

Development of a physiotherapy rehabilitation protocol for promoting cognitive health in elderly individuals

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Abstract: The global population in developed countries is increasing, especially in the age group of 80 years or older, leading to an increase in demand for health services. With aging, there is a decrease in brain activity, which can lead to a reduction in reflexes and sensitivity, changes in attention, and the development of Mild Cognitive Impairment (MCI). Physiotherapy plays a crucial role in maintaining and recovering a healthy and active lifestyle, seeking aging with greater functional independence, and delaying the progression of cognitive decline. Therefore, the present study aimed to develop a physiotherapy protocol for cognitive rehabilitation in the elderly based on a literature review. The protocol can optimize occupational performance and delay the conversion of dementia in elderly people with MCI. In the multidisciplinary team, the physiotherapist can conduct individual or group strategies and interventions with elderly individuals with normal cognitive function, aiming to improve performance in mnemonic tasks and daily activities that require greater cognitive attention. Protocols serve as guides for professionals, leading them to the desired path, and focus on observation and evaluation, aiming at significant contributions to institutions, elderly people, and their families.

Keywords: Cognition; Physiotherapy; Elderly; Rehabilitation.

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1. Introduction

In the last demographic survey in 2010, the global population in developed countries reached 1.9 billion inhabitants. The number of elderly people also increased significantly: in 2000, there were around 14 million elderly people in these countries; by 2010, this number had risen to 19 million, and by 2020, it reached 28 million. It is estimated that by 2050, this number will reach 64 million [1]. The proportion of elderly people is increasing, especially in the age group of 80 years or older, which has extremely important implications due to the higher frequency of comorbidities and a greater incidence of functional decline. This can have a significant impact on health, leading to an increase in demand for health services [2].

Lino et al. [3] highlight that among the physiological changes inherent in aging, there is a decrease in brain activity, which can lead to a reduction in reflexes and sensitivity. In terms of intellectual capacity, changes also occur, mainly in attention. People over 60 tend to develop Mild Cognitive Impairment (MCI), which is related to reaction time, deficits in memory, understanding and learning. Some factors can contribute to these disorders, such as age, low education, lack of physical activity, and low income [4].

Despite this cognitive decline, it generally does not interfere with the independence of elderly people, meaning that they can still perform their daily activities. However, they

may need more effort to carry them out than before, especially in terms of activities of daily living, as well as mnemonic tasks, such as remembering names of family members, conveying messages, and resuming tasks after interruption. They may also have cognitive difficulties in organizing and planning their own daily activities [5].

Cognitive intervention represents a treatment option to optimize occupational performance and delay the conversion of dementia in elderly people with MCI [6]. In this sense, the use of protocols can facilitate the care of these elderly people and optimize the work of physiotherapists, providing quality assistance. Protocols serve as guides for professionals, leading them to the desired path. In care practice, protocols focus on observation and evaluation, aiming at significant contributions to institutions, elderly people, and their families [7].

Therefore, physiotherapy's role in the elderly is important both for maintaining and recovering a healthy and active lifestyle, seeking aging with greater functional independence, and delaying its progression [8]. In the multidisciplinary team, the physiotherapist can conduct individual or group strategies and interventions with elderly individuals with normal cognitive function, aiming to improve performance in mnemonic tasks and daily activities that require greater cognitive attention. Thus, it helps to reduce cognitive decline, mainly in daily life activities [9]. Maintaining cognitive and motor function in the elderly is one of the main challenges to ensuring their quality of life. Treatment and training of motor function are necessary, as well as good cognitive function, so that the elderly can understand the objectives of the proposed activities, as well as the established instructions. With this, it is possible to know their characteristics and determine the best intervention for motor tasks [10].

In this sense, any physiotherapeutic approach in elderly patients is important, combined with an efficient evaluation, so that individualized objectives and conducts can be established to resolve each case according to its specific need. Protocols are established based on the guidelines of the Brazilian Unified Health System (SUS), but each institution may have its own protocol for care and assistance, following the local needs of users, based on protocols already developed by the Ministry of Health (MS). Therefore, the justification for this study is based on the consensus that physiotherapy can work on cognitive domains in the elderly and reduce deficits caused by problems arising from aging. However, the physiotherapist's role can be conducted in different ways, which can affect the improvement of the elderly.

