

Original Article

Implementation of brain gym and puzzle therapy and changes in cognitive function among elderly people with dementia in primary health care: A descriptive case study

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Abstract

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Background: Dementia is a progressive decline in cognitive function that affects memory, thinking, behavior, and activities of daily living, particularly among older adults. The increasing proportion of the elderly population has contributed to the rising burden of cognitive impairment, emphasizing the need for accessible non-pharmacological interventions in primary healthcare settings. Brain gym and puzzle therapy are cognitive stimulation approaches that may support cognitive function among older adults with mild cognitive impairment.

Objective: This study aimed to describe changes in cognitive function among older adults before and after the implementation of brain gym and puzzle therapy.

Methods: A descriptive case study was conducted in the working area of Tanjung Agung Primary Health Center, Ogan Komering Ulu Regency. Two older adults were selected using purposive sampling based on the inclusion criteria: aged 60 years or older, having mild cognitive impairment based on Mini-Mental State Examination scores, and willingness to participate in the entire intervention program. The intervention was delivered by a nurse with family members acting as caregivers over four weeks. Each session was conducted daily for 30–45 minutes, consisting of 10–15 minutes of brain gym followed by 20–30 minutes of puzzle therapy. Cognitive function was assessed before and after the intervention using the Mini-Mental State Examination and the Short Portable Mental Status Questionnaire. Data were analyzed descriptively.

Results: The Mini-Mental State Examination scores increased from 18 to 24 in participant 1 and from 17 to 23 in participant 2. The Short Portable Mental Status Questionnaire error scores decreased from 5 to 3 and from 6 to 3, respectively. Additional improvements were observed in the participants' ability to follow instructions, active participation, and speed of puzzle completion.

Conclusion: Brain gym and puzzle therapy may contribute to improved cognitive function among older adults with mild cognitive impairment. These interventions can be considered as feasible non-pharmacological nursing strategies in gerontological care within primary healthcare settings.

Background

Increased life expectancy is an important indicator of progress in health development; however, it is also accompanied by a growing older adult population. Older adults aged 60 years and above physiologically experience the ageing process, which is characterized by a gradual decline in organ function, including cognitive function. This decline may progress to dementia, a progressive disorder that affects memory, thinking ability, behavior, and activities of daily living (World Health Organization, 2023). Dementia not only reduces the quality of life of older adults but also increases the burden on families and healthcare systems. Globally, more than 55 million people are living with dementia, with nearly 10 million new cases occurring each year (World Health Organization, 2023). In Indonesia, the

increasing number of older adults has contributed to a higher risk of dementia and has become a challenge for healthcare services, particularly at the primary care level, which plays a crucial role in early detection and intervention (Ministry of Health of the Republic of Indonesia, 2022).

Non-pharmacological interventions are essential because they are relatively safe, feasible to implement, and focused on maintaining cognitive function and improving the quality of life of older adults. Local data from Ogan Komering Ulu (OKU) Regency indicate a substantial increase in the older adult population, reaching 23,775 individuals, with the working area of Tanjung Agung Primary Health Center having the highest number of older adults, totaling 3,479 individuals (OKU District Health Office, 2023). However, specific

data on dementia cases have not yet been systematically documented. This limitation reflects a gap in the screening and recording system for dementia cases at the primary healthcare level. Reports of older adults experiencing disorientation and even becoming lost indicate the presence of real cognitive problems, yet these conditions have not been optimally identified and documented through the existing healthcare system.

Cognitive decline in older adults is influenced by various factors, including degenerative processes, vascular disorders, lack of physical activity, and insufficient mental stimulation (Livingston et al., 2020). Therefore, comprehensive interventions are needed, including non-pharmacological approaches based on cognitive stimulation. Brain gym and puzzle therapy are potential interventions in this context. Brain gym focuses on coordinated movements that stimulate the integration of brain functions, whereas puzzle therapy trains memory, concentration, and problem-solving ability (Karssemeijer et al., 2019). Previous studies have shown that cognitive stimulation is effective in improving cognitive function among older adults with dementia, including through cognitive stimulation therapy and game-based activities (Woods et al., 2023; Karssemeijer et al., 2019).

Nevertheless, most previous studies have employed experimental designs using a single-intervention approach. Evidence regarding the combined implementation of brain gym and puzzle therapy in community nursing practice, particularly within a case study context at the primary healthcare level, remains limited. This indicates a gap in the application of interventions that are contextual, practical, and appropriate to real-world primary care settings. Therefore, this study aimed to describe changes in cognitive function scores before and after the implementation of brain gym and puzzle therapy among two older adults with mild dementia in the working area of Tanjung Agung Primary Health Center, Ogan Komering Ulu Regency. This study is expected to provide preliminary evidence regarding the potential effectiveness of simple and practical non-pharmacological interventions to support gerontological nursing care in primary healthcare settings.

