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Original Article

Cognitive stimulation in older adults: an online intervention proposal during the pandemic

Estimulação cognitiva em idosos: uma proposta de intervenção online em tempos de pandemia

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Abstract

It is known that cognitive decline occurs with human aging. Cognitive stimulation (CS) is understood as an essential tool for enhancing cognitive functions. This study aimed to evaluate the benefits of online CS and compare the performance of older adults after cognitive intervention sessions. Twenty older women were recruited through non-probability sampling and selected for convenience. The participants were divided into two groups: Experimental Group (EG) and Control Group (CG), with 10 members each. The cognitive interventions occurred in six weekly group sessions conducted online via the Google Meet platform. Data were analyzed using the *R* statistical software (R Core Team, 2019). Descriptive analysis was used for the means, and the *t*-test was applied for comparisons between the EG and CG. The results indicated that the EG showed significant improvements in cognition, particularly in the domains of attention and strategy adoption, as well as slight improvement in depressive symptoms after the CS sessions. Therefore, it is concluded that CS has significant effects on older adults.

Keywords: Cognition, Aged, Healthy Aging.

Resumo

Sabe-se que há declínio cognitivo no envelhecimento humano. A estimulação cognitiva (EC) é compreendida como uma ferramenta essencial para a potencialização das funções cognitivas. Este estudo teve como objetivo avaliar os benefícios da EC online e comparar o desempenho de idosos após sessões de intervenção cognitiva. Participaram 20 mulheres idosas, recrutadas por amostragem não probabilística e selecionadas por conveniência. As participantes foram divididas em dois grupos: Grupo Experimental (GE) e Grupo Controle (GC), cada um com 10 integrantes. As intervenções cognitivas ocorreram em seis encontros semanais,

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realizados em grupo e online por meio da plataforma virtual *Google Meet*. Os dados foram analisados no programa estatístico *R* (R Core Team, 2019). Utilizou-se a análise descritiva para as médias e o teste *t* para comparação entre o GE e o GC. Os resultados indicaram que o GE apresentou melhorias significativas na cognição, especialmente nos domínios da atenção e da adoção de estratégias, assim como discreta melhora na sintomatologia depressiva após as sessões de EC. Portanto, conclui-se que a EC tem efeitos significativos nos idosos.

Palavras-chave: Cognição, Idoso, Envelhecimento Saudável.

Introduction

Human aging is a complex and multifaceted phenomenon that necessitates increased investments in the health of older adults, particularly considering the emergence and progression of age-related diseases. The growing prevalence of neurocognitive disorders underscores the importance of prioritizing cognitive health in older adults, with an emphasis on preventing potential dementia. According to the World Health Organization (WHO), recent data indicate that by 2050, 80% of older adults will reside in low- and middle-income countries. Given the continuous global and national increase in the older population, it is imperative to implement strategies that promote aging with enhanced quality of life (Organização Mundial da Saúde, 2018).

A guide developed by Organização Mundial da Saúde (2017) suggests interventions for managing declining abilities and maintaining the capacities of older adults. Among these interventions, cognitive stimulation (CS) stands out for all older adults, including those without established neurocognitive or dementia disorders. This prompts reflection on the potential of cognitive interventions to maintain and stimulate brain functions, including memory and other cognitive domains.

CS is regarded in the literature as the intervention with the greatest support and scientific evidence, despite existing limitations. It is suggested that CS significantly improves cognitive functions, social interaction, and quality of life in older adults (Yokomizo et al., 2020). McDermott et al. (2019) also emphasize that group interventions yield even more satisfactory outcomes, potentially because older adults interact more effectively and share their experiences, fostering a sense of belonging and a social support network.

CS can be understood as a broad approach involving engagement in activities aimed at improving the cognitive and social performance of individuals or groups. Evidence regarding the effectiveness of intervention programs focused on cognitive performance dates to the 1980s in the international context (Golino & Flores-Mendonça, 2016). Advances are also observed in Brazil regarding cognitive intervention models applied to the older population. Studies employing individualized, group, and intergenerational approaches have demonstrated effectiveness in maximizing cognitive functions, particularly attention skills, recent memory, social participation, and other cognitive aspects (Krug et al., 2019; Parola et al., 2019; Justo-Henriques, 2021).

