methods

Study design and setting. This quantitative quasi experimental study used a non equivalent control group pretest posttest design. Reporting was guided by the Transparent Reporting of Evaluations with Nonrandomized Designs statement. The study was conducted from April to May 2026 in Banjar Senapahan, Banjar Anyar Village, Kediri District, Tabanan Regency, Bali, Indonesia. The objective was to evaluate differences in cognitive function between an intervention group receiving Brain Gym and a control group assessed over the same study period.

Participants and sampling. The source population comprised 90 older women living in Banjar Senapahan Kaja and Banjar Senapahan Kelod. Participants were recruited using purposive sampling after screening against the predefined eligibility criteria shown in Table 1. Forty women who met the criteria, attended the study procedures, and agreed to participate by providing written informed consent were included. Group assignment was determined by residential area. Residents of Banjar Senapahan Kaja formed the intervention group ($n = 20$), whereas residents of Banjar Senapahan Kelod formed the control group ($n = 20$). This area based allocation was used to separate the locations of intervention delivery and reduce the possibility of interaction or exchange of the intervention between groups.

Sample size determination. An a priori sample size calculation or power analysis was not performed before the study. All participants who met the eligibility criteria during the study period, attended the study procedures, and provided written informed consent were included, resulting in a total sample of 40 participants. This pragmatic recruitment approach is retained transparently because the original study did not contain the information required to reconstruct a valid prospective sample size calculation. The absence of an a priori calculation is considered a methodological limitation and may have limited the ability of the study to detect smaller effects.

The eligibility criteria are presented in Table 1 to clarify the characteristics of participants included in the study and the conditions used to reduce potential safety concerns or major sources of clinical heterogeneity.

Table 1. Eligibility criteria

Inclusion criteria	Exclusion criteria
Women aged 60 to 70 years who had undergone menopause	Cardiovascular disorders, including heart failure, arrhythmia, or other relevant conditions
At least primary school education	Neuromuscular disorders, including vertigo, stroke, Parkinson disease, or other relevant conditions
Able to perform basic functional activities, including independent standing and walking without an assistive device, and able to understand and follow instructions	Musculoskeletal injury of the lower extremities within the previous 6 months
Willing to participate from study initiation to completion and provide written informed consent	Receipt of another intervention during the study period

Intervention and comparator. Participants received procedures according to their assigned group. The intervention group performed Brain Gym three times per week for four weeks, totaling 12 sessions. Each session began with ECAP preparation, followed by the planned sequence of Brain Gym movements under the guidance of the study team. The intervention was delivered directly in a group setting by a provider who had completed undergraduate and professional physiotherapy education. The control group did not receive Brain Gym and continued their usual daily activities during the study period. Attendance was recorded at every intervention session to monitor adherence. The original dataset reported that all 40 participants completed the study and post intervention assessment, with no dropout or missing outcome data.

The intervention protocol is detailed in Table 2. Frequency was three sessions per week throughout the four week program. Drinking water was provided as the energizing component before exercise, whereas the movement components were generally prescribed as sets of eight repetitions, with each component lasting approximately 1 to 2 minutes as specified in the original protocol.

Table 2. Brain Gym intervention protocol

Stage	Movement	Dose
ECAP	Energize: Drinking Water	3 sessions/week; approximately 150 to 250 mL before exercise
ECAP	Clear: Brain Buttons	3 sessions/week; 3 × 8 repetitions, 1 set; approximately 1 to 2 minutes
ECAP	Active: Cross Crawl	3 sessions/week; 3 × 8 repetitions, 1 set; approximately 1 to 2 minutes
ECAP	Positive: Hook Ups	3 sessions/week; 3 × 8 repetitions, 1 set; approximately 1 to 2 minutes
Core movement	The Owl	3 sessions/week; 3 × 8 repetitions, 1 set; approximately 1 to 2 minutes
Core movement	Gravity Glider	3 sessions/week; 3 × 8 repetitions, 1 set; approximately 1 to 2 minutes
Core movement	Arm Activation	3 sessions/week; 3 × 8 repetitions, 1 set; approximately 1 to 2 minutes
Core movement	The Grounder	3 sessions/week; 3 × 8 repetitions, 1 set; approximately 1 to 2 minutes
Core movement	Cross Crawl	3 sessions/week; 3 × 8 repetitions, 1 set; approximately 1 to 2 minutes
Core movement	Lazy 8	3 sessions/week; 3 × 8 repetitions, 1 set; approximately 1 to 2 minutes
Core movement	Neck Roll	3 sessions/week; 2 × 8 repetitions, 1 set; approximately 1 to 2 minutes
Core movement	Space Buttons	3 sessions/week; 3 × 8 repetitions, 1 set; approximately 1 to 2 minutes
Core movement	Positive Points	3 sessions/week; approximately 1 to 2 minutes, 1 set