The physiotherapist is a professional who has autonomy to address cognitive problems in the elderly. He or she will promote activities according to each elderly person's difficulty, developing greater stability and safety. Early intervention can delay the progression of cognitive decline [11]. The protocols, in addition to assisting them, exert influence on the construction of the attention model as fundamental strategies, both in the planning, implementation, and evaluation of actions for the elderly and in the standardization of actions and the work process [12]. In this context, the present study aimed to develop a physiotherapy protocol for cognitive rehabilitation in the elderly based on a literature review.

2. Materials and methods

2.1 Type of study

The research was characterized as a methodological, analytical, and descriptive study with a technological approach for the construction of an instrument aimed at the physiotherapist's role in rehabilitating cognitive disorders in the elderly. This study was developed from August 2021 to June 2022.

2.2 Step 1: Scientific literature review to identify elements for the construction of a cognitive rehabilitation protocol for elderly individuals

To develop the cognitive rehabilitation protocol for elderly individuals, a literature review was conducted, and the protocol was constructed based on scientific evidence. The following health descriptors were used in the search: protocol, rehabilitation, cognition, and elderly. The search was performed using the following electronic portals/databases: Virtual Health Library (BVS), including the following databases: Scientific Electronic Library Online (SciELO), Latin American and Caribbean Health Sciences Literature (LILACS), PubMed, and Medline. The review included full-text articles in English and Portuguese published from 2012 to 2022.

2.3 Step 2: Development of the physiotherapy protocol based on the results of the scientific review.

Following the literature review (Step 1), a cognitive rehabilitation protocol for the elderly was developed based on its main findings.

3. Results and discussion

A total of 311 full-text review articles were found in English and Portuguese languages published from 2012 to 2022. Those that did not correspond to the study question and duplicate articles were excluded. After analyzing titles and abstracts, 14 articles were selected, included in this review, synthesized, and presented in Table 1.

Table 1. Demographic and clinical characteristics in the total population and according to presence of CAD.

Authors/Year	Objectives	Types of intervention	Country	Main findings
[13]	To make a study protocol to conduct different combinations of cognitive and/or physical training interventions in elderly individuals.	This study is a cluster randomized controlled trial (CRCT). A total of 285 elderly individuals (age ≥ 60) are included.	Hong Kong	Board games were used in groups, with each game aimed at improving cognitive functions by training visual, spatial, auditory, and proprioceptive memory, as well as physical conditioning functions through training of physical and motor skills in moderate-intensity aerobic activities, muscle endurance, balance, reaction, and coordination.
[14]	To analyze the effect of a 6-month intervention on cognitive and motor competence, physical fitness, levels of regucalcin, risk of falls, and body composition in elderly individuals.	Randomized clinical trial. A total of 90 elderly individuals above 65 years of age.	Spain	The primary outcome will be balance, but other motor variables (body mass index, upper and lower limb strength, flexibility, and speed-agility) and cognitive functions (executive functions and attention) will also be evaluated. The expression of regucalcin levels will

- [15] To explore the advantages of long-term table tennis intervention (open exercise) compared to aerobic fitness (closed exercise) on the inhibitory response capacity of elderly individuals. A randomized single-blind and controlled trial. A total of 90 elderly individuals were recruited and randomly allocated to the following groups: table tennis, aerobic fitness, and control. China
- [16] Determining the effects of physical and cognitive training programs, as well as their combination, on cognitive functions and physical abilities in women over 80 years old. Double-blind case-control study with 43 women (80.86±5.03 years old). They were divided into four groups (three experimental groups and one control group). Spain
- [17] Preventing cognitive impairment in institutionalized elderly individuals through combined exercises. A total of 24 sessions of combined exercises were conducted, with a frequency of twice weekly and a duration ranging from 50 to 60 minutes per session, over a period of 12 weeks. The assigned exercises included aerobic training, balance exercises, flexibility routines, and also be assessed. Therefore, this project aims to analyze the effect of a 6-month SSE intervention on cognitive and motor competence, physical fitness, regucalcin levels, risk of falls, and body composition in elderly individuals.
- Open-skills exercises can improve the cognitive capacity, level of depression, and mental state of elderly individuals while enhancing their inhibitory and control abilities.
- The control group experiences a reduction in both their physical and cognitive abilities, whereas the three experimental groups enhance these capacities. We found a strong correlation between the improvement of physical and cognitive capabilities. Eight weeks of physical, cognitive, or combined training elevated the physical and cognitive functions of the elderly, potentially mitigating the adverse effects of the aging process.
- It can be concluded that the combination of exercises incorporating cognitive activities and physical exercises enhances the cognitive and physical abilities of elderly individuals with mild cognitive impairment residing in long-term care facilities.
- Brazil

