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PHYSICAL ACTIVITY AND MUSCULOSKELETAL DISORDERS IN EDUCATION WORKERS: A SYSTEMATIC REVIEW

ATIVIDADE FÍSICA E DISTÚRBIOS MUSCULOESQUELÉTICOS EM TRABALHADORES DA EDUCAÇÃO: UMA REVISÃO SISTEMÁTICA

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Gilvanio Alves Pereira[1]

Eduardo Lucia Caputo[2]

Mariele dos Santos Rosa Xavier[3]

Sérgio Rosa Vieira Pasqualinoto[4]

Marcelo Frio Marins[5]

Vanise dos Santos Ferreira[6]

Marcelo Cozzensa da Silva[7]

ABSTRACT

This study examined whether physical activity (PA) programs can help prevent or treat musculoskeletal disorders (MSDs) in education workers. Methods: We searched PUBMed and EMBASE in April 2025 for intervention studies that used PA to address MSDs and reported outcomes related to pain or physical function. Results: Four studies met the inclusion criteria. The interventions involved different types of exercises, targeting various body areas with varying frequencies. One study showed a significant improvement in disability from low back pain (SMD: -0.59; 95% CI: -1.06 to -0.11), and another found a significant reduction in neck pain (SMD: -1.90; 95% CI: -2.67 to -1.23). Conclusions: Exercise programs may help reduce disability caused by MSDs, especially low back pain. However, there is limited evidence on their effectiveness for reducing pain intensity in other body regions, with only one study showing a benefit for neck pain.

Keywords: Exercise; Musculoskeletal pain; Workers; Education workers.

RESUMO

Este estudo examinou se programas de atividade física (AF) podem ajudar a prevenir ou tratar distúrbios musculoesqueléticos (MSDs) em trabalhadores da educação. Métodos: Buscamos no PUBMed e EMBASE em abril de 2025 por estudos de intervenção que usaram AF para abordar MSDs e relataram resultados relacionados à dor ou função física. Resultados: Quatro estudos atenderam aos critérios de inclusão. As intervenções envolveram diferentes tipos de exercícios, visando várias áreas do corpo com frequências variadas. Um estudo mostrou uma melhora significativa na incapacidade de dor lombar (SMD: -0,59; IC de 95%: -1,06 a -0,11), e outro encontrou uma redução significativa na dor no pescoço (SMD: -1,90; IC de 95%: -2,67 a -1,23). Conclusões: Programas de exercícios podem ajudar a reduzir a

incapacidade causada por MSDs, especialmente dor lombar. No entanto, há evidências limitadas sobre sua eficácia para reduzir a intensidade da dor em outras regiões do corpo, com apenas um estudo mostrando um benefício para dor no pescoço.
Palavras-chave: Exercício; Dor musculoesquelética; Trabalhadores; Trabalhadores da educação.

1. INTRODUCTION

Musculoskeletal disorders (MSDs) are a group of conditions characterized by pain, paresthesia, a sense of heaviness, fatigue, limited movement, and reduced work capacity (Arvidsson et al., 2016; T. A. H. Rocha et al., 2016). These disorders affect muscles, bones, nerves, tendons, ligaments, joints, cartilage, and spinal discs (IIF Home: U.S. Bureau of Labor Statistics, [s.d.]). MSDs are the second most common cause of disability worldwide, imposing substantial economic burdens on employers and healthcare systems (Rodrigues et al., 2014). Notably, the most commonly affected areas include the dorsal region (44.7%), multiple body regions (28.9%), and upper limbs (26.4%) (Arvidsson et al., 2016). Between 2007 and 2012, an estimated five million workdays were lost in Brazil due to MSD-related absences, resulting in significant economic losses (Haeffner et al., 2018).

