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SYSTEMATIC REVIEW ARTICLE

Exercise programs for work-related musculoskeletal pain: a scoping review protocol

Programas de exercício físico para a dor músculo-esquelética relacionada com o trabalho: protocolo de scoping review

Programas de ejercicio físico para el dolor musculoesquelético relacionado con el trabajo: protocolo de revisión exploratoria (scoping review)

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Abstract

Background: Musculoskeletal pain is a very common problem in workers from different sectors. Exercise can contribute to preventing and reducing this phenomenon.
Objective: To map exercise programs for work-related musculoskeletal pain.
Review method: The JBI PCC (Participants, Concept, and Context) strategy will be used. A search will be carried out in CINAHL Complete, PubMed, Scopus, SciELO, PEDro, and SPORTDiscus databases. DART-Europe, OpenGrey, and RCAAP databases will be used to search unpublished studies. Studies published in English, Spanish, and Portuguese will be considered for inclusion and analysis. Two independent reviewers will select the studies and extract and synthesize the data.
Presentation and interpretation of results: Data will be presented in a diagrammatic or tabular form, or using a descriptive summary.
Conclusion: The mapping of exercise programs for preventing work-related musculoskeletal pain can lead to a reflection on the most appropriate programs and the identification of priority areas.

Keywords: musculoskeletal diseases; musculoskeletal pain; secondary prevention; workplace; physical exercise; occupational health

Resumo

Contexto: A dor a nível músculo-esquelético é um problema muito frequente em trabalhadores de diferentes contextos laborais. O exercício físico pode contribuir na prevenção e diminuição deste fenómeno.
Objetivos: Mapear os programas de exercício físico para a dor músculo-esquelética relacionada com o trabalho.
Método de revisão: Será considerada a estratégia de definição dos participantes, conceito e contexto (PCC) proposta pelo *Joanna Briggs Institute*. Serão incluídas as bases de dados: CINAHL Complete; PubMed; Scopus; SciELO; PEDro; SPORTDiscus. A pesquisa por estudos não publicados incluirá: DART-Europe; OpenGrey; RCAAP. Estudos publicados em inglês, espanhol e português serão considerados para inclusão e análise. A seleção dos artigos, a extração e síntese dos dados será desenvolvida por dois revisores independentes.
Apresentação e interpretação dos resultados: Os dados analisados serão apresentados de forma diagramática, tabular e descritiva.
Conclusão: O mapeamento de programas de exercício físico direcionados à prevenção de dores músculo-esqueléticas relacionadas com o trabalho poderá levar à reflexão sobre os mais adequados e a identificar áreas prioritárias.

Palavras-chave: doenças músculo-esqueléticas; dor músculo-esquelética; prevenção secundária; local de trabalho; exercício físico; saúde ocupacional

Resumen

Contexto: El dolor a nivel musculoesquelético es un problema muy frecuente en trabajadores de diferentes contextos laborales. El ejercicio físico puede contribuir a la prevención y reducción de este fenómeno.
Objetivos: Mapear los programas de ejercicio físico para el dolor musculoesquelético relacionado con el trabajo.
Método de revisión: Se considerará la estrategia de definición de los participantes, el concepto y el contexto (PCC) propuesta por el Instituto Joanna Briggs. Se incluirán las bases de datos: CINAHL Complete; PubMed; Scopus; SciELO; PEDro; SPORTDiscus. La búsqueda de estudios no publicados incluirá: DART-Europe; OpenGrey; RCAAP. Se considerarán para su inclusión y análisis los estudios publicados en inglés, español y portugués. La selección de los artículos, la extracción y la síntesis de los datos serán desarrolladas por dos revisores independientes.
Presentación e interpretación de los resultados: Los datos analizados se presentarán en forma de diagrama, tabla y descripción.
Conclusión: El mapeo de los programas de ejercicio físico dirigidos a la prevención del dolor musculoesquelético relacionado con el trabajo puede llevar a reflexionar sobre los más adecuados y a identificar las áreas prioritarias.