- stretching.
- Sensitization dynamics, tasks, and cognitively recognized skills commonly found in elderly individuals with mild cognitive impairment were employed. Interventions were analyzed, and instruments and questionnaires were administered before and after the sessions.
- Randomized controlled clinical trial with two parallel groups of elderly individuals aged 65 years and older (vortioxetine and placebo), both groups receiving computerized cognitive training. Blind outcome assessments were conducted to evaluate results.
- Investigating neuro-pathological, neuro-degenerative, and neurotrophic blood biomarkers as surrogate outcomes for treatment responses to three interventions in elderly individuals with amnesic mild cognitive impairment (aMCI), a prodromal stage of Alzheimer's disease (AD): aerobic
- Describe and analyze group interventions in occupational therapy for elderly individuals with possible mild cognitive impairment.
- Investigating the use of vortioxetine for enhancing cognitive performance.
- Investigating neuro-pathological, neuro-degenerative, and neurotrophic blood biomarkers as surrogate outcomes for treatment responses to three interventions in elderly individuals with amnesic mild cognitive impairment (aMCI), a prodromal stage of Alzheimer's disease (AD): aerobic
- Brazil
- United States of America
- United States of America
- There was an improvement in cognitive performance, enhancement in the capacity to perform instrumental activities that more directly involve cognitive skills, and a reduction in participants' subjective memory complaints.
- Participants who received vortioxetine along with cognitive training exhibited a greater increase in overall cognitive performance compared to those who received placebo along with cognitive training. This divergence was significant at week 12 but not at other assessment points. Both groups demonstrated improvement in the secondary outcome measure of functional cognition, with no significant difference between the groups.
- For the ACT training, the ACT Trial employs the online program In-Sight (Posit Science), which consists of five games (Eye for Detail, Hawk Eye, Visual Sweeps, Double Decision, and Target Tracker). These SOP training games target multiple cognitive processes, primarily focusing on attention and processing speed. The difficulty of these games increases progressively, requiring faster reaction times. In the ACT group, participants engage in cycling exercises before playing the

- exercise, cognitive training, combined aerobic and cognitive exercises, and cognitive training (ACT).
- [21] Exploring the effectiveness of a 16-week cognitive training (CT) intervention to reduce the risk and incidence of falls in community-dwelling older adults at risk of falling. A controlled randomized study with two groups. Eligible participants are older adults (aged 65-85 years) residing in the community who are at risk of falling based on physical performance tests. Data were collected through a socio-demographic and clinical questionnaire, along with the Mini-Mental State Examination (MMSE), at three time points (pre, after 10, and after 20 interventions). The health promotion program consisted of weekly sessions, each lasting for a certain duration.hora. United States of America
- [21] Analyzing the effects of a Physiotherapy health promotion program on the cognitive capacity of institutionalized elderly women. A statistically significant improvement was observed in the performance on the MMSE. The elderly women demonstrated enhanced performance, both in the overall score and in the subcategories, including temporal orientation, registration, recall memory, reading and executing, and copying a diagram. Brazil
- [22] The benefits of recreational activities targeted towards elderly patients with mild cognitive impairment (MCI), a common alteration associated with aging that involves compromised recreational activities were implemented over 30 sessions, twice a week, with each session lasting 45 to 60 minutes. The activities involved the use of balloons, colored balls with varying textures, SOP games without any time interval. In the attention control group, participants perform stretches (i.e., seated movements and static stretches), and the games become progressively more challenging, demanding quicker reaction times. Limited evidence supports the potential of CT to improve cognition and gait, but no published study has assessed whether such an intervention would reduce the incidence of falls. A statistically significant improvement was observed in the performance on the MMSE. The elderly women demonstrated enhanced performance, both in the overall score and in the subcategories, including temporal orientation, registration, recall memory, reading and executing, and copying a diagram. Cognitive stimulation carried out through recreational activities brings benefits to patients with mild cognitive impairment (MCI), serving as a means to delay the onset of dementia and further cognitive decline. Additionally, it helps stimulate reasoning abilities and fosters social interaction among the