ECAP, Energize, Clear, Active, Positive.

Outcome measurement. Cognitive function was assessed before and after the intervention period using the Mini Mental State Examination, MMSE. The instrument was administered through direct interview by the researcher. A study cited in the original manuscript reported a validity coefficient of $r = 0.776$ and a reliability coefficient of $r = 0.827$ for the use of the MMSE in assessing cognitive function among older adults.¹³ The MMSE assesses orientation, registration, attention and calculation, recall, and language, with total scores ranging from 0 to 30. Higher scores indicate better cognitive function. The original study also categorized

scores as normal cognitive function and mild, moderate, or severe cognitive impairment according to the scoring ranges used in the study.

Study procedure and blinding. Recruitment began with eligibility screening. Eligible participants received an explanation of the study purpose and procedures and provided written informed consent before data collection. Baseline MMSE assessment was then performed in both groups. The intervention group completed 12 Brain Gym sessions, whereas the control group continued usual daily activities. After the four week study period, both groups underwent repeat MMSE assessment using the same instrument. The outcome evaluator was not blinded to group allocation because the researcher was aware of participant assignment.

Potential confounding factors. Some potential influences on cognitive function were addressed indirectly through the eligibility criteria. However, physical activity, medication use, depression, sleep quality, and comorbidities were not measured or specifically controlled. Their potential influence on the observed outcomes therefore cannot be excluded and is considered when interpreting the findings.

Statistical analysis. Data were summarized descriptively to characterize participants and MMSE scores. Normality was assessed using the Shapiro Wilk test, and equality of variance between groups was assessed using Levene's test. Because the reported assumptions were met, within group pretest and posttest differences were examined using paired sample t tests. Change scores were defined as posttest MMSE minus pretest MMSE, denoted as Δ MMSE. Between group differences in Δ MMSE were assessed using an independent sample t test. Results were reported with mean $\pm$ standard deviation, 95% confidence intervals where available, t values, degrees of freedom, p values, and Cohen's d with its 95% confidence interval for the primary between group comparison. Analyses were performed using IBM SPSS Statistics version 25.0 with a significance threshold of $\alpha = 0.05$.

Ethics. The study received ethical approval from the Ethics Committee of Dhyana Pura University, with Ethical Approval No. 001483/KEP Universitas Dhyana Pura/2026. Written informed consent was obtained from all participants before participation.

Data management. Participant information and outcome data were collected before and after the intervention period and entered for analysis in IBM SPSS Statistics version 25.0. Because all 40 participants completed the posttest assessment, the analysis did not require imputation for missing outcome data. The analytical approach used the available complete data from all enrolled participants. Change scores were calculated consistently as posttest minus pretest values, so positive values represented improvement in MMSE score. This definition was applied to the within group summaries and the between group comparison.

Reporting of intervention exposure. The intervention schedule was predefined as three sessions per week for four weeks. Attendance was recorded at each session as a measure of adherence, although the source manuscript did not provide session by session attendance percentages. The final report therefore describes the monitoring method without adding unsupported adherence statistics. Similarly, the source manuscript did not document adverse events, and none are inferred in this revision. The intervention is described according to the documented protocol and should not be interpreted as establishing safety outcomes beyond those data.

Results

All 40 enrolled participants completed the study and were included in the final analysis. The participant flow shown in Figure 1 summarizes the source population, eligibility screening, area-based group allocation, intervention period, post intervention assessment, and final analysis. No dropout or missing outcome data were reported.