Palabras clave: enfermedades musculoesqueléticas; dolor musculoesquelético; prevención secundaria; lugar de trabajo; ejercicio físico; salud ocupacional

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Introduction

Work-related musculoskeletal pain (WRMSP) is the most common health problem in the European Union (EU), caused and aggravated by work activities, environments, and conditions affecting muscles, joints, tendons, ligaments, nerves, cartilage, bones, and the blood system (Centers for Disease Control and Prevention [CDC], 2020; Commissaris & Douwes, 2019; Kok et al., 2019). Despite the strategies and preventive measures developed in recent decades at the business, institutional, and political level, WRMSP continues to be a public health issue, varying across countries in terms of prevalence, sectors, and occupations, with an impact on the workers and very high costs for businesses and society in general (Kok et al., 2019; Van der Beek et al., 2017).

Back pain is the most common type of pain, particularly low back pain, accounting for 35-50% of all WRMSP, followed by pain in the neck and upper limbs, accounting for 15-45% of all WRMSP (Vos et al., 2017). There are multiple risk factors, but the most common ones are repetitive movements of the hands and upper limbs (61%). In recent years, the number of complaints related to the mass use of laptops and smartphones has increased substantially (CDC, 2020; Commissaris & Douwes, 2019; Kok et al., 2019).

The paradigm of the type of work activities and their risk factors has been changing in recent years. The most physically demanding work and the associated risks (for example, freight elevators, work surface height) has been replaced by static physical activity, usually accompanied by prolonged periods of physical inactivity, in the sitting position, with little or no movement, that is, sedentarism (for example, teleworking, office workers, drivers, teachers, researchers, laboratory workers, and security guarding; Van der Beek et al., 2017; Vos et al., 2017).

Trends for the coming years are also not very encouraging and involve changes in strategies and interventions at various levels (political, social, and economic). International recommendations suggest preventing not only physical/biomechanical risk factors but also organizational and psychosocial risk factors. Prevention should be integrated and complemented by an occupational health promotion approach focused on good musculoskeletal health at the workplace (Commissaris & Douwes, 2019; Kok et al., 2019).

The literature often associates the lack of exercise with several chronic diseases such as cardiovascular diseases, Type 2 diabetes mellitus, and obesity (Buckley et al., 2015). As described in the previous paragraphs, this situation is aggravated by the advent of mostly sedentary professional activities, which do not offer activity alternatives throughout the day. The risks of inactivity to the citizens' health is not a new phenomenon, and the adoption and maintenance of healthy lifestyles, including regular physical activity (PA), is of the utmost importance for controlling chronic non-communicable diseases and improving the quality of life of the populations at all stages of the life cycle (Direção-Geral da Saúde [DGS], 2016).

On the other hand, the decline in health status, whether related to work or not, can influence productivity and work ability. Therefore, employers have an economic interest in developing and proposing interventions to improve the employees' health status (Søgaard & Sjøgaard, 2017). Enterprises should promote PA/exercise and reduce their workers' sedentary lifestyles through the valorization and dissemination of best practices in PA that promote behaviors and innovative solutions to avoid sedentary lifestyles (Kok et al., 2019).

Some exercise physiology theories support a plausible therapeutic and preventive effect of exercise in controlling WRMSP. General physiologic responses to exercise that are relevant to obtaining a therapeutic or analgesic effect include improved systemic circulatory capacity and vasodilatory capacity, increased stimulation of endorphins, transient elevations in pain threshold, increased muscle strength, and may moderate pain due to a reduction of the relative physical load at work (Lowe & Dick, 2014).

The concepts of PA and exercise should be carefully considered because they are often used interchangeably but are not synonymous. PA is any bodily movement produced by the contraction of skeletal muscles that results in a substantial increase in caloric requirements over rest energy expenditure. Exercise is a subcategory of PA consisting of planned, structured, and repetitive bodily movements, done to improve and/or maintain one or more components of physical fitness (American College of Sports Medicine [ACSM], 2018). Paradigms change and, according to Søgaard and Sjøgaard (2017), PA takes place in three domains of daily life: leisure, sleep, and work. Each one has different profiles of intensity, duration, and repetitiveness of muscular activity and, therefore, different effects on musculoskeletal health. According to these authors, the balance between these three domains is essential to prevent lifestyle diseases, including musculoskeletal disorders, which does not usually happen.