The use of technologies and virtual reality has also been cited in the literature as an important tool for implementing CS programs, especially during the COVID-19 pandemic, when remote services became prominent (Silva Neto et al., 2023; Lucena et al., 2020).

Researchers who evaluated older adults after five sessions of cognitive intervention based on metamemory and mental imagery creation demonstrated the positive effects of stimulation and its potential gains in cognitive domains. Authors have highlighted the importance of continuous and longitudinal monitoring, as well as interventions with a cognitive focus (Aramaki & Yassuda, 2011). A bibliographic review on CS and its benefits for human ageing conducted by Oliveira et al. (2017) highlighted the positive effects of CS on maintaining cognitive performance and functionality for activities of daily living (ADL).

Another study that evaluated the cognitive functions of older adults before and after CS workshops identified significant improvements in cognitive performance, particularly in recall memory. Like the aforementioned studies, it suggests continuous interventions to amplify cognitive gains (Matos et al., 2020).

A review of studies focusing on cognitive training interventions in healthy older adults and those with mild cognitive impairment revealed that most research reported significant effects and improvements in cognitive performance in experimental groups. Additionally, it highlighted that group interventions yielded more expressive results (Olchik et al., 2012).

Souza et al. (2019) conducted a systematic review that sought to identify methodological designs, procedures, and outcomes of studies focusing on group CS practices and identified a diversity of methodologies regarding sample size, number of sessions, and themes. Corroborating previous studies, it emphasized the multimodal nature of interventions and the benefits for cognitive performance, social participation, and mood among older adults involved. Thus, considering the cognitive approach and its multidisciplinary nature, the importance of occupational therapists utilizing these resources to enhance performance in everyday life is underscored.

Occupational therapy is characterized as a profession dedicated to the issues of everyday life, considering biopsychosocial and spiritual aspects. In the field of gerontology, occupational therapy addresses the effects of these aspects on the daily performance of older adults, fostering participation and engagement in ADL, Instrumental Activities of Daily Living (IADL), and other meaningful occupations (Assis et al., 2017).

Occupational therapy interventions focused on stimulating the cognitive and functional performance of older adults have stood out in research and professional practice across various contexts (Tobar et al., 2017; Raymundo et al., 2017; Cruz et al., 2022; Alcantara et al., 2019). These interventions contribute to maintaining and enhancing cognitive functions, reducing declines associated with ageing. The diversity of these practices highlights the relevance of the profession and other fields operating in this domain.

Based on the state of the art regarding cognitive interventions, this study is guided by the following questions: Does CS enable better cognitive performance in older adults? Are there improvements in test results after the quasi-experimental stage with cognitive intervention? The hypotheses indicate positive effects of stimulation on cognitive performance and test results following the quasi-experimental intervention.

Considering the growing older population and the need to address cognition in their everyday lives, this study is justified by the relevance of the theme and the need for investments in older adults' cognitive health and in investigating the benefits of CS. The

terms cognitive stimulation and cognitive training are used synonymously throughout this study.

Therefore, this study aimed to evaluate an online cognitive intervention proposal for older adults during the COVID-19 pandemic and to compare test performance after CS sessions. To this end, cognitive functions, functionality in IADL, depressive symptoms, and the use of cognitive strategies were assessed.

Method

Study type and ethical aspects

This is a quasi-experimental study with pre- and post-intervention evaluation. It was developed by an occupational therapist along with other team members from the psychology field, highlighting the importance of multidisciplinary work in the domain of human ageing, with an emphasis on cognitive and social performance.

The study was submitted to the Ethics and Research Committee of the State University of Paraíba (UEPB) and received approval (protocol no. 4.729.429 and CAAE 46761120.4.0000.5187). All ethical aspects and recommendations outlined in Resolution no. 466/2012 of the National Health Council were respected. Participants signed an Informed Consent Form (ICF), were informed about all stages of the research, and had the confidentiality of the information provided assured (Brasil, 2012).

