PERSPECTIVASonline CIÊNCIAS BIOLÓGICAS E DA SAÚDE

Online Perspectives Journal: Biology & Health
December/2024, v.14, n.49 , p. 29-44
ISSN: 2236-8868 (Online)
DOI: 10.25242/8868144920242686

ANALYSIS OF PHYSICAL TRAINING PROGRAMS IMPROVE SENSORIMOTOR SKILLS IN ELDERLY POST-COVID-19: SYSTEMATIC REVIEW

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ABSTRACT

CABO, C.A.; FERNANDES, O; MENDOZA-MUÑOZ, M.; PARRACA, J.A. Physical training programs improve sensorimotor skills in older adults: Systematic Review with relevance to COVID-19. **Online Perspectives: Biology & Health**, v.14 , n.49 , p. 29-44, 2024.

An unforeseen public health challenge was brought forth by the COVID-19 outbreak. Globally, steps were taken to slow the virus's transmission in order to prevent overburdening the healthcare system. As a result, engaging in physical activity helps to boost immunity, which is advantageous for both preventing and treating viral infections and chronic illnesses. This systematic review's main goal was to provide information on how exercise programs impact sensorimotor abilities as people age, with a focus on the COVID-19 pandemic. Method: The Preferred Reporting Items for Systematic Reviews and Meta Analysis (PRISMA) guidelines were followed in the conduct of this systematic review. Databases were searched starting in May 2022 for articles that addressed physical training regimens to enhance sensorimotor skills in older adults over 50. A total of approximately 895 people aged 60 to 85 years were included in this review. Specific findings support the positive benefits of exercise programs during COVID-19 to improve physical, cognitive, social, and psychological health skills in older adults. Improvements in mood, anxiety, and quality of life in relation to health are among the results; however, they present an increase in body fat due to reduced daily physical activity (PA) and changes in daily diet. These results will update healthcare professionals and researchers on how to target a specific group. Therefore, it was imperative to maintain physical activity during COVID-19, using specific voluntary and motivating skills that overcome the obstacles unique to COVID-19 and increase motivation and success in physical exercise.

Keywords: COVID-19; Elderly; Falls; Gait; Postural Control.

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Received: 06/07/2023 Accepted: 16/05/2024 Published online: 27/12/2024

Revista Perspectivas Online: Biológicas & Saúde
Dezembro/2024, v.14 , n.49, p.29-44
ISSN: 2236-8868 (Online)
DOI: 10.25242/8868144920242686

ANÁLISE DOS PROGRAMAS DE TREINAMENTO FÍSICO MELHORAM HABILIDADES SENSÓRIO-MOTORAS EM IDOSOS PÓS-COVID-19: REVISÃO SISTEMÁTICA

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RESUMO

CABO, C.A.; FERNANDES, O; MENDOZA-MUÑOZ, M.; PARRACA, J.A. Programas de treino físico melhoram as habilidades sensório-motoras em adultos idosos: Revisão Sistemática com relevância à COVID-19. **Perspectivas Online: Biológicas & Saúde**, v.14, n.49, p. 29-44, 2024.

Um desafio imprevisto de saúde pública foi trazido pelo surto de COVID-19. Globalmente, foram tomadas medidas para retardar a transmissão do vírus, a fim de evitar a sobrecarga do sistema de saúde. Como resultado, a prática de atividade física ajuda a aumentar a imunidade, o que é vantajoso tanto para prevenir como para tratar infecções virais e doenças crónicas. O objetivo desta revisão sistemática foi fornecer informações sobre como os programas de exercícios impactam as habilidades sensório-motoras à medida que as pessoas envelhecem, com foco na pandemia de COVID-19. As diretrizes Preferred Reporting Items for Systematic Reviews and Meta Analysis (PRISMA) foram seguidas na condução desta revisão sistemática. As bases de dados foram pesquisadas a partir de maio de 2022 em busca de artigos que abordassem regimes de treinamento físico para melhorar as habilidades sensório-motoras em idosos com mais de 50 anos. Um total de aproximadamente 895 pessoas com idade entre 60 e 85 anos foram incluídas nesta revisão. Descobertas específicas apoiam os benefícios positivos dos programas de exercício durante a COVID-19 para melhorar as competências de saúde física, cognitiva, social e psicológica em adultos mais velhos. Melhorias no humor, ansiedade e qualidade de vida em relação à saúde estão entre os resultados; entretanto, apresentam aumento da gordura corporal devido à redução da atividade física (AF) diária e às mudanças na dieta diária. Estes resultados irão atualizar os profissionais de saúde e investigadores sobre como atingir um grupo específico. Portanto, era imperativo manter a atividade física durante a COVID-19, utilizando habilidades voluntárias e motivadoras específicas que superassem os obstáculos exclusivos da COVID-19 e aumentassem a motivação e o sucesso no exercício físico.