	learning and memory capacity.	sizes, and sounds. The memory game with animal images was employed for visual perception and memory enhancement. The therapist imitated and spelled out the names of the animals, with the patient repeating them.		elderly.
[23]	Provides an overview of the use of new technologies in the cognitive rehabilitation process.	The main technologies utilized include computers, TVs, and smartphones, which offer a diverse array of games and applications to be used as therapeutic resources. Semi-structured interviews were conducted before and after interventions, inquiring about memory.	Brazil	It is noticeable that the general overview of using ICTs in the cognitive rehabilitation process primarily focuses on compensatory therapeutic approaches for deficient skills, predominantly utilizing computer, television, and smartphone as resources.
[24]	Assessing self-perceived memory in elderly illiterate individuals with mild cognitive impairment.	Weekly activities lasting two hours were provided.	Brazil	The workshops and lectures led to improvement in functionality, socialization, and integration.

3.1 Proposed Physiotherapeutic Protocol

Following the literature review, a protocol was developed, which is divided into: a physiotherapeutic rehabilitation protocol for cognitive health promotion, focusing on cognitive training and physical exercise. The primary technologies utilized are computers, TVs, and smartphones, which offer a diverse array of games and applications to be used as therapeutic resources. The use of these technologies (ICTs) in such cases can be of great value for restoring autonomy. Through "external aids" such as reminders and alarms, individuals can regain control over their daily lives, preventing dependency and caregiver burden [23].

Initially, the proposal suggests that exercises should start with light stretching, staying within each individual's limits, holding each stretch for 30 seconds bilaterally. Following that, physical exercises should be combined with playful activities and varied music, incorporating both combined and cognitive exercises. This includes brisk and slow walking on even ground, exercises for motor coordination, and balance [17] (Table 2).

Table 2. Physiotherapeutic Rehabilitation Protocol for Cognitive Health Promotion, with a Focus on Cognitive Training.

Resources	Frequency/Execution Method
Use of technologies	Recommendation of smartphone applications such as crossword puzzles, memory games, jigsaw puzzles, etc.
Fine motor coordination exercises	Painting, drawing, assembling, and disassembling objects, creating zig-zag patterns between holes to form geometric shapes. 4 to 6 times per week, ranging from 20 to 60 minutes each session.
Instructions and reminders about medication or meals	Setting alarms on the cellphone according to the patients' medication schedules, based on the frequency of their dosages.
Playful activity	Group walks, card games, thinking through the game, devising strategies to win, and guessing games. The cognitive stimulation ranges from planning the cards to the competitiveness of the game.
Memory	Initially, play the sound of 4 different musical instruments. At the end of the activity, the individual will have to identify the name of the instrument that produces the characteristic sound.
Attention, intelligence, and memory	Close your eyes and identify each presented sound.

Internal and external factors to the individual, such as age, education level, behavior, psychosocial aspects, and sociocultural elements, as well as brain injuries caused by trauma, stroke, and neurodegenerative diseases, can alter cognitive function, leading to a decrease in functional capacity. This capacity is directly related to an individual's potential to perform daily activities without third-party assistance and with decision-making freedom, ensuring autonomy and quality of life [23] (Tabela 3).

Table 3. Physiotherapeutic Rehabilitation Protocol for Cognitive Health Promotion, with a Focus on Cognitive Training.

Resources	Frequency/Execution Method
Gait training "with obstacles"	2 to 3 times per week, using cones on the ground.
Physical exercises	Swimming, Pilates, water aerobics, walking, stretching. 3 to 5 times per week, ranging from 20 to 60 minutes.
Motor coordination exercises	Exercises with hoops and balls, circuit exercises, exercises with resistance bands, exercises for walking on a line without stepping off. 3 to 5 times per week, ranging from 30 to 40 minutes.
Stretching exercises	Stretching of the chest muscles, stretching of the shoulder region, stretching of the upper and lower limbs, stretching of the quadriceps region, stretching of the muscles in the posterior region, and stretching of the thigh adductor muscles.

5. Conclusion

The protocol developed in this study was constructed based on scientific literature demonstrating cognitive improvement in older adults, particularly those experiencing cognitive decline due to aging. This rehabilitation protocol aims to benefit patients and healthcare professionals by providing strategies for cognitive rehabilitation or delaying cognitive aging, whether in a home setting or not. The goal is to enhance functional capacity, enabling individuals to carry out daily activities independently and improve their

quality of life. For further research, it is advisable to validate the content and appearance of the protocol, as well as to practically apply it with rigorous evaluations to establish its effectiveness in promoting cognitive health among the elderly.

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