MSD is one of the most common complaints among teachers and education professionals. The pooled prevalence of MSDs in teachers is 68%. However, individual studies report prevalence reaching up to 90%. Notably, the most commonly affected areas are the low back and the neck, with pooled prevalence of 47% (Tahernejad et al., 2024). Studies show that pain impacts their social, work, and emotional well-being, leading to a decline in their quality of life (Ng

et al., 2019; Vega-Fernández et al., 2022). Factors influencing the quality of life among education workers include adequate work infrastructure, fair wages, length of service, and opportunities for continuing education and training (Fernandes et al., 2011; Rosa Bernardino da Silva Lima & José Gusmão Coutinho, Biologist with a PhD in Biology from UFPE, 2020). Conversely, poor working conditions, heavy workloads, and low salaries adversely affect their well-being.

Physical activity (PA) plays a crucial role in maintaining the health and functionality of the musculoskeletal system, supporting muscle, bone, joint, and tendon health. Engaging in regular PA helps prevent muscle and joint injuries, increases muscle strength, and reduces the loss of bone mass and density. PA also contributes to pain management, decreases disability, and enhances overall quality of life (Caputo et al., 2024). For education professionals, regular PA offers benefits beyond physical health, positively influencing job performance and increasing functional capacity. Improvements in vitality and enthusiasm are essential for teachers, as their work often requires substantial energy and motivation to effectively manage large groups of students (Alencar et al., 2021; Dumith, 2020).

Increasing research on the effectiveness of PA for preventing and treating MSDs in this population may help reduce the negative impact of MSDs on work performance, lower public costs associated with sick leave and early retirement, and benefit society as a whole. However, there is limited research on PA programs specifically targeting educational professionals (Pillastrini et al., 2009). Thus, we aimed to evaluate the effectiveness of PA interventions in preventing or treating MSDs in education professionals.

2. MATERIALS AND METHODS

We followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)(Page et al., 2021) recommendations, and the protocol was prospectively registered in the International Prospective Register for Systematic Reviews (PROSPERO) (CRD420250569820). The Population, Intervention, Comparison, Outcome, and Time (PICOT) model guided the research question as follows: (P) workers regardless of occupational status (hybrid or in-person); (I) any PA intervention (health education, messages, exercises); (C) no exercise or other type of intervention; (O) musculoskeletal pain regardless of location (lower back, neck, shoulder, etc.); and (T) intervention time (up to 8 weeks).

Searches were conducted in PubMed and EMBASE on April 2025. The search strategy used relevant keywords and medical subject headings (MeSH) related to musculoskeletal disorders, workers, and physical activity interventions. The full search strategy is available in the Supplementary material. Articles published in English, Portuguese, and Spanish were included to minimize language bias.

Studies were independently selected by two researchers based on the following inclusion criteria: (1) intervention studies (i.e., randomized or non-randomized controlled trials); (2) interventions involving PA; and (3) pain and/or functionality outcomes. Studies that did not meet these criteria were excluded. We excluded studies conducted during the COVID-19 pandemic.

The screening process was independently performed by two reviewers, with discrepancies resolved through consensus. The dataset was exported to the Systematic Review Data Repository

(SRDR). We evaluated each study for risk of bias using the Cochrane Risk of Bias Tool (Higgins et al., 2011).

Since the included studies did not provide sufficient data for a meta-analysis, we summarized the findings narratively. However, due to the wide range of continuous outcome measures reported, we calculated, and meta-analyzed between-group standardized mean differences (SMDs) using Hedges' g, which accounts for potential bias in small sample sizes.

3. RESULTS AND DISCUSSION

A total of 9,342 articles were identified. After screening titles and abstracts, 402 articles were selected for full text screening. Ultimately, four studies met the inclusion criteria. Further details are provided in the adapted PRISMA flowchart (Figure 1).

One study was conducted in Italy (Pillastrini et al., 2009), one in Saudi Arabia (Iqbal et al., 2021), one in Peru (Manrique-Collantes & Manrique-Collantes, 2020), and one in the Netherlands (Hamberg-van Reenen et al., 2009). Regarding the study populations, one study focused on university staff, while the other three examined schoolteachers, with participants ranging in age from 36 to 52 years.