Palavras-chave: COVID-19; Adultos idosos; Quedas; Marcha; Controle postural.

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Data de recebimento: 06/07/2023 Aceito para publicação: 16/05/2024 Data de publicação: 27/12/2024

1. INTRODUCTION

The paradigm of the twenty-first century is demographic aging, with an increasing proportion of the population becoming older adults. In the Office of Statistics National Institute's central forecast scenario, between 2015 and 2080, there will be 2.8 million more older persons than there were in 2.1 million. (INE, 2017). The primary risk factor for functional decline in older persons is aging, making it crucial for public health to comprehend and prevent impairment in this population (Anton et al., 2020).

The natural aging process is defined as continuous and irreversible and is associated with a decline in the physical and cognitive functions of the human body and an increased risk of falls (Wong et al., 2019). Aging-related loss of strength causes a decline in functional ability, including impaired walking and balance (Rosa, 2012). When walking, older persons typically exhibit a wider gait, more postural sway, and greater gait variability (Ready, 2019).

The sensory system is crucial for motor function, and when it malfunctions or operates poorly, it might affect the functions required to detect the surroundings. This is an aptitude that starts to diminish with age. According to Suzuki et al. (2019), this loss may cause a significant biomechanical alteration in gait. Decreased muscle strength, impaired balance, and reduced mobility are some of the elements that lead to dependency and a loss of autonomy (Bacha et al., 2016). Although sensorimotor training helps older persons balance better and develop their gait more confidently, it might not have a direct impact on this function's biomechanical elements (Rezende et al., 2012).

Health is impacted by the world's population's lack of physical activity (Hernández-Beltrán et al., 2023). It is well known that physical activity has an impact on healthy aging and that chronic diseases have been linked to inactivity (Park et al., 2020). According to recent research on sedentary behavior, a sedentary lifestyle is a unique health risk factor that is associated with successful aging, morbidity, and death in addition to physical inactivity. According to Dhuli et al. (2022) and Donoghue et al. (2016) a sedentary lifestyle is a substantial risk factor for a variety of health problems, including overweight, obesity, and the related metabolic disorders. According to physical activity recommendations published by the World Health Organization (WHO), more than a quarter (27.5%) of the world population does not perform at least 150 minutes of moderate PA or 75 minutes of vigorous PA per week.

Whether at a provincial, national, continental, or global level, some historical events leave an indelible impression on generations. 2020 will surely be remembered for the COVID-19 epidemic and its effects over the world (Ribeiro et al., 2020). During a COVID -19 pandemic, the older adults, who are at excessively high risk for viral infections, are confined to their homes. A viable strategy to reduce daily PA loss and inactivity is home-based physical activity programs (Chaabene et al., 2021). In this context, as new studies have since been published and considering the need to clarify the association between PA and COVID-19, the objective of this systematic review was to investigate the effects of physical training on sensorimotor skills in the aging process during the COVID-19 pandemic.

2. MATERIALS AND METHODS

The Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRISMA) guidelines provided guidance in the development of the systematic review methodology. The

study was registered with PROSPERO (www.crd.york.ac.uk/PROSPERO) with the registration number of CRD42022333326 on 18/05/2022, available from: https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42022333326 and with title of "Physical training programs improve sensorimotor skills in older people: Systematic Review with relevance to COVID-19" (Cabo et al., 2022).

Weaknesses that are identified by the systematic review surface during a narrative review (Tranfield et al., 2003). To address the subject at hand, a systematic literature review entails multiple stages of planning, carrying out, documenting, and sharing information. This stage has been split up into seven sections: Search approach, eligibility requirements, study selection, data extraction, result, data synthesis, and bias risk.

2.1. Search Strategy

The research strategy started in May 2022 through the analysis of documents published in the last 5 years. Bibliographic databases, keywords and search strategy are determined at this stage. The following databases were considered: Science Direct, Scielo, PubMed/Medline and Scopus.

In the search strategy stage, we used the International Registry of Systematic Reviews, PROSPERO, to identify any recent or previous systematic reviews that meet the selection criteria (i.e., investigating the physical training programs improve sensorimotor skills in older people).

The keywords that make up the investigate process remained intentionally broad to ensure that we have many articles associated to gait and motor control. Therefore, the keywords "exercise", "neuromuscular training", "strength training", "resistance training", "strength training" and "balance training" were used. In this way, different combinations of keywords were tested: 'fitness', 'strength', 'flexibility', 'power', 'balance' and 'endurance'. To obtain the most specific sample of documents for analysis, the words "older", "healthy" and "COVID-19" were introduced. The following Boolean operators and terms were used as a search strategy: (exercise OR "neuro-muscular training" OR "strength training") AND (strength OR agility OR power) AND older adults AND healthy AND COVID-19. In addition, we applied two filters to the PubMed database: "randomized control trial" and "5 years".

