Benefits of combined interventions for cognitive enhancement in older adults

Benefits de intervenções combinadas para aprimoramento cognitivo em idosos

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Abstract

Objective: To investigate the effects of different combined interventions (Stimullus, MEMO, physical activity, and psychoeducation) on the cognitive performance of older adults.

Methods: This is a quasi-experimental study with pre- and post-intervention. Thirty-four older adults underwent different combined interventions for a period of 48 weeks and were evaluated at three different points (pre-intervention; post-cognitive intervention; post-physical activity or psychoeducation intervention). Cognitive domains (verbal episodic memory, executive function, general cognitive performance) and depressive symptoms were evaluated.

Results: Postintervention gains in global, attentional, and mnemonic cognition were observed, as well as a reduction in depressive symptoms. The MEMO intervention + physical activity or psychoeducation resulted in greater cognitive gains, while Stimullus + psychoeducation showed benefits only in evocation and the free learning index, while Stimullus + physical activity resulted in improvement in the investigated variables.

Conclusion: The results of these combined interventions appear promising for healthy older adults and the impact of these interventions should be discussed with individual older patients and evaluated more broadly in the context of public health.

Keywords: aged; cognition; aging.

Resumo

Objetivo: Investigar os efeitos de diferentes intervenções combinadas (Stimullus, MEMO, física e psicoeducação) no desempenho cognitivo de idosos.

Metodologia: Trata-se de um estudo quase experimental com pré e pós-intervenção. Trinta e quatro idosos foram submetidos a diferentes intervenções combinadas pelo período de 48 semanas e avaliados em três tempos diferentes (pré-intervenção; pós-intervenção cognitiva; pós-intervenção física ou psicoeducação), nos quais foram analisados domínios cognitivos (memória episódica verbal, funções executivas, desempenho cognitivo geral) e sintomas depressivos.

Resultados: Após as intervenções, observaram-se ganhos na cognição global, atencional e mnemônica, bem como redução dos sintomas depressivos. A intervenção MEMO (física ou psicoeducação) resultou em maiores ganhos cognitivos, enquanto Stimullus + psicoeducação demonstrou benefícios apenas no índice de evocação e aprendizagem livre, e Stimullus + atividades físicas não apresentou melhora em nenhumas das variáveis investigadas.

Conclusão: Os achados positivos dessas intervenções combinadas parecem promissores no contexto de idosos saudáveis, e o impacto dessas intervenções deve ser discutido em relação às especificidades de cada indivíduo idoso e avaliado mais amplamente no contexto de saúde pública.

Palavras-chave: idoso; cognição; envelhecimento.
INTRODUCTION

According to Malloy-Diniz et al.,1 cognitive changes in older adults are not static: some skills decline while others remain stable (e.g., language and judgment) throughout life. A lack of memory stimuli, associated with a decrease in information storage capacity, are the main factors in age-related memory decline. Thus, it is important to develop cognitive or combined/multimodal interventions (cognitive + physical activity and/or psychoeducation) to improve cognitive plasticity in older adults.2,3

In the context of aging, training and cognitive stimulation have been the most common interventions for cognitive decline. Findings suggest that these interventions can preserve certain cognitive domains or halt further decline.4,5 However, more recent studies have suggested that their potential can be maximized when combined with interventions based on lifestyle changes, such as social and physical activities,2,3 which promote changes in physiology and brain architecture.6,7

According to Zheng et al.,6 an intervention including both physical and cognitive tasks more efficiently improved brain function in older adults than unimodal approaches.4,5 Given the importance and relevance of multimodal cognitive plasticity interventions in older adults, this study aimed to analyze the effects of combined interventions in the cognition of a sample of older Brazilians.

METHODS

Sample and procedures

The sample consisted of healthy older adults living in the Federal District who participated in geriatric programs. The interventions and the sample are described in Figure 1. Of 58 older adults who were initially evaluated, 50 began a cognitive intervention program (Stimulus or MEMO)8, according Chariglione, Janczura and Belleville (2018). Thirty-four completed at least 75% of the sessions. The study lasted a total of 48 weeks, but the stages had different durations. This is a quasi-experimental study with pre- and post-intervention.