Participants

The study sample consisted of 20 older women. Participants were selected using non-probabilistic convenience sampling, employing the snowball sampling method (Vinuto, 2014). Subsequently, participants were randomly assigned to two groups: the Experimental Group (EG) and the Control Group (CG). A simple random draw was conducted using a virtual program based on protocol numbers enumerated from 1 to 20. The first ten numbers drawn formed the EG, and the remaining numbers comprised the CG.

Inclusion criteria were as follows: being aged ≥60 years; not presenting cognitive impairment as evidenced by a score ≥24 on the Mini-Mental State Examination, considering the sample's educational profile (Brucki et al., 2003); not presenting functional impairment as indicated by a lower score on the Lawton and Brody Scale for IADL; not presenting depressive symptoms identified by the Geriatric Depression Scale (GDS); not being institutionalized.

Exclusion criteria included having a prior diagnosis of Major Neurocognitive Disorder according to DSM-V criteria or Severe and Persistent Mental Disorders (SPMD); not having attended school or not having completed the Elementary School (*Ensino Fundamental I*); presenting sensory, functional, or communication deficits that could interfere with the application of instruments or the research process; having difficulties managing online technologies.

Instruments and procedures

The instruments used in the pre-test (initial stage) included:

– Sociodemographic Questionnaire: Collected data on sex, educational level, professional activity, religiosity, among other variables.
– Mini-Mental State Examination (MMSE) (Folstein et al., 1975): Used to assess cognitive functions, consisting of 18 items with a maximum score of 30. This instrument was translated and validated in Brazil by Bertolucci et al. (1994) and presents positive internal consistency and test-retest reliability. Participants scoring >25 were considered cognitively healthy. Given the profile of the participants in this study, it was unnecessary to adopt cut-off points for educational levels.
– Lawton & Brody (1969 Functional Scale: Employed to assess Instrumental IADL, aiming to identify functional capacity in performing complex daily activities. Scores range from 7 to 21, with higher scores indicating better functional performance. Participants with a score ≤7 were considered dependent for complex activities, while those with a score >7 were considered independent. Although not validated in Brazil, this scale has demonstrated reliability in research (Santos & Virtuoso Júnior, 2008) and is widely used.
– Geriatric Depression Scale (GDS): Composed of 15 items, this scale aims to identify the presence of major depressive symptoms. Scores >5 are indicative of depressive symptoms (Almeida & Almeida, 1999). In the Brazilian validation study by Paradela et al. (2005), a cut-off score of 5 was adopted to suggest major depression in the sample.
– Multifactorial Memory Questionnaire (MMQ-Strategy): Comprising 19 items, this instrument evaluates the frequency of memory strategy use over the past two weeks, using the following scale: 4 - all the time; 3 - often; 2 - sometimes; 1 - seldom; 0 - never. Higher scores indicate better adoption of cognitive strategies in everyday life (Simon et al., 2016). This scale was translated and validated for Brazil and is publicly available.

These instruments were compiled into a single protocol, with a maximum application time of 60 minutes in an online format. These tools provided a comprehensive evaluation of the sample, aiming to meet the study's objectives and proceed with its stages, as well as addressing integral cognitive and functional health.

The CS intervention consisted of six sessions aimed at guiding and stimulating the participants' cognitive functions using a multimodal approach. This included attention, memory, executive functions, cognitive strategies (compensatory measures), and other skills to maintain and improve cognitive capacity. The first and last sessions were dedicated to the pre- and post-intervention evaluation processes, respectively. During the weekly sessions, EG participants were instructed on activities to be conducted at home, focusing on the continuity of CS in the targeted domains. CG participants were invited to participate in group CS activities after the experimental study's conclusion.

Table 1 describes the methodology of the interventions. The cognitive intervention protocol and plan were developed by the authors, considering the main themes to be addressed, the cognitive domains to be stimulated, and the timeframe for the study's completion.

The sessions were conducted in groups using the Google Meet platform, considering the relevance of group approaches for fostering social interaction among older adults and creating new bonds during the COVID-19 pandemic. The interventions prioritized participants' safety.