2.2. Eligibility Criteria

The following inclusion criteria were used to select the articles for this systematic review: (a) research involving older adults; (b) studies assessing sensorimotor resources; (c) complete papers published in journals with peer review and indexing; and (d) publications written in English. The individuals' gender was not a criterion for disqualification. Furthermore, publications that involved individuals with mobility impairments, psychological diseases, neurological disorders, and other addictions, reviews, or duplicate articles were disqualified (Pereira et al., 2023; Sterne et al., 2016).

Table 1: Table with the PICOS strategy

Initials	Description	Analytics
P	Participants	A total of approximately 895 people aged 60 to 85 years.
I	Interventions	Physical training programs and their effects on sensorimotor skills in older people, with relevance to COVID-19.
C	Comparisons	In the analysis of the different studies, we will compare the intervention groups, in order to understand the benefits of each intervention, not comparing with groups that did not receive any physical intervention.
O	Outcomes	Individuals with mobility impairments, psychological diseases, neurological disorders, and other addictions.
S	Study design	The study types to be included in the review were randomized controlled trials, published within the last 5 years.

2.3. Selection of studies

The search results were downloaded into a Zotero database. The main reviewer checked the titles, abstracts, and content of the documents for selection, as well as the full texts of relevant articles to ensure that the eligibility criteria were met. Two reviewers independently verified the titles and abstracts of all studies, retaining those that met the inclusion criteria. Studies included based on title and abstract were then peer-reviewed in full text, again independently by the two reviewers. Any disagreements were resolved by discussing with a third reviewer. Finally, we checked the reference lists of the selected articles for other relevant studies.

The studies allowed the collection of the following data: name of the first author, year of publication, country of origin, research objectives, study population (number of participants, gender, and age), type of study, instruments used, and main results. The initial bibliographic search yielded a total of 94 articles, of which 3 were duplicates. Of the remaining 91 articles, 48 were excluded because the title and abstract were not related to the topic, and 21 because they were reviews. Twenty-two articles were selected for full-text reading, but 11 were excluded because they did not study healthy people, 2 because they did not study older people, and 3 because the sample was not stratified by different age groups. Six studies were ultimately selected. Subsequent documents were read in full to assess attention to a likely increase in falls and reduced quality of life for those affected. In this way, we obtained a final sample of 22 documents

2.4. Data Extraction

Independent reviewers took data on studies out of the Zotero database. The following data extraction was done: 1) Publication information: writers and year of release; 2) Nation: participants' nationality; 3) Goals: research aims; 4) Sample: includes the quantity of

participants and demographic details (such as gender and age over 50); 5) Intervention: comprises the nature and attributes of the training program; 6) Results: research findings.

2.5. Outcomes

The results of this review will first identify whether physical activity programs are a viable strategy to reduce daily physical activity loss and inactivity. Furthermore, will also examine possible effects of the practice of these same programs in times of a pandemic, covid-19, considering the restrictions applied.

2.6. Data synthesis

Data extracted from eligible studies were synthesized using a narrative approach. The synthesis aimed describe the existing body of literature, identifying any strengths and gaps in the analysis of different physical training programs in the older adults. Findings are further summarized below in a narrative interpretation focused on the main objective of this review, to synthesize evidence on whether physical activity programs are a viable strategy to reduce daily physical activity loss and inactivity in the older adults.

2.7. Risk of Bias

The methodological quality of randomized control trials was assessed using the Evidence Project assessment for risk of bias (Vitale et al., 2020). Using this tool, you can get an overall score (0–8) by answering yes (1) or no (0) to eight questions from three distinct areas. A higher score reduces the possibility of prejudice.

3. RESULTS

The results are presented in this section. The aim is to analyze the content of the sample in detail and to provide data for the creation of the investigate question. The initial bibliographic search of the files resulted in a total of 94 articles, of which only six studies were selected because they met the inclusion criteria for the systematic review (Figure 1).