Methods

Study Design

This study employed a descriptive design with a case study approach to explore in depth the implementation of nursing interventions, namely brain gym and puzzle therapy, in improving cognitive function among older adults with dementia. The case study approach allows for a contextual understanding of individual responses in real-life situations (Yin, 2018). The reporting of this study was guided by the CARE Case Report Guidelines to ensure completeness and transparency in case study reporting (Gagnier et al., 2020). The study was conducted from January to February 2024.

Sampling and Setting

This study was conducted in the working area of UPTD Tanjung Agung Primary Health Center, Ogan Komering Ulu Regency, South Sumatra, Indonesia. The study participants were selected using purposive sampling from older adults registered in the older adult health program at the primary health center. The selection process began with screening using the Mini-Mental State Examination (MMSE) and the Short Portable Mental Status Questionnaire (SPMSQ), administered by nurses.

The study involved two older adult women: participant 1 was 69 years old, and participant 2 was 66 years old. The inclusion criteria were as follows: (1) aged 60 years or older; (2) MMSE score of 17–23, indicating mild cognitive impairment; (3) SPMSQ score of 5–7 errors, indicating moderate cognitive impairment; (4) able to communicate verbally; and (5) willing to participate in the entire intervention program throughout the study period. The exclusion criteria included severe hearing impairment, severe neurological disorders, or acute conditions that could hinder participation in the study. Differences in cognitive impairment categories between the MMSE and SPMSQ at baseline were interpreted as reflecting differences in the sensitivity of the two instruments in assessing distinct cognitive domains.

Instruments

The instruments used in this study included the Mini-Mental State Examination (MMSE), the Short Portable Mental Status Questionnaire (SPMSQ), and the Indonesian Nursing Outcomes Standard, known as Standar Luaran Keperawatan Indonesia (SLKI). The MMSE was used to assess global cognitive function, including orientation, attention, memory, language ability, and calculation, with a total score ranging from 0 to 30. The SPMSQ was used to identify the level of cognitive impairment based on the number of incorrect responses, where fewer errors indicate better cognitive function. In addition, the SLKI was used as a reference for evaluating nursing outcomes related to improved cognitive function among older adults.

Intervention

The intervention consisted of a combination of brain gym and puzzle therapy, implemented over four weeks or 28 days. The activities were conducted daily at the participants' homes with family assistance. Prior to the intervention, family members received two training sessions from the researcher and nurses, each lasting approximately 60 minutes, regarding therapy procedures and completion of the daily logbook.

Brain gym therapy was performed for 10–15 minutes and included cross crawl, hook-ups, brain buttons, and lazy 8s movements. Each movement was performed in 8–10 repetitions at light to moderate intensity. Afterward, participants continued with puzzle therapy for 20–30 minutes using jigsaw puzzles containing motivational sentences as stimuli for communication and storytelling during the puzzle completion process. The level of puzzle difficulty was gradually adjusted according to the participants' cognitive abilities, beginning with 4–6 pieces during the first and second weeks and increasing to 8–12 pieces during the third and fourth weeks. The implementation of the intervention was evaluated by nurses through weekly home visits.

Data Collection

Data were collected through interviews, observation, and cognitive function assessments conducted before and after the intervention. Adherence to the intervention was monitored using a daily logbook completed by family members, which included the time of implementation, duration of activities, and older adults' responses during therapy. Adherence was verified by the researcher during weekly home visits and through telephone communication every two to three days.

Observations were conducted to record participants' responses during the intervention, including puzzle completion time, ability to follow instructions, frequency of errors in arranging the puzzle, emotional responses during the activity, and the level of family involvement.

Data Analysis

Data were analyzed descriptively by comparing MMSE and SPMSQ scores before and after the intervention for each participant. In addition, changes in observational indicators during the intervention were analyzed to provide a more comprehensive description of changes in cognitive function and behavioral responses following therapy.

Ethical Considerations

This study adhered to the ethical principles of health research, including respect for autonomy, beneficence, non-maleficence, and justice (Beauchamp & Childress, 2019). All participants received an explanation regarding the study objectives, benefits, and procedures, and were asked to sign an informed consent form before the study was conducted. Participant identity was protected through the use of codes or initials to ensure anonymity, and all data obtained were used solely for research purposes to maintain confidentiality. This study received ethical approval from the Health Research Ethics Committee of Poltekkes Kemenkes Palembang, with approval number 0296/KEPK/Adm2/II/2024.

Results

This study presents changes in cognitive function among two older adults with dementia after receiving brain gym and puzzle therapy for

four weeks. Cognitive function was assessed using the Mini-Mental State Examination (MMSE) and the Short Portable Mental Status Questionnaire (SPMSQ) before and after the intervention.