3.1. Characteristics Of The Interventions

The included studies investigated exercise-based interventions targeting different body regions, incorporating various exercise modalities and frequencies (Table 1). Pilastrini et al. (2009) focused on the lumbar and cervical spine, implementing a program that combined stretching, strengthening, and deep cervical flexor muscle training using pressure biofeedback. The intervention was

conducted twice per week, with one-hour sessions and a two-day interval between sessions, for three consecutive weeks.

Iqbal et al. (2021) targeted the neck and examined two types of interventions emphasizing stretching and strengthening exercises. The experimental group participated in sessions five times per week for six weeks, progressively increasing pressure levels across five stages. Each session included 20 minutes of stretching and warm-up exercises, followed by three sets of 10 repetitions.

Manrique-Collantes (2020) adopted a broader approach, targeting multiple body regions, including the neck, back, shoulders, knees, calves, and feet. The intervention incorporated breathing exercises and muscle stretching, performed twice per week for eight weeks. Each session lasted 30 minutes, with individual exercises held for 10 to 20 seconds (Table 2).

Hamberg-van Reenen et al. (2009) addressed pain in the back and shoulders through a combination of an educational leaflet and prescribed exercises. The intervention was conducted twice per week for eight weeks, with sessions lasting 55 to 60 minutes. The program followed a progressive structure, with repetitions ranging from 10 to 15 per set (Table 2).

3.2. Main Results

Pilastrini et al. (2009) found that the intervention was significantly effective in reducing disability-related pain assessed for the Roland Morris Disability Questionnaire (SMD: -0.61; 95%CI: -1.08; -0.13) and Oswestry Disability Index (SMD: -0.70; 95%CI: -1.18; -0.22). Significant effectiveness of the disability related pain in participants with low back pain was reported (SMD: -0.59; 95%CI: -1.06; -0.11) (Table 3).

Regarding pain intensity, Iqbal et al. (2021) demonstrated a significant reduction in neck pain (SMD: -1.90; 95%CI: -2.67; -1.23). However, other studies that assessed pain intensity did not find significant effects of the interventions on pain in the neck, shoulders, back, hips, knees, calves, feet, or thoracic muscles (Table 3).

3.3. Risk Of Bias

All included studies had a high risk of bias related to the blinding of participants. Additionally, one study showed a high risk of bias in the blinding of study personnel (Iqbal et al., 2021), and another study had a high risk of bias in the use of intention-to-treat analysis (Manrique-Collantes & Manrique-Collantes, 2020).

PRISMA 2020 flow diagram for new systematic reviews which included searches of databases and registers only