Studies show that planned exercise to maintain and improve muscle strength, endurance, and resilience can reduce pain and improve health, and the workplace can offer excellent conditions for physical training with benefits for health (Andersen et al., 2017).

In this context, occupational PA (OPA), also called workplace physical activity by some authors (WPA, Neves et al., 2018), has increased significantly in recent decades. These programs aim to promote workers' health in a safer and more productive work environment. They can include pauses at opportune times, short workouts (15 to 20 minutes) in the form of recreational activities at the workplace to compensate for the negative effects of work, and exercises (muscle strengthening, body awareness, postural correction, breathing exercises, self-massage, recreation, and relaxation) to maintain or improve physical ability (Laux, 2019; Neves et al., 2018).

Despite reported evidence, some authors argue that OPA programs should be combined with other intervention strategies to be successful (Serra et al., 2020; Sowah et al., 2018). Other studies highlight the need for further studies to clarify the characteristics of the most effective exercises (Kelly et al., 2018; Lowe & Dick, 2014; Moreira-Silva et al., 2017) and studies with new methodologies

(qualitative, multimethod; Neves et al., 2018).
In fact, despite the evidence and convergence of objectives, strategies, and measures adopted by national and international bodies for promoting workers' health and healthy lifestyles, WRMSP remains a very significant problem among workers worldwide (Kok et al., 2019).
Among the interventions recommended for this public health issue, exercise, either at the workplace or not, emerges as an intervention strategy for preventing and reducing WRMSP (Søgaard & Sjøgaard, 2017; Sowah et al., 2018).
However, the information seems scattered and disorganized, and some authors suggest conducting better quality studies and clarifying various dimensions, such as the type of exercise programs for each occupational activity and body segments at higher risk. Regarding the most appropriate duration, intensity, type, and frequency of exercise, it should be clarified whether the interventions and outcomes are properly assessed and which professionals implement these programs. Other individual (motivation, adherence to the program) and organizational factors (working conditions, absenteeism, cost-benefit) influencing the process should also be identified (Kelly et al., 2018; Lowe & Dick, 2014; Moreira-Silva et al., 2017; Serra et al., 2020; Sowah et al., 2018).
An initial search in the JBI database of systematic reviews and implementation reports, Cochrane Library, MEDLINE, and CINAHL found a systematic review with meta-analysis on the effectiveness of PA programs in workplace-related musculoskeletal pain (Moreira-Silva et al., 2017). The authors concluded that current interventions are moderately effective and recommend that other studies find other effective PA components. Also, they suggest that future research should focus on the efficacy of interventions for the arm, elbow, wrist, hand, and low back. On the other hand, the search revealed a recent systematic review (Sundstrup et al., 2020) on the effectiveness of exercise at the workplace for musculoskeletal disorders, also involving pain, but among workers with physically demanding jobs. Although these studies have been recently developed on the same topic, they focused only on effectiveness, with the latter focusing on highly demanding contexts rather than only on pain. As suggested by the studies mentioned above, there is a need to map the structure and components of exercise programs in preventing and reducing WRMSP in several work contexts rather than focusing only on the effectiveness in highly demanding contexts.
It should also be noted that an initial search on the PROSPERO platform revealed no ongoing or future scoping or systematic review with this specificity.
Given that the most recent systematic review on pain prevention in several work contexts (Moreira-Silva et al., 2017), rather than only in highly-demanding contexts, only looked for articles until 2013, it will be important to map exercise programs for the prevention and reduction of WRMSP in several work contexts that have been published between 2013 and 2021.
This scoping review followed the recommendations proposed by the Joanna Briggs Institute (JBI), assuming that this methodology can "provide an overview of the evidence or to answer questions regarding the nature and diversity of the evidence/knowledge available" (Peters et al., 2020, p. 3).
Thus, this mapping can identify relevant issues to advance evidence-based health care, develop knowledge, identify possible gaps, and suggest systematic reviews.
This scoping review aims to map the exercise programs for WRMSP. More specifically, this review will focus on the following questions: i) What are the characteristics of the exercise programs that have been implemented in the workplace (modality, type, intensity, frequency)? ii) How are the exercise programs implemented in the workplace evaluated? iii) Who are the professionals implementing and evaluating exercise programs? iv) Who are the workers (occupational sector) receiving the exercise interventions that have been implemented and evaluated? v) Which body segments are the target of exercise programs? vi) What are the dimensions (physical, cognitive, and emotional) influenced by the physical exercise program?