Each session lasted 60 minutes, and participants were required to maintain a minimum attendance rate of 80%. All participants met the minimum required attendance for the CS sessions, demonstrating regular attendance and active participation. During the final stage of the study (post-test), the evaluation instruments used in the pre-test stage were reapplied, except for the sociodemographic questionnaire, to compare the performance of participants in the CG and EG after the cognitive intervention.

Table 1. Methodological description: sessions, objectives, and activities conducted during cognitive interventions.

Identification	Objective	Stimulation	Home Activity
Pre-intervention assessment	**Conduct evaluation tests.**	–	–
Session 1	Introduce the Cognitive Stimulation program and explain the sessions.	- Group dynamic for interaction: each participant shared their name and a personal quality, then repeated the name and quality of the previous participant. - Psychoeducation: "What is Cognitive Stimulation?" - Orientation about the Cognitive Stimulation program, followed by a Q&A session.	Game: "Completing words with vowels." Participants filled out an exercise sheet containing only vowels to form various words.
Session 2	Stimulate attention and short-term memory.	- Psychoeducation: "What are attention and short-term memory?" (Resources: slides and audiovisual material). - Telephone list: a list containing 10 different phone numbers was presented for 60 seconds. Participants selected one number, and after the image was removed, they recalled the numbers assigned to them. - Use of audiovisual resources: a music video was presented with details such as the singer, composer, lyrics, and year. Questions followed: Who is the singer? What year is the song from? Who is the composer? Participants identified the location of specific excerpts in the song: beginning, middle, or end.	- Sudoku game (3x3 and 4x4 grids). - Musical video with embedded images shown at various points. Participants completed a questionnaire about the video and images presented.

Table 1. Continued...

Identification	Objective	Stimulation	Home Activity
Session 3	Stimulate language and visuospatial memory.	- Psychoeducation: "What are Language and Visuospatial Memory?" (Resources: slides and audiovisual material).	- Spot the differences game.
		- Four geometric shapes (circle, cone, cylinder, cube) were projected. Participants copied these shapes, maintaining their exact location. Copies were later assessed individually for accuracy of shape and placement.	- Creating new words by altering suffixes. Participants received a list containing prefixes and completed it by adding new suffixes to form words.
		- Writing two lists: (1) Names of people starting with a selected letter within 60 seconds. (2) Names of objects starting with a selected letter within 60 seconds.	
Session 4	Stimulate episodic memory and long-term memory.	- Psychoeducation: "What is Long-Term Memory?" (Resources: slides and audiovisual material).	- Reflect on a significant life event (participants could write, record audio, or make a video) using guiding questions.
		- Word lists: a list containing 10 words was read aloud and displayed with corresponding images. Participants had 90 seconds to recall and write down as many words as possible. This process was repeated twice with new lists: (1) objects, (2) animals, (3) colors, totaling 30 words.	
		- Delayed recall: participants recalled previously presented word lists and had 90 seconds for each.	
Post-intervention assessment	Reapply the tests used in the initial stage.	–	–

Data analysis

Categorical variable data were expressed as absolute (n) and relative (%) frequencies. In the exploratory analysis using R Core Team (2019), quantitative variable data showed normal distribution (Shapiro-Wilk test) and homoscedasticity (Levene's test) and were reported as mean and standard error (SE). Scores of the variables were analyzed using independent and paired *t*-tests. Percentual variation between stages was calculated as $\Delta = [(post - pre) \div pra]) \times 100$. Additionally, the effect size (ES) was calculated using

Cohen's (1988) d, following Morris (2008). The ES was interpreted as follows: no effect ($d \leq 0.19$), small (d=0.20–0.40), moderate (d=0.41–0.79), or large ($d \geq 0.80$). Inferential analyses were conducted using the Jamovi 2.4 (The Jamovi Project, 2020) statistical package. The level of statistical significance was set at 5% ($p<0.05$).

Results and Discussion

Table 2 presents the participants' social profile, which shows similar characteristics between the groups.

Table 2. Social profile of study participants (n=20).