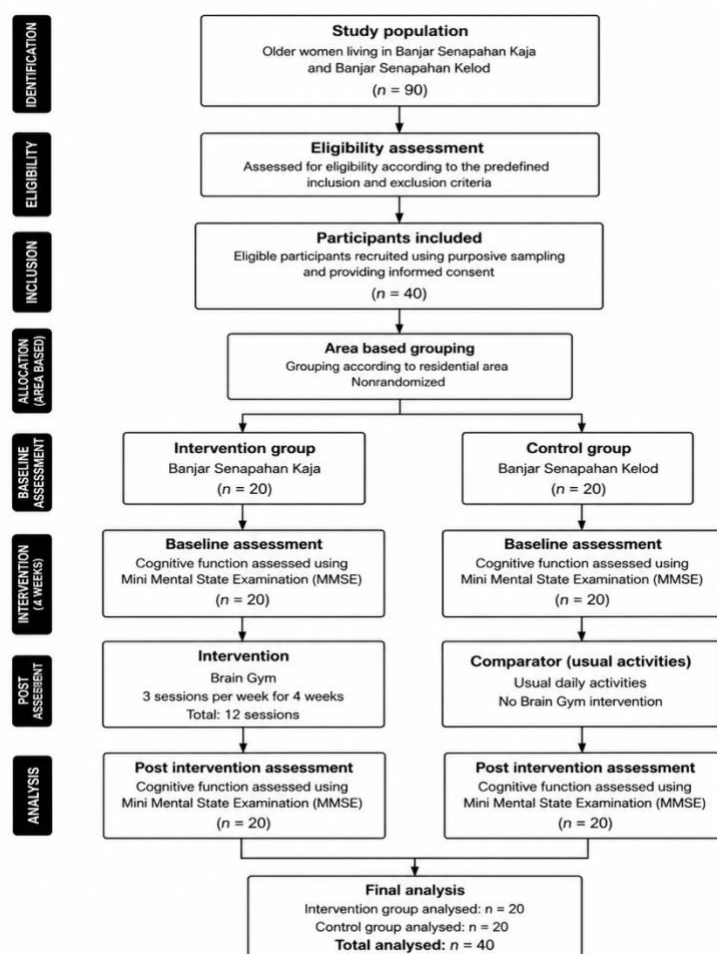


Figure 1. Participant flow and study procedures.

Baseline characteristics are summarized in Table 3. All participants were women and all had completed primary school. The intervention group had a greater proportion of participants aged 68 to 70 years, whereas the control group had a greater proportion aged 60 to 63 years. The reported baseline comparisons showed no statistically significant difference in age distribution ($p = 0.133$) or pretest MMSE score ($p = 0.915$).

Table 3. Baseline characteristics of participants

Characteristic	Intervention (n = 20)	Control (n = 20)	p value
Female sex, n (%)	20 (100%)	20 (100%)	
Age category, n (%)			0.133
60 to 63 years	5 (25%)	10 (50%)	
64 to 67 years	4 (20%)	5 (25%)	
68 to 70 years	11 (55%)	5 (25%)	
Primary school education, n (%)	20 (100%)	20 (100%)	
Pretest MMSE, mean $\pm$ SD	17.25 $\pm$ 4.575	17.40 $\pm$ 4.198	0.915

The baseline findings indicate that the measured preintervention MMSE scores were similar between groups, although the nonrandomized allocation and unmeasured confounding factors remain relevant to interpretation.

Table 4 presents the distribution of cognitive function categories before and after the study period. At baseline, most participants in both groups were classified as having moderate cognitive impairment. After four weeks, the intervention group showed an increase in the number of participants classified as having mild impairment or normal cognitive function. The control group did not show a comparable pattern and included two participants classified as having severe impairment at posttest.