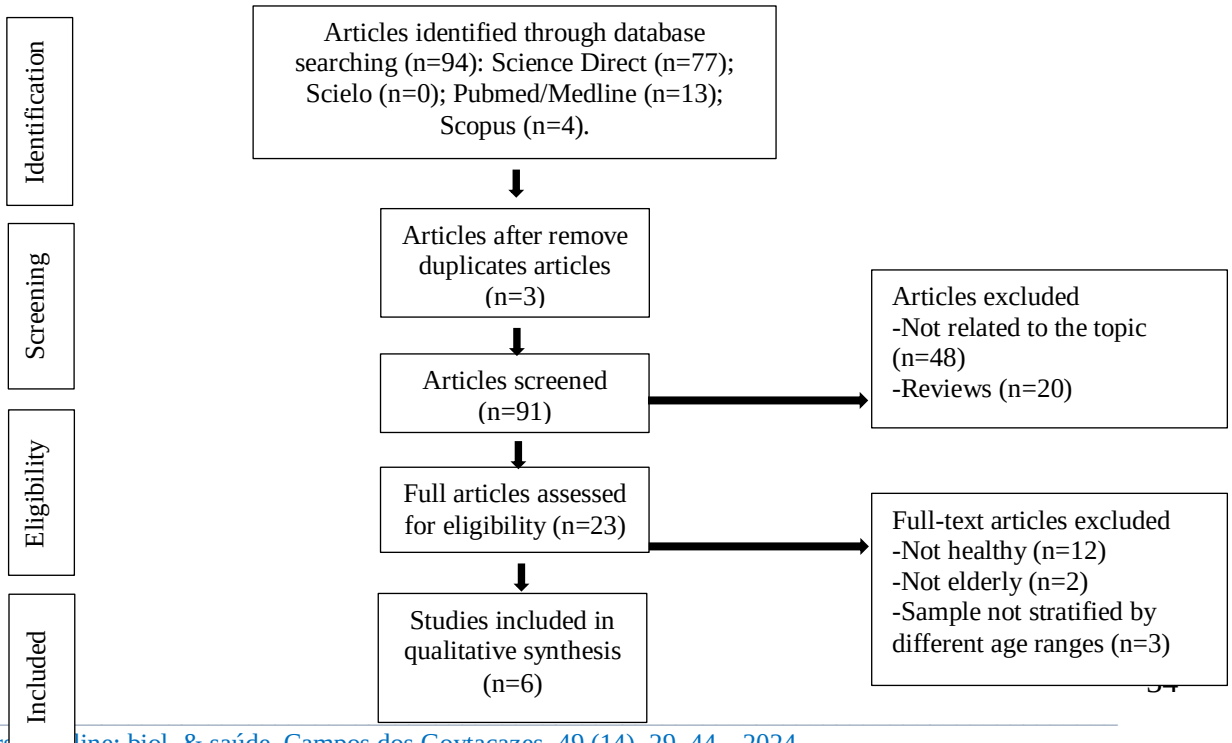

Figure 1: Study selection flowchart.

3.1. Study Characteristics

The main characteristics of the selected studies are summarized in Table 1. All articles were written in English and published in the last five years. About the study sites, one was conducted in Italy (Verghese et al., 2021), one in USA (Corley et al., 2021), one in Scotland (Das & Bhattacharyya, 2021), one in India (Thiel et al., 2021), one in Germany (Dupuy et al., 2021) and one in Canada (Ferrucci et al., 2016). Of the selected articles, four were longitudinal studies and four were cross-sectional studies. In general, the studies examined 895 participants aged between 60 and 90 years.

3.2. Outcomes Measures

3.2.1. Variables

The study revealed numerous instruments measuring the outcomes of physical activity pro-grams during the COVID-19 pandemic (Table 2). The most frequently reported variables were physical, psychological, sleep quality, and psychosocial health related to COVID-19. Personal factors such as health-related quality of life, spasticity in muscle tone functions, gait pattern, and aerobic capacity in exercise tolerance were also frequently examined by the authors (Table 2).

Other variables under study were muscle strength, balance, gait assessment and body composition. Some authors evaluated the functionality and disability of the older adults, among other tests that analyze several dimensions related to mobility, home life and lifestyle habits in general.

Table 2: Description of selected studies.

Author	Country	Objectives	Sample	Intervention	Results
Corley et al. (2021)	Scotland	The aim of the study is to examine whether during COVID-19 self-reported physical and mental well-being in older adults was associated with the use of home gardens.	n=171; age: 84 ± 0.5 years	Around two months after the initiation of COVID-19, 171 participants were asked to complete an online questionnaire. The survey comprised 145 questions about demographics, knowledge and experience of COVID-19 and physical, psychological, and psychosocial health.	The study results assert that associations can be bidirectional and that home gardens can be a positive health resource during the COVID-19 pandemic.
Das et al. (2021)	India	The aim is to develop volunteer services, counseling, awareness plans and policies to make coping strategies more viable to combat this unforeseen crisis.	n=15; age: >60 years	The intervention of the participants is made through telephone calls, to follow all the rules of social distance.	The primary sources of social networks remain instrumental in reciprocal and emotional support. This support helps to alleviate stress, depression and promotes well-being among participants.
Dupuy et al. (2021)	Canada	The aim is to document the effects of 6 months of isolated home exercise versus home exercise combined with cognitive training on cognitive and physical functions.	n=122; age: > 50 years	All participants will be evaluated in four test sessions, by videoconference and online questionnaires over a period of 7 to 10 days at the beginning of the study, 3 months, and 6 months thereafter. At 12 months, an assessment was performed to explore the potential for maintaining the effects of the intervention.	The primary outcome is cognition. The secondary result is physical functions. Exploratory results include anxiety, mood, and health-related quality of life.
Thiel et al. (2021)	Germany	This paper aims to describe the study objectives, design, methods, assessment types, collection schedules and considerations for examining the data within on facilitators and barriers for PA promotion in nursing homes.	n≅200	We designed this participatory intervention study with a mixed methods assessment approach in selected nursing homes. The data collected will be used to develop and evaluate an integrated method to physical activity promotion combining environment-oriented and individual counseling.	This study allowed us to increase our knowledge of how to reach a group characterized by inactivity, multimorbidity and a high prevalence of dementia, through physical exercise in nursing homes.