Review Method

Scoping reviews can be important precursors to systematic reviews in identifying and analyzing knowledge gaps and clarifying the main characteristics or factors related to a concept (Peters et al., 2020).

Inclusion Criteria/Exclusion Criteria

According to this method, JBI proposes the following eligibility criteria: population, concept, and context (Peters et al., 2020). Regarding the population, this review will consider all studies focusing on workers from different sectors and occupations. In terms of concept, this review will consider all studies in which a structured exercise program is implemented and evaluated in the workplace to prevent and/or decrease the workers' WRMSP directed to different body segments (cervical spine/neck, shoulders, thoracic spine, lumbar spine, upper and lower limbs), with different exercise modalities (yoga, running, aerobics, postural gymnastics, among others), types (strength, postural, stretching – active, static, passive, endurance, flexibility, massage, relaxation, among others), intensities (mild, moderate, intense), and duration (short, medium, or long duration). Concerning the context, this review will consider all studies in which exercise programs have been implemented and evaluated for workers from different sectors and occupations, carried out during working hours (in a predefined work context) and/or during leisure time at gyms, home, others).
Regarding the type of study, this review will consider primary research studies, quantitative or qualitative design studies, systematic reviews, including meta-analysis and meta-synthesis, and grey literature on the subject. Any duplicates from primary studies and systematic reviews will be discussed, analyzed, and reported.
Quantitative studies include any designs of experimental studies (including randomized controlled trials, non-randomized controlled trials, or other quasi-experimental

studies, including before and after studies) and observation models (descriptive studies, cohort studies, cross-sectional studies, case studies, and case series).
Qualitative studies include any studies focusing on qualitative data, such as phenomenology, grounded theory, and ethnographic studies.
Abstracts/posters published in conferences and opinion articles will be excluded.

Search strategy
A three-step search strategy will be undertaken to find published and unpublished studies. First, an initial limited search in MEDLINE and CINAHL was undertaken, followed by an analysis of the words in the titles and abstracts and the index terms used to describe the articles.

A second search will be performed using all identified keywords and index terms identified in all included databases. Table 1 shows the final search strategy to be used in the MEDLINE database (via PubMed).
Thirdly, the reference list of all included reports and articles will be screened for additional studies. Studies published in English, Spanish, and Portuguese will be considered for inclusion in this review, allowing for an exhaustive search of the most relevant and current studies on the subject.
The databases to be searched include CINAHL Complete (via EBSCOhost), PubMed, Scopus, SciELO, PEDro, and SPORTDiscus (via EBSCOhost). The search for unpublished studies, including grey literature, will be undertaken in the following databases: DART-Europe, RCAAP, and Open Grey.

Table 1

Search strategy for MEDLINE (via PubMed)

Strategy	Records
((((Work[Title/Abstract] OR "occupational sector"[Title/Abstract] OR "occupational sectors"[Title/Abstract] OR "occupational health"[Title/Abstract]) OR ("Occupational Health"[Mesh])) AND (("physical exercise"[Title/Abstract] OR exercise*[Title/Abstract] OR "physical exercises"[Title/Abstract]) OR ("Exercise"[Mesh]))) AND (((pain*[Title/Abstract] OR hurt*[Title/Abstract] OR ache*[Title/Abstract] OR suffering[Title/Abstract] OR myalgia[Title/Abstract]) OR ("Pain"[Mesh])) OR ("Musculoskeletal Pain"[Mesh]))) AND ((musculoskeletal[Title/Abstract] OR "muscle system"[Title/Abstract] OR "skeletal muscle"[Title/Abstract] OR "skeletal muscles"[Title/Abstract]) OR ("Musculoskeletal System"[Mesh]))*	1145

Study selection process
All retrieved articles will be exported to the Mendeley reference manager and duplicates removed. The records will be screened by two independent reviewers based on the inclusion criteria and with a third reviewer in case of disagreement. In the first phase, the articles will be included based on the information provided in the title and abstract. If there are doubts about the relevance of the title and abstract of a study, the full article will be analyzed. All studies that meet the inclusion criteria for this review will be analyzed in full.
Studies identified from the reference lists will be screened for relevance based on the title and abstract. Search results will be accompanied by a descriptive analysis and a flowchart of the review process according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews *(PRISMA-ScR)* flow diagram, detailing the various stages of the process (Tricco et al., 2018).