Variable	CG (n=10)	EG (n=10)
Age (years)	70.4 (6.0)	69.9 (5.1)
Marital status		
Married or living with a partner	6 (60.0)	4 (40.0)
Widowed	2 (20.0)	5 (50.0)
Divorced, separated, or estranged	0 (0.0)	1 (10.0)
Single	2 (20.0)	0 (0.0)
Ethnicity/Race		
Black	2 (20.0)	2 (20.0)
White	4 (40.0)	7 (70.0)
Mixed/Mulatto/Caboclo	4 (40.0)	1 (10.0)
Occupation during most of life		
Healthcare	0 (0.0)	2 (20.0)
Education	0 (0.0)	3 (30.0)
Administrative services	2 (20.0)	2 (20.0)
Domestic activities	4 (40.0)	1 (10.0)
Industry worker	0 (0.0)	2 (20.0)
Trade worker	1 (10.0)	0 (0.0)
Telemarketing operator	1 (10.0)	0 (0.0)
Education level		
Elementary School	2 (20.0)	0 (0.0)
High School	6 (60.0)	6 (60.0)
Higher education	1 (10.0)	2 (20.0)
Postgraduate education	1 (10.0)	2 (20.0)
Religion		
Catholic	6 (60.0)	8 (80.0)
Evangelical	4 (40.0)	1 (10.0)
Spiritist	0 (0.0)	1 (10.0)

Note: Data are presented as absolute frequency (n) and relative frequency (%), except for age, where mean and standard error (SE) were used. EG = Experimental Group. GC = Control Group.

Based on the pre- and post-intervention evaluations, it is possible to identify, as shown in Table 3 below, significant performance and slight improvements among the older adults during the study, with particular emphasis on mental state performance (CG: Pre – 27.70 (0.63); Post – 27.50 (0.56) / EG: Pre – 27.30 (0.72); Post – 29.30 (0.40)*), which demonstrated a large effect size (0.987).

Table 3 presents the effects of cognitive intervention and the participants' performance across all stages, as well as the scores for the respective groups (CG and EG) during each stage.

For all variables, the groups started from the same condition (p>0.05). Cognitive stimulation demonstrated a large effect on mental state (Δ_{EG}=+7.3%), a small effect on functional capacity (Δ_{EG}=+2.0%), and a moderate effect on metamemory (Δ_{EG}=+15.2%). Depressive symptoms did not change over time or as a result of the intervention.

Table 3. Effect of cognitive stimulation on mental state, functional capacity, depressive symptoms, and metamemory in older women.

Variable	Stage	CG (n=10)	EG (n=10)	ES (Classification)
Mental State [a]	Pre	27.70 (0.63)	27.30 (0.72)	0.987 (Large effect)
	Post	27.50 (0.56)	29.30 (0.40)*	
	Δ	–0.7%	+7.3%	
Functional Capacity [b]	Pre	20.40 (0.27)	20.10 (0.41)	0.350 (Small effect)
	Post	20.40 (0.27)	20.50 (0.22)	
	Δ	0.0%	+2.0%	
Depressive Symptoms [c]	Pre	3.10 (1.14)	2.60 (0.60)	0.133 (No effect)
	Post	2.50 (0.77)	2.40 (0.54)	
	Δ	–19.4%	–7.7%	
Metamemory [d]	Pre	17.80 (2.77)	17.80 (2.35)	0.484 (Moderate effect)
	Post	16.40 (2.91)	20.50 (3.75)	
	Δ	–7.9%	+15.2%	

Note: Data are reported as mean and standard error. CG = Control Group; EG = Experimental Group; ES = Effect size (d) and classification according to Cohen (1992). Δ = Percentual variation between phases. Measurements obtained using the instruments: [a]Mini-Mental State Examination; [b]Instrumental Activities of Daily Living; [c]Geriatric Depression Scale; [d] Multifactorial Memory Questionnaire. *Significant difference compared to CG in the post phase (p<0.05).

Overall, the results indicate an improvement in cognitive performance, which aligns with the literature (García-Sevilla et al., 2014; Ordonez et al., 2017), showing that individuals undergoing cognitive intervention achieve better scores in cognitive function performance. Trindade et al. (2013) investigated cognitive decline in institutionalized

and non-institutionalized older adults, and observed the repercussions and influence of cognitive functions on functionality and even depressive symptoms among participants.