Vitale et al. (2020)	Italy	The objective was to evaluate, during home confinement caused by the COVID-19 pandemic, the effect of a home resistance training program on muscle health and physical performance in older adults for 6 months.	n=9 age: ± 68 years	The intervention involved elders divided into two groups, an experimental group that performed exercises for six months (EXE) and a control group (CON). Participants were assessed for muscle strength, balance, gait assessment, and body composition by dual-energy X-ray absorptiometry and magnetic resonance imaging, at baseline (PRE) and after 6 months (POST).	The home-based resistance training program determined only improvements in lower-limb muscle strength. Home confinement due to COVID-19 reduced the daily PA regimen and changed people's eating patterns, which may partially explain the increase in total body fat.
Verghese et al. (2021)	USA	The objective was to see if there are improvements in walking for people aged 70 and over through a computerized cognitive remediation program.	n=378 age =>70 years	The intervention consists of applying brain games, that is, a computer program of progressive intensity and complexity for 8 weeks.	Participants obtained a change in walking speed at normal pace and in walking conditions during speech.

3.2.2. Instruments

We identified 20 instruments to measure the above variables. The instruments referred to were (a) Hospital Anxiety and Depression Scale subscale (HADS) (Das & Bhattacharyya, 2021), with scores ranging from 0 to 21, and a higher score indicating more signs; (b) a computerized programs, known as brain games (Corley et al., 2021), that has progressive intensity and complexity to improve walking in older adults; (c) dual-energy X-ray absorptiometry and magnetic resonance (Verghese et al., 2021), to assess muscle strength, balance, gait, and body composition; (d) Interview guide (Thiel et al., 2021), allows you to understand their understanding of the pandemic situation, the types of difficulties they face and their concerns about the future; (e) Strength testing on a cycle ergometer (Verghese et al., 2021); (f) The 30-second chair stand test (CST) (Verghese et al., 2021), was conducted to assess lower limb strength; (g) Hand Grip Strength Test (HGS) is a widely used measure be-cause it is easy to apply and economical, and allows you to assess the maximum isometric force that a hand can press; (h) Montreal Cognitive Assessment (MoCA) score (Ferrucci et al., 2016), to assess cognition as well as executive functions, processing speed and episodic memory; (i) one-leg stance test (Ferrucci et al., 2016), to assess physical functions and balance; (j) timed up and go (TUG) (Ferrucci et al., 2016), to assess gait performance and mobility; (k) 5 times standing up (Ferrucci et al., 2016), to assess leg muscle strength; (l) Matthews questionnaire (Ferrucci et al., 2016), to assess cardiorespiratory fitness; (m) geriatric depression scale 30 items (Ferrucci et al., 2016); (n) perceived stress scale (Ferrucci et al., 2016); (o) State-Trait Anxiety Inventory 36 items (Ferrucci et al., 2016); (p) Perseverative Thinking Questionnaire (Ferrucci et al., 2016); (q) Connor - Davidson Resilience Scale 10 (Ferrucci et al., 2016); (r) GAIT Rite® system (Dupuy et al., 2021), assesses PA patterns and interactions and PA -related nursing home infrastructure testing; (s) ACTi Graph wGT3x- BT, Pensacola, F are accelerometers that allow us to assess individual resident physical activity behaviors (Dupuy et al., 2021); (t) Physical exercise Scale for the Older adult (PACE) (Dupuy et al., 2021), interview-administered questionnaires.

The interventions analyzed with the presented assessment tools were questionnaires (Ferrucci et al., 2016), interviews (Thiel et al., 2021), followed by training programs (Verghese et al., 2021), physical tests (Dupuy et al., 2021; Ferrucci et al., 2016; Verghese et al., 2021), and scales (Das & Bhattacharyya, 2021; Dupuy et al., 2021; Ferrucci et al., 2016). Many studies have investigated gait training (Corley et al., 2021; Dupuy et al., 2021; Ferrucci et al., 2016; Verghese et al., 2021). Two studies focused on evaluating the effectiveness of home-based programs, one involving an exercise program (Verghese et al., 2021), and the other examined the use of home gardens in relation to self-reported physical and mental well-being in older adults (Das & Bhattacharyya, 2021). Some authors have examined areas such as social therapy (Corley et al., 2021; Das & Bhattacharyya, 2021; Dupuy et al., 2021; Ferrucci et al., 2016; Thiel

et al., 2021; Verghese et al., 2021), cognitive training (Ferrucci et al., 2016), computerized programs (Corley et al., 2021), and alternative therapies (Das & Bhattacharyya, 2021). Finally, (Vitale et al., 2020) examined dual-energy X-ray absorptiometry and magnetic resonance imaging.

