

Research Article

Effect of Brain-Stimulating Games and Physical Activity on Cognitive Functions in Dementia in Calabar, Nigeria

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Abstract

Introduction: Dementia prevalence has increased in Nigeria in the last two decades, and its challenges have become more visible. Dementia is poorly understood in the population, so older individuals with symptoms of cognitive impairment are commonly branded 'insane' or 'possessed by evil spirits.' This has resulted in stigmatization, rejection, neglect, and abandonment of the affected. Emerging non-pharmacological treatment options like music, dance, brain games, and physical exercises are evidential for improving cognitive functions in older people with dementia. However, studies on such alternative procedures in dementia are scarce in Nigeria. This study determined the short-term effects of brain-stimulating games and physical activities on five cognitive functions in people with mild dementia in, Calabar, Nigeria.

Methods: Mixed method design was used to collect data from 21 participants (13 older people with mild dementia and 8 caregivers). Participants with dementia were engaged in both brain-stimulating games and supervised physical activities for 12 weeks. Quantitative data were collected (pre- and post-intervention) using a validated 32-items tool which assessed 5 cognitive functions, and were analyzed on IBM-SPSS 20.0. Qualitative data were collected from caregivers through structured open-ended interviews, and thematic content analysis was done using NVivo 10.

Results: Scores on all assessed cognitive functions showed that mentally stimulating games and physical activity interventions positively and significantly influenced cognitive functions in patients with mild dementia ($p < 0.05$). Three themes emerged from qualitative data, and caregivers reported significant changes in mood, memory and attention span of the participants with dementia.

Conclusion: A combination of mentally stimulating games and exercises improved cognitive functions in older people with mild dementia. Findings have both local and global implications for enhancing social engagement, self-esteem and wellbeing of people with dementia. Further studies should determine the effect of these interventions on people with severe dementia; and the effect of individual interventions (physical activity, or brain-stimulating games) on cognitive functions.

Keywords: Brain-stimulating games; Dementia; Physical activity; Cognitive function

Introduction

The elderly population in Nigeria has grown rapidly in the last two decades and is becoming more visible with its challenges. With the ageing population, the prevalence of dementia has also increased in the last two decades. The pooled prevalence of dementia is 4.9%; with 6.4% in North-Central; 5.4% in North-West; and 4.6% in South-West [1]. Prevalence is reported to be higher in women and in urban areas. Challenges to dementia care in Nigeria include the fact that dementia is poorly understood; population-wide response is lacking; and there is no comprehensive dementia care in most health institutions. Older people with cognitive impairment behaving out of the ordinary are commonly branded either “insane” or “possessed by evil spirits/witchcraft” [2,3]. On account of this ‘lunacy and witchcraft myth’, it is therefore commonplace to find such affected relatives being taken far away from home and abandoned; or in affluent families being locked up and said to have ‘travelled abroad.’ This is similar to what has been reported in Uganda [4]. The lack of understanding about dementia has resulted in stigmatization, rejection neglect, and abandonment of the affected. Based on these factors, dementia is fast becoming a priority health problem among the aged in Nigeria because of associated stigma and substantial burden to families and caregivers.

Dementia literature highlights the value of the arts and use of emerging non-pharmacological treatment options like music; dance; brain games; and physical activity/exercises, for improving cognitive functions in people with dementia. These modes of alternative treatment therefore present a potential for improving memory and mood in adults with mild cognitive impairment [5-10].

Experts in neurology and neuroscience have posited that just as physical exercises are beneficial for strengthening the body, challenging the brain through mentally stimulating and challenging games exercise and engage the brain. These help to improve cognitive functions and abilities both in healthy individuals and older people dealing with mild cognitive impairment. These experts however recommend a combination of physical activity and brain exercises every day, and counsel on brain-exercise apps and brain games that have gone through rigorous research trials. Such games and new learning are said to improve brain structures and neuroplasticity (ability of the brain to make new connections in response to learning and stimulation). However, there are mixed results from studies in these intervention areas. For instance, researchers from the University of Pennsylvania in Philadelphia [11], using a group of healthy young adults, reported that commercial brain games appear to have yielded negative results

on cognitive function beyond the tasks included in the games. Also, although Palau M, et al. stated that playing video games can be an optimal cognitive training since it involves high levels of engagement and motivation, they reported limited changes in cognitive enhancement in their study [12]. However, despite the skepticism about the effect of brain-stimulating games, other evidence suggests that video games, brain teasers, and physical activity have a positive effect on cognitive functions of the aged [8-10]. Such evidence also shows that physical exercises induce structural and functional changes in the brain, and can enhance cognitive functioning and wellbeing [13].