The functionality of participants in both groups was satisfactory for IADL, with a slight improvement in the EG after cognitive intervention. These findings align with data from Gomes et al. (2020), who conducted a bibliographic review on CS in older adults without cognitive impairment and identified significant improvements in performance in instrumental and/or complex daily activities, as well as in basic and advanced ADL.

Regarding depressive symptoms, other studies similarly did not find significant differences (Firmino et al., 2019; Parola et al., 2019). The results of this study also correspond to those of Irigaray et al. (2012), who found improvements in depressive symptoms following experimental interventions with a cognitive focus. Depression may be associated with cognitive and functional deficits, regardless of the level of cognitive impairment in older adults (Beaudreau & O'Hara, 2009). Considering these effects on cognition is essential when developing preventive strategies to address dementia. The absence of depressive symptoms in this study's sample may be linked to the participants' cognitive and functional profiles, which indicate cognitively healthy older adults with preserved functionality levels.

The use of cognitive strategies is understood as the ability of older adults to employ external or internal aids to compensate for cognitive deficits, particularly in episodic memory (Carvalho et al., 2010), or to address possible lapses and forgetfulness in everyday life. A relevant finding of this study is the high use of cognitive strategies among participants, considering that much of the literature reports older adults with reduced use of mnemonic strategies or difficulties in their implementation. Touron et al. (2010) suggest that the use of internal strategies decreases with time and age progression, which may be explained by cognitive decline, requiring greater effort to use aids, especially internal ones, which demand higher mental effort.

In this study, the sample generally had a high level of education, which may be directly associated with a good cognitive reserve and better performance in adopting daily strategies. This result corroborates those of Teixeira-Fabrício et al. (2012), who, after proposing cognitive interventions, observed increased use of compensatory measures and improved processing speed in the post-test, influenced by the educational level of older adults.

Apóstolo et al. (2011) investigated the effects of CS on older adults and found that participants subjected to stimulation sessions exhibited changes in cognitive performance, similar to the findings of this study, where participants showed significant improvement in cognitive capacity. Gil et al. (2015) verified and compared the performance of adults and older adults in cognitive tests after participating in intergenerational CS sessions and observed improvements in attention and memory tests and a reduction in depressive symptoms.

Carvalhais et al. (2019), while evaluating the effects of a CS program in institutionalized older adults, found significant improvements, with 77.78% of participants showing better performance in cognitive tests, corroborating this study's findings by demonstrating cognitive improvements after CS sessions.

The results of this study suggest that CS programs are potentially effective for improving cognitive functions in older adults and highlight the importance of CS groups for maintaining social functions. Considering the pandemic and isolation

context, these groups emerge as effective tools for promoting cognitive health and preventing possible worsening conditions and dementia in ageing.

Conclusion

This study aimed to evaluate the online cognitive intervention proposal and compare group performance in pre- and post-intervention quasi-experimental assessment tests. Cognitive stimulation (CS) had effects on mental state, functional capacity, and metamemory, suggesting that such interventions can help prevent cognitive decline and enhance global cognitive performance in older adults. In addition to the benefits to cognitive and mental functions, the intervention allowed participants to maintain and build new social connections, considering the disruptions caused by the COVID-19 pandemic.

Although widely studied, there is still a considerable lack of research focusing on CS with older adults. Considering the context of the COVID-19 pandemic and its resulting changes, few studies have focused on online cognitive interventions for the older population, potentially making this study one of the pioneers during this period.

Finally, further research on CS in this population is recommended, prioritizing experimental and longitudinal studies with a multidisciplinary perspective, including occupational therapists, psychologists, speech therapists, and other professionals working with CS. Recruiting a larger number of participants is also advised, as this was a limitation of this study due to the public health scenario and the adaptation of cognitive interventions to the online format.

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Author's Contributions

Rafael Gomes Firmino: intervention research development, data collection and analysis, and manuscript writing. Leonardo Farias de Arruda: data collection and tabulation. Victória Maria de Freitas Nunes: data collection during the intervention process. Maria do Carmo Eulálio: study supervision and guidance and manuscript writing. All authors approved the final version of the text.

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