Table 4. Distribution of cognitive function categories

Category	Intervention pretest	Intervention posttest	Control pretest	Control posttest
Normal	0 (0%)	4 (20%)	1 (5%)	0 (0%)
Mild impairment	6 (30%)	9 (45%)	2 (10%)	6 (30%)
Moderate impairment	14 (70%)	7 (35%)	17 (85%)	12 (60%)
Severe impairment	0 (0%)	0 (0%)	0 (0%)	2 (10%)
Total	20	20	20	20

Assumption testing indicated that the pretest and posttest data in both groups were normally distributed and that the between group variances were homogeneous, with all reported p values exceeding 0.05. The within group analyses are presented in Table 5, including the pretest and posttest means, Δ MMSE, 95% confidence intervals, t statistics, degrees of freedom, and p values.

Table 5. Within group changes in MMSE scores

Group	Pretest mean $\pm$ SD	Posttest mean $\pm$ SD	Δ MMSE mean $\pm$ SD	95% CI for Δ MMSE	t	df	p value
Intervention	17.25 $\pm$ 4.575	21.95 $\pm$ 4.796	4.70 $\pm$ 2.130	3.703 to 5.697	9.868	19	< 0.001
Control	17.40 $\pm$ 4.198	17.55 $\pm$ 4.489	0.15 $\pm$ 3.167	-1.332 to 1.632	0.212	19	0.834

The intervention group showed a statistically significant increase in MMSE score, with a mean improvement of 4.70 points. The control group showed a small mean change of 0.15 points that was not statistically significant.

The primary between group comparison examined Δ MMSE and is summarized in Table 6. The intervention group demonstrated a larger improvement than the control group, with a mean difference of 4.550 points and a large standardized effect size according to the reported Cohen's d estimate.

Table 6. Between group comparison of change in MMSE scores

Analysis	t	df	p value	Mean difference	95% CI	Cohen's d (95% CI)
Δ MMSE	5.332	38	< 0.001	4.550	2.822 to 6.278	1.686 (0.952 to 2.404)

Overall, the observed change in MMSE score was greater in the Brain Gym group than in the control group. These results describe a statistically significant between group difference in change over the four week period, with a reported Cohen's d of 1.686 and a 95% confidence interval of 0.952 to 2.404.

Taken together, the numerical results show a substantially larger observed improvement in the intervention group over the four week period. The complete case analysis included all 40 participants, and the primary comparison was supported by the reported confidence interval and standardized effect estimate. No additional outcome data, secondary analyses, or post hoc power estimates were introduced because they were not part of the source manuscript.

Assumption testing and consistency of analysis. The source manuscript reported that all relevant pretest and posttest data satisfied the normality criterion using the Shapiro Wilk test and that the group variances were homogeneous according to Levene's test, with p values greater than 0.05. Specific test statistics for these assumption checks were not provided in the source data and are therefore not added here. The reported statistical pathway was internally consistent: descriptive analysis and assumption testing preceded paired sample t tests within groups, followed by an independent sample t test of Δ MMSE between groups.

Primary between group comparison. The difference between groups was assessed using the change score rather than the posttest value alone. The mean difference in Δ MMSE was 4.550 points, favoring the intervention group. The corresponding 95% confidence interval ranged from 2.822 to 6.278, and the independent sample t test yielded $t = 5.332$ with 38 degrees of freedom and $p < 0.001$. The reported Cohen's d was 1.686, with a 95% confidence interval from 0.952 to 2.404. The confidence interval remained above zero, consistent with a positive observed difference in change scores favoring the intervention group.

Within group outcome estimates. In the intervention group, the mean MMSE score increased from 17.25 $\pm$ 4.575 at pretest to 21.95 $\pm$ 4.796 at posttest. The mean Δ MMSE was 4.70 $\pm$ 2.130, and the 95% confidence interval for this mean change ranged from 3.703 to 5.697. The paired sample t test was statistically significant ($t = 9.868$, $df = 19$, $p < 0.001$). In the control group, the mean score changed from 17.40 $\pm$ 4.198 to 17.55 $\pm$ 4.489. The mean Δ MMSE was 0.15 $\pm$ 3.167, with a 95% confidence interval from -1.332 to 1.632. This paired comparison was not statistically significant ($t = 0.212$, $df = 19$, $p = 0.834$).