Physical activity (exercise) has also been found to be beneficial to people with dementia [10]. In a meta-analysis reported a statistically significant improvement in cognition of subjects in the measured by the MMSE score, after intervention of physical activity and exercise. Experts conclude that such evidential positive results should lead to reflection on the use of exercise as a modifiable factor for enhancing cognitive abilities and mood. They however stress that excessive physical exercise could be counter-productive. These alternative modes of treatment (brain games and physical activity), therefore present a potential for improving memory and mood in adults with mild cognitive impairment. However, studies on such alternative procedures in dementia are scarce in Nigeria. This study therefore aimed to determine the short-term effects of brain-stimulating games and physical activities on five cognitive functions in people with mild dementia in Calabar, Nigeria. Results will add to existing literature in this area. The five Cognitive functions evaluated in the study were memory of everyday events, attention span, and judgment, processing speed, and reasoning [14].

Materials and Methods

Mixed methods design (intervention and exploratory) was utilized to collect data from 21 participants made up of 13 older people with mild cognitive impairment identified in two Old People’s Homes in Calabar; and 8 caregivers (called ‘caretakers’) in the Homes. To be eligible for inclusion, Community Screening Interview for Dementia and the Five-Word Test were used for screening. Only people with scores indicating mild cognitive impairment were recruited along with the caregivers. Institutional ethical clearance was obtained, as well as permission from relevant gatekeepers, and voluntary informed consent from participants and significant others.

Intervention

All participants had both interventions so results were for a combination of mind-stimulating games and physical activity. For the physical activities, participants were engaged in sessions comprising thirty minutes of supervised aerobics by a trained instructor, plus 30 minutes of walking in groups around the

compound, and 45 minutes of group dancing, interspersed with 20 minutes rest periods. These were done on alternate days (three days a week) for 12 weeks, giving a total of thirty-six sessions. For the brain-stimulating games, participants played 5 selected Google play games for forty-five minutes. These games were in the categories of adventure (for all), plus e-football (male participants) and role playing (female participants). These were followed by playing five mentally stimulating board and word games (Sudoku, Crossword puzzle, Draft/Checkers, Jigsaw puzzle, and Scrabble) for one hour each day on alternate days (three days a week) for the 12 weeks, totaling thirty-six sessions. These games focused on speed of processing information, reasoning and memory. This means that participants were engaged in one hour forty-five minutes active physical exercises and one hour forty-five minutes of brain-stimulating games on alternate days. Participants (both those with dementia and the caregivers) were encouraged to learn and play new games, but only few of them agreed to learn Chess and interactive online games.

Instruments

Quantitative data were collected using a validated structured interview schedule with 32 items on four-point Likert-type scale adapted from two standardized instruments (Mini-Mental State Examination (MMSE) by Folstein MF, et al. [15]; and Test of Everyday Attention [16]. The tool also included a module on

logical verbal reasoning. Qualitative data (verbal responses on perceptions, and impressions about changes in behavior in the aged etc.) were collected from caregivers through non-structured, in-depth interview schedule with twelve open-ended questions.

Data collection and analysis: Quantitative data assessed five cognitive functions (reasoning, processing speed, judgment, memory of everyday events, and attention), and were collected three times during the study (before intervention, two weeks after the 12 weeks intervention, and 8 weeks later, that is week 0, week 14, and week 22). Verbal responses about changes in behavior in the aged participants with dementia were collected from caregivers ('caretakers'), and recorded on audio-tapes and field notes. Data analysis for quantitative data involved descriptive (percentages and means), and inferential statistics (one-tailed t-test) analyzed on IBM-SPSS 20.0, while qualitative data were transcribed, and coded for thematic content analysis using NVivo 10.

Results

Socio-demographic characteristics of participants: The mean age of the participants with dementia was 75±3.4 years; 61.5% were female; 69.2% widowed; and highest education being secondary education (76.9%). The caregiver participants had a mean age of 41±2.6 years; 100% were married; 100% had secondary education; and 75% were female (Table1).

Characteristics	Participants with Dementia (n = 13)		Caretakers (n = 8)	
	No.	%	No.	%
Age (in years)				
35 to 40	-	-	2	25.0
41 to 50	-	-	6	75.0
70 to 80	9	69.2	-	-
Over 80	4	30.8	-	-
	Mean: 75±3.4		Mean: 41±2.6	
Gender				
Male	5	38.5	2	25.0
Female	8	61.5	6	75.0
Marital status				
Married	0	0	8	100
Widowed	9	69.2	0	0
Divorced	4	30.8	0	0

Highest education obtained				
Primary	2	15.4	0	0
Secondary	10	76.9	8	100
Tertiary	1	7.7	0	0

Table 1: Socio-demographic characteristics of participants.