Table 1. Characteristics of the Participants

Variable	Participant 1	Participant 2
Age	69 years	66 years
Sex	Female	Female
Baseline cognitive status	Mild dementia	Mild dementia
Location	Primary health center working area	Primary health center working area

Based on Table 1, both participants were classified as having mild cognitive impairment according to the MMSE, but moderate cognitive impairment according to the SPMSQ. This

difference indicates variation in the sensitivity of the two instruments in assessing cognitive function.

Table 2. Changes in MMSE and SPMSQ Scores Before and After the Intervention

Measurement	Participant	Pre-intervention Score	Post-intervention Score	Difference	Baseline Category	Final Category
MMSE	1	18	24	+6	Mild impairment	Normal
MMSE	2	17	23	+6	Mild impairment	Mild impairment
SPMSQ	1	5	3	-2	Moderate impairment	Mild impairment
SPMSQ	2	6	3	-3	Moderate impairment	Mild impairment

As shown in Table 2, both participants demonstrated improvement in cognitive function after completing the four-week brain gym and puzzle therapy intervention. The MMSE results showed an increase in scores for both participants, with each participant improving by 6 points. Participant 1 showed an increase from 18 to 24, accompanied by a shift in category from mild cognitive impairment to normal cognitive function. Meanwhile, participant 2 showed an increase from 17 to 23. Although participant 2 remained within the mild cognitive impairment category, this score improvement indicates clinically meaningful cognitive improvement.

The SPMSQ results also showed improvement in cognitive function in both participants. In this instrument, cognitive function is assessed based on the number of incorrect responses; therefore, a reduction in the number of errors reflects better cognitive function. Participant 1

showed a decrease in error scores from 5 to 3, with a difference of -2, while participant 2 showed a decrease from 6 to 3, with a difference of -3. These changes were accompanied by a shift in category from moderate cognitive impairment to mild cognitive impairment in both participants. Compared with participant 1, participant 2 showed a greater reduction in error scores, indicating relatively greater cognitive improvement based on SPMSQ assessment. Overall, the MMSE and SPMSQ findings demonstrated a consistent pattern of improved cognitive function following brain gym and puzzle therapy in both participants.

Observational Findings During the Intervention

The observational findings showed measurable changes throughout the intervention period. During the first week, participants required an average of 18–22 minutes to complete simple puzzles consisting of 4–6 pieces. They made 4–

6 placement errors per session and frequently required verbal assistance from family members. Their ability to follow instructions was still limited, with only 50–60% of instructions completed independently.

By the fourth week, substantial improvement was observed. Participants were able to complete puzzles consisting of 8–12 pieces within 10–12 minutes, while the frequency of placement errors decreased to 1–2 errors per session. Their ability to follow instructions increased to 80–90% independently. Emotional responses also improved, as indicated by more positive facial expressions, increased motivation, and reduced frustration when encountering difficulties.

In addition, improvements were observed in communication skills and social interaction. Participants became more responsive to questions and demonstrated more positive expressions during the activities. No adverse effects or harmful events were reported during the implementation of the intervention. Family involvement also increased, as reflected in the consistent completion of daily logbooks, with adherence exceeding 90%, and active participation in assisting the older adults throughout the intervention.

Discussion

The findings of this study indicate that the implementation of a combined brain gym and puzzle therapy intervention had a positive effect on improving cognitive function among older adults with dementia. This improvement was reflected in a 6-point increase in Mini-Mental State Examination (MMSE) scores in both participants, along with a reduction in the number of errors on the Short Portable Mental Status Questionnaire (SPMSQ). In addition, observational findings showed improvements in concentration, the ability to follow instructions, and social interaction during the intervention process. These findings suggest that cognitive stimulation using a non-pharmacological approach has the potential to serve as an effective strategy for maintaining and improving cognitive function in older adults in a holistic manner.

Theoretically, cognitive decline in older adults is a consequence of degenerative processes in the central nervous system, including neuronal loss, impaired neurotransmitter function, and reduced brain plasticity (Livingston et al., 2020). However, the concept of neuroplasticity emphasizes that the brain retains an adaptive capacity to form new synaptic connections in response to stimulation. In this context, brain gym, as a form of light physical activity, may contribute to increased cerebral blood flow and oxygenation, while puzzle therapy stimulates cognitive function through thinking, memory, and problem-solving activities. The combination of these two interventions allows simultaneous activation of multiple cognitive domains, thereby supporting more optimal cognitive improvement (Park & Bischof, 2019).