Data extraction
Data will be extracted using a table aligned with this scoping review's purpose and questions, as recommended and developed by JBI (Peters et al., 2020). Based on the same author, a data extraction instrument was developed (Table 2) that may be further refined at the review stage. Following JBI guidelines (Peters et al., 2020), two reviewers will extract data from 10 articles in a pilot phase. Any doubts or disagreements between reviewers will be resolved through discussion until consensus is reached. If necessary, primary authors will be contacted to request more information/clarification, as suggested by Arksey and O'Malley (2005, as cited in Peters et al., 2020).

Table 2

Data extraction tool developed by the researchers

Title	Exercise programs for work-related musculoskeletal plain: a scoping review protocol
Review questions	i) What are the characteristics of the exercise programs implemented in the workplace (modality, type, intensity, frequency)? ii) How are the exercise programs implemented in the workplace evaluated? iii) Who are the professionals implementing and evaluating exercise programs? iv) Who are the workers (occupational sector) receiving the exercise interventions that have been implemented and evaluated? v) Which body segments are the target of exercise programs? vi) What are the dimensions (physical, cognitive, and emotional) influenced by the exercise program?
Methodology (PCC mnemonic)	**Population** Studies focusing on workers from several sectors and occupations **Concept** Studies on the implementation and evaluation of a structured exercise program at the workplace to prevent and/or reduce workers' WRMSP **Context** Primary research studies, quantitative or qualitative studies, systematic reviews, including meta-analysis and meta-synthesis, and gray literature, in which exercise programs for workers have been implemented and evaluated within and/or outside the workplace
Extraction of details and characteristics of included studies	Authors: _____ Year of publication: _____ Geographic location and occupational context: _____ Study type and design: _____ Research objectives and question: _____ Sample size: _____ Concepts relevant to the review question: _____

Data synthesis

Extracted data will be analyzed taking into account the review objectives and questions (Peters et al., 2020). Data synthesis will be carried out independently by the researchers involved in the previous phase and, when necessary, after the consensus of the research team, in case of disagreement. Aggregated data will be presented in tables and/or charts, which can be refined during the review, to give an overview and synthesize data (Tables 3, 4, 5, and 6).

Table 3

Data synthesis grid for the first review question

Study	Study type	Design	Exercise program				
			Modality	Type	Frequency	Intensity	Duration

Table 4

Data synthesis grid for the second and third review questions

Study	Professional	Sector/Occupation

Table 5

Data synthesis grid for the fourth review question

Study	Body segment							
	Neck	Back	Low back	Shoulders	Elbow	Wrist and hand	Hip	Knees

Table 6

Data synthesis grid for the fifth review question

Study	Dimensions influenced by exercise		
	Physical	Cognitive	Emotional

Data presentation and interpretation

The mapping of the evidence selected from the international literature on exercise programs for preventing workers' WRMSP will enable the analysis and reflection on the type of studies, the workplaces, the professionals involved in their implementation, the characteristics of exercise programs in terms of type, frequency, intensity and duration, the affected body segments, and the dimensions of their contributions.

Conclusion

Considering the importance of adopting WRMSP prevention strategies, the analysis of PE programs for workers from various occupational contexts is essential to map the most appropriate programs for preventing this public health problem.

The selected and analyzed scientific evidence will help reflect on the best and most recent practices in this field and clarify the contributions of these programs. This scoping review is expected to contribute to the formulation of new research questions for systematic reviews on the effectiveness of these programs in preventing WRMSP.

Author contributions

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Writing – review & editing: Cruz, A. G., Bernardes, R. A., Parreira, P. M.

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