In the cognitive intervention, the participants were divided into two groups (Stimulus or MEMO), with 25 participants in each group. In both groups, a 90-minute meeting was held each week for 6 weeks. In the second semester of the follow-up period, the participants were again divided into 2 groups: a physical activity group that followed a protocol of aerobic exercise, resistance training, and multicomponent training, and a psychoeducational group that received different educational interventions.

Instruments

The instruments were grouped into two categories: sociodemographic and neuropsychological. The sociodemographic assessment collected data on age, sex, education, marital status, and socioeconomic level, which was assessed using the Critério de Classificação Econômica do Brasil (Brazilian Economic Classification Criterion).

The neuropsychological assessment consisted of the following tests:

1. The Stroop Color–Word Test – Victorian version), which assesses selective attention, cognitive flexibility, and distractions

This study was approved by the Catholic University of Brasilia Research Ethics Committee (number 67653517.4.3001.5553).
Data analysis
The data were analyzed in SPSS version 23.0. The descriptive data were analyzed to characterize the sample and comparative analysis was performed, although more robust statistical tests could not be performed since the sample size (n = 34) was smaller than recommended (n ≥ 45).9

Thus, descriptive and comparative tests were carried out, which may indicate, even if only preliminarily, the behavior of the data in terms of the proposed research. For data analysis, the general group portrays the set of combined interventions that occurred over the 12 months, without division by type of intervention. There was also an analysis of intergroup results, considering the variable of the type of combined intervention. The purpose was to verify the effect of the combined interventions on cognitive improvement, as well as to verify which type of combination can result in the best cognitive performance and to enable the analysis, the difference between the results of the applications was carried out, generating the variables of moment 1 and moment 2, where moment 1 refers to the difference between the second and the first application, moment two is the difference between the score of the third application and the second, where this result consists of gain or loss.

RESULTS
The mean participant age was 69.44 (SD, 6.26) years, with a minimum and maximum of 60.00 and 87.00, respectively. The vast majority were women (88.00%). Regarding education, 46.60% completed elementary school, 31.10% completed high school, and 22.40% had at least some higher education.

The analysis showed more gains than losses, especially in tests requiring executive function, attentional skills (Stroop Scale subtests), inhibition, long-term memory (Rey’s Auditory Verbal Learning Test), and emotional states (Geriatric Depression Scale). On the other hand, decline was observed in interference factor, an aspect of executive function related to working memory and the ability to inhibit information, which requires greater memory recall and the selection of more complex information. Table 1 presents an analysis of the most important variables in the performance of cognitive skills, with repercussions on the daily life and functionality of older adults individuals.

All groups showed improvement in Stroop Test 3 results (the task requiring the highest level of executive function), although the Stimullus + physical activity group made the most errors. In the overall analysis, the Stimullus + physical activity group had the greatest effectiveness in all Stroop Test subtasks (gains in 7 subtasks), followed by MEMO +

<table>
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Note: F = Frequency; % = Valid percentage; RAVLT = Rey Auditory-Verbal Learning Test; GDS = Geriatric Depression Scale; Stroop-Inter= interference factor of the Stroop test. * non-parametric multivariate test
Combined interventions for cognition in older adults

psychoeducation (gains in 6 subtasks and loss in 1). Only the MEMO + physical activity showed gains in short-term memory. All groups showed improvement in long-term memory, especially the MEMO + physical activity group.

Another highlight was the memory learning curve (A1-A5): only the Stimulus + physical activity group showed no improvement in the memory learning process. Regarding cognitive screening (Addenbrooke’s Cognitive Examination - Revised), both Stimulus groups improved. The combined interventions that were the most effective were Stimulus + physical activity and MEMO + psychoeducation (14), followed by MEMO + physical activity and Stimulus + psychoeducation, with the latter showing the greatest loss (8).