Regarding physical training interventions, in the study by Corley et al. (2021), a questionnaire consisting of 145 questions on demographics, knowledge and experience of COVID-19 and physical, psychological, and psychosocial health was applied. The questionnaire took about 30 to 45 minutes to complete. Participants were also asked to retrospectively assess how they felt before COVID-19, to assess the change in health perception after the pandemic. In the study by Das and Bhattacharyya (2021), the intervention consisted of telephone interviews, between April 7, 2020, and April 14, 2020, lasting approximately 30 minutes. In the study by Dupuy et al. (2021), the study design included six months of intervention. All participants were evaluated at baseline, 3 months, and 6 months. At each point in time, four test sessions were conducted remotely using video conferencing supervision and online questionnaires over a period of 7 to 10 days.

At twelve months, a follow-up assessment was performed to explore the potential maintenance of intervention effects. Participants were encouraged to perform a physical exercise at home using video capsules available on Facebook or YouTube. The videos lasted approximately 15 minutes and included a 3–5-minute warm-up, followed by a 10-minute workout, and finally a 2-minute cool-down period. The exercises did not require any equipment and included aerobic, muscle strengthening, flexibility and/or balance exercises. Participants were asked to perform exercise sessions at least 5 times a week. Participants rated their exercise intensity using the modified Borg Perception of Effort (RPE) scale. Participants were also encouraged to undertake cognitive training lasting at least three sessions per week.

In the study by Thiel et al. (2021), questionnaires were applied to obtain information on self-reported physical activity, as well as the individual's activity prerequisites regarding reasons for participating in exercise, exercise-specific self-efficacy, and activity restriction for fear of falling. To assess individual residents' physical activity behavior, we used accelerometer-based devices. We recorded the residents' total physical activity in everyday life over seven consecutive days. The primary outcome measure was steps per day recorded by ankle-mounted accelerometers. For additional secondary analyses, minutes per day with sedentary behavior.

In the study by Vitale et al. (2020), the intervention involved elderly people divided into two groups, an experimental group that performed exercises (EXE) and a control group (CON). Participants were assessed for muscle strength, balance, gait assessment, and body composition by dual-energy X-ray absorptiometry and magnetic resonance imaging, at baseline (PRE) and after 6 months (POST).

The EXE subjects were instructed and familiarized with the execution of the training protocol. The first session of the resistance training program was performed at home under the supervision of the researchers. Therefore, EXE per-formed four at-home resistance training sessions per week for 24 weeks. Each session consisted of 5 min of warm-up, 45 min of resistance exercise intervention and 5 min of cool-down. In detail, the warm-up included light, dynamic movements, and exercises. The core part of the training included resistance exercises for both the lower and upper body muscles. The exercises were performed in 3-4 sets, 12-15 repetitions and with a rest period of 60 to 90 seconds. The cool-down phase consisted of light

static stretching exercises, lasting between 25 and 40 seconds.

In the study by Verghese et al. (2021), the intervention consists of the application of brain games, that is, a computer program of progressive intensity and complexity for 8 weeks. Participants were divided into groups of up to eight participants and performed training sessions three days a week for 8 weeks. Each session lasted approximately 50 minutes and was divided into three blocks, the first two blocks included training tasks in the cognitive domain and an assessment task that monitored performance and increased the difficulty of the task in future sessions, and the third block specifically targeted the executive functions training and related processes. Participants in the control group also trained for about 150 minutes every week for 8 weeks. Each session consisted of interactive computer-based health education classes and a low-complexity, non-progressive program.

3.3. Risk of Bias

As indicated in Table 3. item 1, the mean risk of bias analysis score using the Evidence Project tool was 5.88 out of 8 with a standard deviation of 1.31. The scores ranged from 5 to 7. Merely two individuals made it to item 2. Item 3 was not met by two investigations. However, the results of the assessment of the individuals' representativeness are more inconsistent. All studies satisfied item 4, which evaluated the "random assignment of participants to the intervention." Item 5 ("random selection of participants for evaluation") was not met by any publication, nevertheless. Ultimately, every study satisfied items 6, 7, and 8.

Table 3: Risk of bias analysis with the Evidence Project tool.