Cognitive category distribution. The categorical data showed a shift in the intervention group toward less severe classifications after the program. Four participants were classified as having normal cognitive function at posttest compared with none at pretest, and the number classified with mild impairment increased from six to nine. The number with moderate impairment decreased from 14 to seven. In contrast, the control group changed from one to no participants in the normal category and from two to six in the mild category, while the moderate category decreased from 17 to 12 and two participants were classified with severe

impairment at posttest. These categorical results describe changes in classification but were not accompanied by additional statistical tests in the source manuscript.

Participant completion and baseline profile. The study included 20 participants in each group. No participant was reported to have withdrawn, and the same number of participants in each group contributed pretest and posttest data. Baseline MMSE values were nearly identical, with means of 17.25 in the intervention group and 17.40 in the control group. The reported *p* value of 0.915 did not indicate a statistically significant difference in this measured baseline outcome. Although the groups differed descriptively in their age distribution, the reported comparison also did not reach statistical significance (*p* = 0.133). These results provide the documented baseline context for interpreting the subsequent change score analysis.

Discussion

This study found that older women who participated in Brain Gym for four weeks showed a greater improvement in MMSE scores than participants in the control group. The intervention group improved by a mean of 4.70 points, whereas the control group changed by 0.15 points. The between group difference in change was 4.550 points, with a reported large effect size. The findings therefore support an association between participation in the structured Brain Gym program and improved cognitive function during the study period, while the quasi experimental design requires caution in making causal claims.

The change was also reflected in the distribution of cognitive function categories. Before the intervention, most participants in both groups were classified as having moderate cognitive impairment. After four weeks, the intervention group had more participants in the mild impairment and normal categories, whereas the control group showed no similar improvement. This pattern is consistent with earlier studies cited in the manuscript that reported improved cognitive outcomes after Brain Gym among older adults.^{16,17,18,19,20} Although the designs and populations of these studies differ, the overall direction of the findings suggests that structured movement based stimulation may have potential value for cognitive health.

Several mechanisms may help explain the observed pattern. The Brain Gym protocol used in this study involved repeated coordinated movements, including bilateral and cross body activities, alongside attention to movement sequences. Such activities may combine motor practice with cognitive engagement. More broadly, exercise and combined cognitive interventions have been associated with executive and cognitive benefits in older adults.²¹ Coordinated and repeated activity may support neural processes related to attention, information processing, and adaptive neural change. However, the present study did not directly measure cerebral blood flow, neural connectivity, neuroplasticity markers, or cognitive reserve. These mechanisms should therefore be regarded as plausible explanatory frameworks rather than outcomes demonstrated by this study.

The study population also provides important context. All participants were older women who had completed primary school, and the intervention group included a larger proportion of participants aged 68 to 70 years. Despite this difference in age distribution, the reported baseline comparison was not statistically significant, and pretest MMSE scores were similar between groups. Education is relevant when interpreting cognitive assessment because educational experience can influence performance on cognitive screening instruments.²² The relatively homogeneous educational background may reduce one source of variation within this sample, but it also limits the extent to which the findings can be generalized to older adults with different educational experiences.

The absence of a statistically significant change in the control group should also be interpreted cautiously. Cognitive function can be influenced by sleep, physical activity, medication, psychological factors, daily activities, and comorbid conditions.²³ These factors were not measured or controlled in the present study. The small change in the control group therefore cannot be attributed solely to the absence of Brain Gym, nor can the observed intervention effect be assumed to be free from residual confounding. The area based allocation also created the possibility of systematic differences between communities that were not captured by the reported baseline variables.

From a clinical and practical perspective, the intervention has characteristics that may be useful in community physiotherapy. The protocol was delivered three times per week for four weeks, used simple movements, and did not require specialized equipment. If adapted appropriately to local capacity and participant safety, a structured movement based program could be incorporated into community activities for older adults, including healthy ageing and preventive initiatives. The present findings, however, should not be interpreted as evidence that Brain Gym alone prevents dementia or reverses established cognitive disorders. The outcome was a screening measure of global cognitive function over a short observation period.

The study has several strengths. It included a contemporaneous control group, reported the intervention frequency and duration, documented the area based allocation process, used pretest and posttest assessment, and analyzed between group differences in change scores. The report also included confidence intervals for within group change and the primary between group difference, as well as a standardized effect size with a confidence interval. All 40 participants completed the study, avoiding outcome loss within the reported sample.