Effect of intervention on cognitive function: The results were for a combination of both mind-stimulating games and physical activity, since all participants had both interventions. Quantitative results showed that mentally stimulating games and physical activity interventions positively and significantly influenced cognitive functions in patients with mild dementia, both at the first and second post-tests. The mean for reasoning increased from 12.4 at pre-test to 18.9 at post-test 1, and 20.5 at post-test 2. Processing speed increased from 10.5 at post-test 1, and 16.7 at post-test 2; Judgment increased from 11.0 to 16.9 and 19.7; Memory of everyday events increased from 10.2 to 13.4 and 15.8; while Attention increased from 11.6 to 18.8 at post-test 1, and 21.1 at post-test 2 (Table 2). There was no significant difference in means on the basis of gender.

Cognitive functions	Pre-interv. \bar{X}	Post-interv. 1 \bar{X}	t	p	Post-interv. 2 \bar{X}	t	p
Reasoning	12.4	18.9	3.8	0.001	20.5	2.3	0.01
Processing speed	10.5	14.0	1.7	0.05	16.7	2.2	0.01
Judgment	11.0	16.9	2.8	0.01	19.7	2.8	0.005
Memory of every day events	10.2	13.4	1.8	0.05	15.8	2.3	0.01
Attention	11.6	18.8	3.5	0.001	21.1	3.9	0.001

Table 2: Pre- and post-intervention results on cognitive functions of participants with dementia (n = 13).

For qualitative results, caregivers reported that they had noticed significant changes in mood, memory and attention span in the older participants involved in the study. Five of these eight caregivers reported noticing remarkable changes from the fifth week of the intervention. Three themes emerged from qualitative data: ‘eagerness to engage in activities’; ‘taking better care of self-hygiene’; and ‘looking happier and friendlier.’

People with dementia tend to lack interest in activities and so often feel withdrawn. However, after the intervention these participants were more eager to engage in activities in the Home, and also began to pay more attention to their self-hygiene and grooming. Typical statements made by caregivers on the theme ‘Eagerness to engage in activities’ include:

“...They now seem eager to engage in the Home activities and household chores...” (C 03)

“Our ‘mamas and papas’ now wake up early and are eager to start

the day’s activities. Mrs. E woke up yesterday and told Mrs. B, ‘I will plait (braid) your hair today’” (C 06)

For the theme ‘Taking better care of self-hygiene’, verbatim quotes include:

“Before now we had issues with their self-hygiene, now they do it without being persuaded or coerced” (C 01)

“For 3 weeks now, our people are serious about self-hygiene... and are particularly concerned about their grooming, dressing and self-care” (C 08)

Verbatim statements signifying that the aged participants were ‘Happier and more friendly’ after the intervention, were:

“I have worked at this Home for over four years, and I have never seen the people brought here looking so happy, friendly, and so expectant” (C 02)

“Ever since Mrs. E was brought here, she has always been reclusive, but for three weeks now she seems happier and more friendly” (C 05).

These actions and behaviors by the participants may signify improvement in cognition in terms of their mood, attention span, judgment and reasoning, and also complement the findings from the quantitative data showing significant increase in scores after the intervention.

Discussion

Results from this study are similar to other studies [9,14,17], who reported the positive effects of exercises/physical activity interventions, especially strategies that include aerobic exercise, on cognitive function in dementia. [10]. However reported that intense aerobics and strength exercises do not slow down cognitive impairment in people with mild or moderate dementia. The meta-analysis by Forbes D, et al. [18], concludes that there is promising evidence that exercise programmes may improve the ability to perform ADLs in people with dementia. This conclusion is in line with the report by Raleigh MF, et al. [17], who stated that some evidence shows the ability of exercise to improve cognitive function in relation to ADLs in dementia patients. [19]. Also reported that physical exercise interventions are capable of preserving the functional capacity of persons with mild to moderate dementia, and have indirect benefits to their caregivers.

With regards to brain-stimulating games, Anderson P [20], reported that studies in Sydney and Montreal have found that brain training through engaging games are capable of improving memory, mood, and attention in older people with mild cognitive impairment. The findings in the present study are in line with these reports. Malisa N and Kirana Y [21], also reported a positive effect of Android-based video games on the cognitive function of stroke patients in Indonesia. West GL, et al. [8], reported that older adults can benefit from video-game training which was shown to have a positive effect on the hippocampal memory system.

The findings in this study have implications for enhancing social engagement, self-esteem and wellbeing of people with dementia. People with dementia in Nigeria, tend to be left alone by carers because of their lack of interest in daily activities, and other behaviours. Physical and mental stimulation influences their mood/affect and makes them become more engaged. This was evident six weeks into the twelve weeks of intervention in this study. Caregivers and carers should therefore utilize these interventions for people with dementia.

Conclusion

A combination of mentally stimulating games and exercises improved five cognitive functions (memory of everyday events,

attention span, judgment, processing speed, and reasoning) in older people with mild dementia. Future research should involve the effects of these interventions on people with severe dementia. Research should also address how these interventions (physical activity, or brain-stimulating games) individually affect cognitive functions.

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