	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	
Study	**Study Design**			**Participant Representativeness**		**Equivalence of Comparison Groups**			**Total Score**
Corley et al. (2021)	Yes	No	No	Yes	No	Yes	Yes	Yes	5/8
Das et al. (2021)	Yes	No	No	Yes	No	Yes	Yes	Yes	5/8
Dupuy et al. (2021)	Yes	No	Yes	Yes	No	Yes	Yes	Yes	6/8
Thiel et al. (2021)	Yes	No	Yes	Yes	No	Yes	Yes	Yes	5/8
Verghese et al. (2021)	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	7/8
Vitale et al. (2020)	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	7/8

4. DISCUSSION

This review systematically examined physical exercise programs aimed at improving sensorimotor skills in older adults, focusing on how aging and COVID-19 affect variables like sleep, stress, anxiety, strength, gait, and balance. These programs not only enhance sensorimotor abilities but also help older adults stay active, improving their quality of life, health, and well-being. However, only six studies evaluated physical training programs in older adults after the onset of the COVID-19 pandemic.

Twenty distinct measures were discovered in the review, none of which were used repeatedly in various studies to assess quality of life, physical, cognitive, mental, or social capacities. To evaluate strength and balance, well-known instruments like the cycle ergometer, the 30-second chair stand test (CST), the Hand Grip Strength Test (HGS), and the one-leg

standing test were frequently employed. Studies have indicated that exercising with a cycle ergometer can help avoid cardiovascular illnesses and improve metabolic responses in older persons. It also improves cognitive function, muscular strength, and functional status. Based on this information, medical professionals can offer cycle ergometer training with confidence to older adults, enabling them to preserve their independence in everyday activities and reap the health benefits (Bouaziz et al., 2015; Carballeira et al., 2021). A popular sit-to-stand evaluation in clinical and laboratory settings is the 30-second chair-stand test (30s-CST). This test has a moderately high test-retest reliability and is easy to score (Rikli & Jones, 1999; Roongbenjawan & Siriphorn, 2020).

One popular physical fitness test that is especially useful for community-based evaluations is handgrip strength (HGS). Physical restrictions have been associated with a reduction in HGS in persons 60 years of age and older. A correlation between low HGS and higher mortality was found in a pooled examination of 6,426 older persons who lived in the community. Because of this, HGS is a clinically meaningful measure of older persons' health state. Because of this, the HGS test can be used independently to effectively evaluate physical fitness levels in older persons who live in the community, offering insightful, unbiased data. (Pan et al., 2022). The one-leg standing test is a helpful indicator of frailty in older people who live in communities. Enhancing balance, resistance, strength, and endurance through interventions has the potential to improve one-leg standing times (Michikawa et al., 2009).

Furthermore, to monitor muscle activity, dual-energy X-ray absorptiometry and magnetic resonance imaging were employed in our investigation. Dual-energy X-ray absorptiometry (DXA) is a relatively new technique in an aging culture, yet it is regarded as the gold standard for diagnosing sarcopenia in terms of limb muscle mass measurement. Furthermore, in terms of measuring limb muscle mass, bioelectrical impedance analysis (BIA), which has been widely utilized in clinical settings recently and assesses body composition, shows a strong association with DXA (Fujimoto et al., 2019).

The timed up and go (TUG) test, which is particularly user-friendly, was the sole one used by the authors to evaluate dynamic balancing. According to guidelines released by the American Geriatric Society and the British Geriatric Society, the TUG is advised as a regular screening test for falls. In order to reduce falls in the elderly population, the National Institute of Clinical Evidence (NICE) guidelines also support the use of the TUG for gait and balance assessments (Barry et al., 2014).

Cognitive capacities were measured using the Montreal Cognitive Assessment (MoCA) and an automated algorithm. The MoCA has a sensitivity of 90% and 100% in identifying MCI and Alzheimer's disease (AD), respectively, and is intended to aid in the detection of mild cognitive impairment (MCI). The MoCA is a screening tool that can also be used to test cognitive function across various domains, including attention and visuospatial ability, and so serve as an indicator of total global cognitive ability (Cardoso et al., 2021). Accelerometers, guided interviews, and the Physical Exercise Scale for the Older Adult (PACE) were used to measure physical activity. Numerous self-report questionnaires have been employed to measure older individuals' daily physical activity levels. The Physical Activity Scale for the Elderly (PASE), which is used extensively, is intended to evaluate the quantity, frequency, intensity, and length of physical activity that people 65 years of age and older complete over the course of seven days. This instrument offers a low-cost approach to tracking physical activity and health, making it appropriate and valuable for field research (Logan et al., 2013).