DISCUSSION

According to our results, multimodal intervention combining cognitive stimulation/training and physical or psychoeducational activities led to gains in cognitive performance and reduced depressive symptoms in healthy older adults. These findings are in line with previous findings that highlighted cognitive, physical or social activities as key elements for maintaining cognitive plasticity and changing brain architecture and function.10-12

Several previous studies have demonstrated the effectiveness of combined interventions that involve physical and cognitive components, which was again confirmed in our results.13-16 In our study, the MEMO intervention provided cognitive training by teaching of mnemonic strategies. In both the physical activity and psychoeducational groups, MEMO increased performance in the memory domain, with the greatest gains observed in long-term memory (free recall). These data are in line with Reijnders et al.17 and may be associated with its training characteristics, which focus on association strategies, categorization, imagery, and the use of cognitive resources for better information encoding and retrieval.12,18

Regarding attentional performance, Stimulus + physical activity had the best results. In subtask 3 (inhibition factor) all combinations resulted in gains, especially Stimulus + physical activity, which resulted in the fewest errors. MEMO + psychoeducation was the second most effective intervention for attentional processes. The type of activities in the MEMO intervention may have contributed to this result since cognitive training teaching strategies that assist in memorizing information.8,19

Only MEMO + physical activity increased short-term memory scores. However, for long-term memory, four combinations showed good results, with MEMO + physical activity showing the best. Chariglione et al.,8 used the Stimulus intervention with 44 healthy older individuals (pre- and post-cognitive interventions), also finding beneficial results in verbal, semantic, episodic memory, and total memory scores.

Stimulus + physical activity was also effective for increasing the learning curve and the mnemonic domain, despite not having a specific cognitive stimulation strategy per se. Some studies have reported that interventions consisting of cognitive, social, and physical activities can reduce the risk of cognitive decline.2,3

In our sample, the most effective intervention for attentional skill was Stimulus + physical activity, while the MEMO + physical activity resulted in a greater memory gains. However, Addenbrooke’s Cognitive Examination scores (cognitive screening) declined. This may have been due to the fact that this test includes several cognitive skills, some of which may not have been included in the cognitive interventions in this study (e.g. language, verbal fluency, visuospatial ability, etc.).

There are some limitations to the present investigation. It is a preliminary study with older adults Brazilian individuals, which used different cognitive interventions (Stimulus or MEMO) combined with the subsequent exposure to physical activities and/or psychoeducational interventions. During the execution of the study, there was a reduction in the sample, which may have led to a decrease in the statistical power when analyzing the effects of the interventions. In addition, the follow-up period (48 weeks) may have been too short and may have diluted part of the effect given the time, since the engagement rate in the activities was not investigated, in other words, it is possible that the activity per se had gone through with motivational variables and cognitive profiles which were not investigated. Thus, other studies are justified, in order to map if the MEMO strategy is actually superior to the Stimulus one, and if the effects of physical activities are combined in a relationship of response to cognitive interventions in older adults Brazilian individuals. These investigations can assist in the design of more effective gerontological interventions and practices, favoring actions to promote a healthy cognitive aging program.

CONCLUSION

Our results corroborate the findings of other studies that combined interventions improve cognitive skills in older adults. However, our results must be interpreted carefully, and future investigations are needed to more fully investigate this subject. It will be important to determine which type of combined intervention is most effective for different cognitive constructs.
Conflict of interest
The authors declare no conflicts of interest.

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Author Contributions
AMS: Conceptualization, data curation, formal analysis, investigation, methodology, validation, visualization, writing – original draft. JNSA: Data curation, formal analysis, methodology, validation, visualization, writing – original draft. GSTP: Data curation, formal analysis, investigation, methodology, validation, visualization, writing – original draft. IPFSC: Conceptualization, data curation, formal analysis, investigation, methodology, project administration, supervision, validation, visualization, writing – original draft.

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