The results of this study describe the implementation process and initial responses that are consistent with previous studies demonstrating the effectiveness of cognitive stimulation in improving cognitive function among older adults with dementia. A systematic review by Woods et al. (2023) reported that cognitive stimulation therapy significantly improved cognitive function and quality of life among individuals with mild to moderate dementia. In addition, Karssemeijer et al. (2019) found that combined physical and cognitive exercise produced greater effects on executive function and memory than single interventions. These findings support the results of the present study, in which the combination of brain gym and puzzle therapy appeared to have a synergistic effect on improving cognitive function in older adults.

Furthermore, puzzle therapy specifically plays a role in enhancing cognitive ability through mental stimulation activities such as pattern recognition, problem-solving, and short-term memory reinforcement. Nurleny et al. (2021) reported that puzzle therapy significantly improved concentration and memory among older adults with dementia. In the present study, administering puzzle therapy after brain gym may have produced a priming effect, whereby prior physical activity increased brain readiness to receive subsequent cognitive stimulation. This suggests that the sequence of intervention

delivery may play an important role in optimizing therapeutic outcomes.

Nevertheless, not all participants achieved normal cognitive function after the intervention. One participant remained in the mild cognitive impairment category despite showing an increase in score. This finding indicates that the effectiveness of the intervention may be influenced by individual factors, such as dementia severity, general health status, motivation, and family and environmental support. This is consistent with Livingston et al. (2020), who stated that responses to non-pharmacological interventions are heterogeneous and influenced by biopsychosocial factors.

On the other hand, several studies have reported findings that are not fully consistent regarding the effectiveness of brain gym. Hyatt (2020) argued that empirical evidence supporting brain gym remains limited and requires further investigation using stronger research designs. These differences may be attributed to variations in intervention duration, exercise intensity, and participant characteristics. However, in the present study, combining brain gym with puzzle therapy appeared to address these limitations by providing more comprehensive stimulation than a single intervention.

This study offers a distinct approach by integrating two non-pharmacological interventions: physical stimulation through brain gym and cognitive stimulation through puzzle therapy, delivered sequentially within the context of community nursing care in primary healthcare settings. This approach enriches current practice, which has generally relied on single interventions. In addition, the case study design enabled a more in-depth exploration of individual responses throughout the intervention process, an aspect that remains relatively underexplored in previous studies dominated by quantitative approaches. Therefore, this study provides an important contribution to the development of gerontological nursing interventions that are more practical, contextual, and evidence-informed.

Several challenges were encountered during the implementation of this study, including participants' limited cognitive ability to understand instructions during the initial phase, physical fatigue while performing brain gym exercises, and limited family involvement in assisting participants. To address these challenges, the researchers applied adaptive strategies, including the use of simple and repeated therapeutic communication, direct demonstrations, and adjustment of intervention intensity and duration according to each participant's condition. In addition, family involvement as caregivers was strengthened to support the continuity of the intervention at home. These strategies proved useful in improving participant engagement and positive responses throughout the study.

In addition to improvements in cognitive function, this study also demonstrated improvements in participants' communication ability and social interaction. This is important because dementia affects not only cognitive aspects but also psychosocial functioning. Interactive interventions may enhance social engagement, reduce isolation, and improve mood among older adults (Woods et al., 2023). Therefore, the benefits of this intervention are multidimensional and may contribute to overall quality of life improvement.

Despite these positive findings, several limitations should be acknowledged. The case study design with a limited number of participants restricts the generalizability of the findings. In addition, the relatively short intervention period was insufficient to determine the long-term effects of the therapy. Therefore, future studies are recommended to use experimental designs with larger sample sizes and longer intervention periods to generate stronger evidence regarding the effectiveness of this intervention.

Conclusion and Recommendation

This case study showed that the implementation of brain gym and puzzle therapy for four weeks among two older adults with mild dementia was followed by improvements in MMSE and SPMSQ scores, as well as enhanced ability to follow instructions, concentration, and participation

during activities. In addition, observational findings indicated improvements in concentration, instruction-following ability, and social interaction throughout the intervention process. These findings highlight that cognitive stimulation integrated with physical activity may not only affect cognitive aspects but also provide psychosocial benefits, such as increased engagement and improved communication responses among older adults.

These findings provide preliminary evidence that brain gym and puzzle therapy have the potential to serve as supportive non-pharmacological interventions to improve or maintain cognitive function among older adults with dementia within the context of primary healthcare services and community-based gerontological nursing care.

However, the findings of this study should be interpreted with caution, given that the case study design and limited number of participants do not allow causal conclusions or broad generalization. Therefore, further studies with stronger designs, such as quasi-experimental studies or randomized controlled trials, involving larger sample sizes, control groups, and longer follow-up periods, are needed to confirm the benefits of this intervention for cognitive function and quality of life among older adults with dementia.

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Declaration of conflict of interest

The authors declare no competing interests.

Declaration on the Use of AI

None.

Data Availability Statement

Data sharing is not applicable to this article.

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