Several limitations are equally important. First, no a priori sample size calculation or power analysis was performed. The sample was therefore determined by the number of eligible and consenting participants available during the study period, which may have limited statistical precision and the ability to detect smaller effects. A post hoc reconstruction cannot replace a prospectively specified sample size calculation and was not introduced into the present report. Second, allocation was nonrandomized and based on residential area, creating a risk of selection bias and cluster related differences. Third, the outcome evaluator was not blinded. Fourth, important potential confounders, including physical activity, medication use, sleep quality, depression, and comorbidities, were not measured or adjusted for. Fifth, the sample was limited to older women from one community, all with primary school education, and the intervention lasted only four weeks. These features restrict generalizability and do not establish long term effectiveness.

Future research should use prospectively justified sample sizes, random allocation where feasible, blinded outcome assessment, and measurement of major confounding variables. Larger and more diverse samples should include participants with different educational backgrounds and geographic settings. Longer follow up would also help determine whether observed changes in cognitive screening scores persist after the intervention period. Studies that compare standardized Brain Gym protocols with other forms of physical or cognitive activity may further clarify whether any benefit is specific to the intervention or reflects broader effects of structured movement and engagement.

An additional consideration is the interpretation of the MMSE itself. The instrument provides a global screening score and is useful for describing broad changes in cognitive performance, but it does not provide a comprehensive assessment of every cognitive domain. The present results therefore cannot determine whether the observed improvement was concentrated in memory, attention, executive function, language, practice effects, or a combination of these factors. Repeated assessment over a short interval may also be influenced by familiarity with testing procedures. Because the same instrument was used in both groups, the comparison of change scores partially addresses common testing exposure, but it does not eliminate all measurement related influences.

The findings should also be considered alongside the magnitude and precision of the estimated effect. The reported between group confidence interval was entirely positive, and the standardized effect estimate was large. Nevertheless, effect size estimates from small nonrandomized studies may be unstable and can be influenced by baseline differences, unmeasured confounding, and the characteristics of the recruited sample. Replication in larger studies is therefore essential before broad clinical recommendations are made. This distinction is particularly important because feasibility and apparent short term benefit do not by themselves establish superiority over other forms of exercise, social participation, or cognitive stimulation.

Conclusion

Among the older women included in this quasi experimental study, participation in a four week Brain Gym program was associated with a greater improvement in MMSE scores than continuation of usual daily activities. The intervention group showed a mean increase of 4.70 points, whereas the control group showed little change, and the between group difference in Δ MMSE was statistically significant. The reported standardized effect size was large. These findings suggest that Brain Gym may be considered as a simple, low equipment, community based movement intervention that could be incorporated into physiotherapy and healthy ageing activities for older women. However, the findings should be interpreted cautiously because the study used nonrandomized area based allocation, did not perform an a priori sample size calculation, did not blind the evaluator, and did not measure several potential confounders. The results therefore support further investigation rather than definitive causal conclusions. Future studies should use prospectively justified sample sizes, stronger allocation methods, blinded assessment, longer follow up, and more diverse populations to clarify the reproducibility and durability of the observed changes in cognitive function. In practice, implementation should be accompanied by appropriate participant screening, trained supervision, and monitoring of individual tolerance. The present study provides preliminary community based evidence and a rationale for more rigorous trials rather than a basis for universal clinical adoption.

Author Contribution

Elisabeth Ivonia Age: Conceptualization; Methodology; Investigation; Data curation; Formal analysis; Writing, original draft; Visualization.

Luh Putu Ayu Vitalistyawati: Conceptualization; Methodology; Writing, review and editing; Supervision; Validation. Ni Putu Dwi Larashati: Methodology; Investigation; Writing, review and editing; Validation. Ni Luh Made Reny Wahyu Sari: Methodology; Supervision; Writing, review and editing; Validation.

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Conflict of Interest Statement

The authors declare no conflict of interest.

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Ethics Statement

This study was approved by the Ethics Committee of Dhyana Pura University under Ethical Approval No. 001483/KEP Universitas Dhyana Pura/2026. Written informed consent was obtained from all participants before participation.

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