Other physical abilities, such as muscle strength, gait, and cardiorespiratory fitness, were also well assessed in the selected studies. Dual-energy X-ray absorptiometry and magnetic resonance were used to assess muscle strength. For gait analysis, the authors suggested dual-energy X-ray absorptiometry and magnetic resonance imaging, timed up then go (TUG), GAIT Rite® system and accelerometry. Gait was the most assessed physical ability in the different studies (Corley et al., 2021; Das & Bhattacharyya, 2021; Ferrucci et al., 2016) analyzed. For cardiorespiratory fitness the authors proposed the Matthews' questionnaire. Can we stop the mobility failure that accompanies the older adults? And all the physical and biological changes associated with aging? These are the questions we attempt to answer in this article. In the last decade, new information has highlighted the complexity of walking and shown that it affects several systems can have a dramatic impact on mobility and function in older people. In addition, new findings directly link functional capacity to various biological and behavioral factors (Ferrucci et al., 2016).

The social and psychological abilities such as anxiety, depression, and stress were examined in the selected studies. To measure anxiety, the authors used the Hospital Anxiety and Depression Scale (HADS) and the State-Trait Anxiety Inventory. To measure depression, the geriatric de-pression scale was used. To measure stress, the Perceived Stress Scale was used. To assess the social component, the authors used the GAIT Rite® system and guided interviews. Sousa et al., (2017) indicate that among older Portuguese persons, anxiety prevalence is 9.6% and depression prevalence is 11.8%. Seniors who suffer from anxiety or depression are more likely to self-report having a lower quality of life and a higher degree of physical infirmity. Anxiety and despair are prevalent among older Portuguese individuals. These prevalence rates indicate that there is a critical need to prevent mental disease in the senior population. The well-being of the elderly can be effectively increased by a well-thought-out preventative plan.

Elderly people who engage in physical activity (PA) benefit from many different sources, such as the prevention of physical deterioration and improvements in psychological health and social perception. By assisting people in developing and reinforcing the movement patterns necessary for daily activities, physical activity enhances quality of life. A higher sense of social and personal well-being results from this. It is possible to lower the risk of disease, cardiovascular problems, and the detrimental effects of a sedentary lifestyle in older persons by maintaining excellent functional ability. Programs or tactics that promote regular PA should be created in order to support this, with a recommended frequency of at least three days per week (Cabo et al., 2024).

According to the results of our work, the studies with the highest score (7/8) use tests and the studies with the lowest score (5/8) in the analysis of risk of bias use questionnaires. One hundred percent of the articles analyzed (6 articles) scored five or more of the eight points, so we can consider them to be good quality clinical trials and protocol studies and therefore good measures of physical activity intervention programs for older people. The good quality of the studies suggests that the way the instruments were used was probably appropriate to achieve the results; however, the analysis regarding the appropriateness of the instruments used should be more precise in future studies. This work includes many articles that may be of importance considering that the COVID-19 pandemic is recent, and we all need studies that are fundamental to understanding the relationship with exercise.

The review highlighted that while the studies generally scored well in quality, there were limitations. Only English-language articles indexed in specific databases were included, and

the studies varied in the equipment used, making data comparison difficult. Additionally, the cross-sectional nature of most studies introduced a moderate risk of bias. Despite these challenges, the review provides valuable insights into the relationship between physical activity and COVID-19 in older adults, emphasizing the importance of continued research in this area. The pandemic has underscored the need for self-care and the protection of vulnerable elderly populations, highlighting the critical role of physical activity in maintaining health and well-being.

Finally, the review acknowledges the need for further research to determine which assessment tools are most reliable and sensitive for older adults, particularly in the context of COVID-19. Despite the study's limitations, it offers significant data on the relationship between physical activity and aging, particularly in the wake of the pandemic.

5. CONCLUSIONS

Physical activity programs have garnered the attention of physiology researchers due to their impact on aging-related changes and the effects of the COVID-19 pandemic. Physical, social, and psychological abilities are significantly influenced by aging, which in turn affects daily functionality and quality of life. Engaging in physical exercises, social therapies, cognitive training, computer programs, and alternative therapies can improve sensorimotor abilities in older adults. This relationship can aid healthcare professionals and study participants in enhancing their sensorimotor skills, thereby preventing a decline in functionality and quality of life. Various instruments have been used in studies to assess sensorimotor abilities in older adults. Although there is some disagreement on the best tools to evaluate these variables, this article provides an overview of the instruments employed by researchers in the field of physiology

Author Contributions: Formal analysis, J.A.P., and O. F.; Investigation, C.A.C. and M.M.-M Supervision; Writing – original draft, C.A.C.; Writing – review & editing, J.A.P and M.M.-M.; Visualization, M.M.-M. All authors have read and agreed to the published version of the manuscript.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The datasets used during the current study are available from the corresponding author on rea-sonable request.

Acknowledgments: The author M.M.-M. was supported by a grant from the Universities Ministry and the European Union (NextGenerationUE) (MS-12).

Conflicts of Interest: The authors declare no conflict of interest.

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