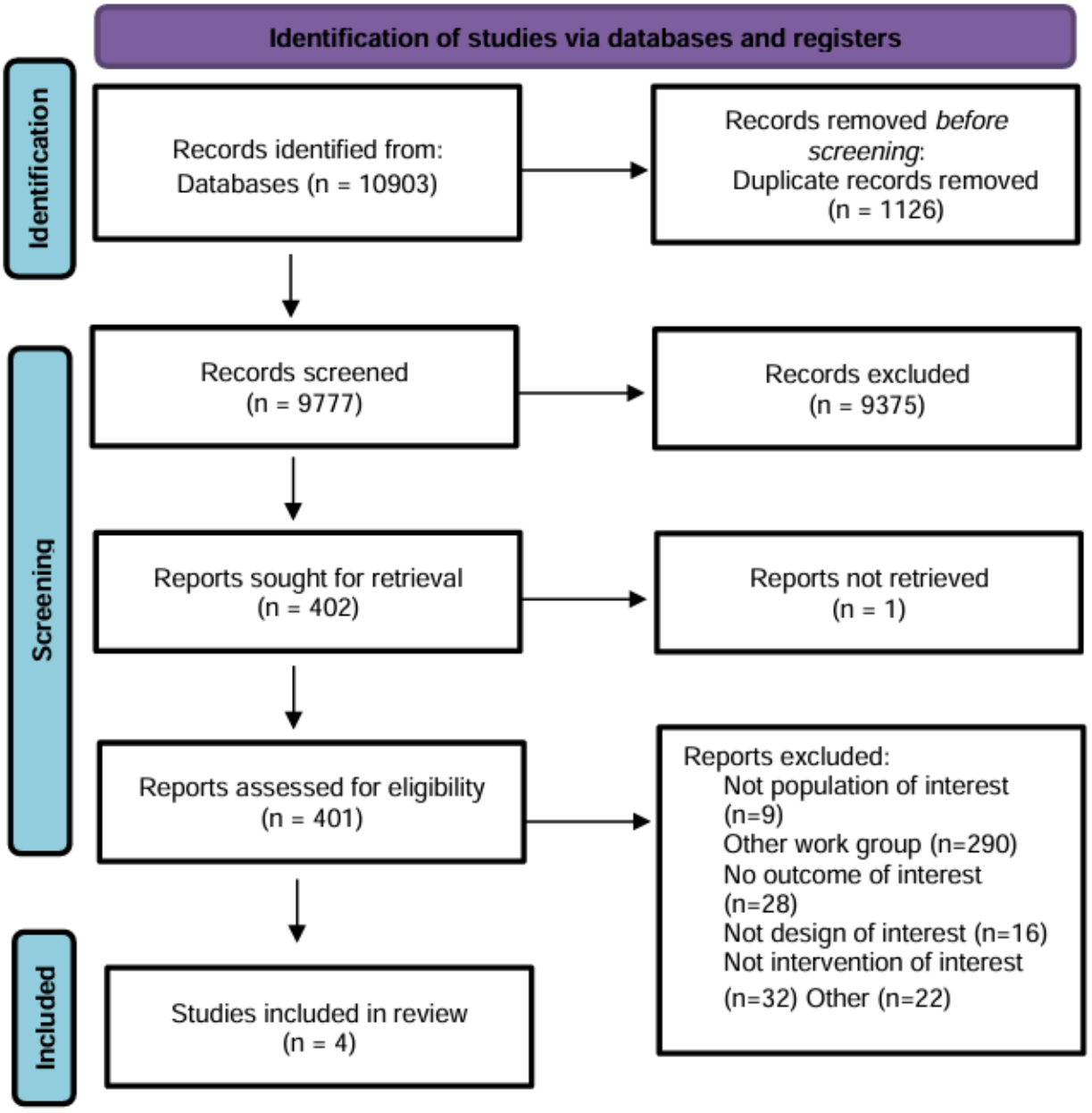

Table 1: Sample characteristics of included studies (n=4).

Author, year, country	Occupational group	Focus	Sample size	Age*	% wom
Pillastrini, 2009, Italy	Nursery school teachers	Prevention and treatment	71	44.1	100
Iqbal, 2021, Saudi Arabia	School teachers	Treatment	50	36.4	50
Mangiavo	School	Treatment	66	52	93.1

⚠ Esta tabela possui muitas colunas e foi cortada para impressão. Para visualizá-la completa, acesse o artigo original em: https://revistatopicos.com.br/artigos/physical-activity-and-musculoskeletal-disorders-in-education-workers-a-systematic-review?noblockage

*** Mean age of overall sample**

Source: Authors

Table 2: Intervention characteristics of included studies (n=4).

Author, year	Type	Frequency (times per week)	Duration (weeks)
Pillastrini 2009	Experimental group - Brochure and exercises Control group - Brochure with ergonomic suggestions to avoid musculoskeletal pain.	Experimental group - 2 times a week Control group - NA	3
Iqbal 2021	Experimental group - Stretching, strengthening and muscle training of the deep cervical flexors using pressure biofeedback Control group - Stretching and strengthening.	Experimental group - 5 times a week Control group - 4 times a week	6
Manrique-Collantes 2020	Intervention group - Breathing exercises and muscle stretching. Control group – NA	Experimental group - 2 times a week Control group - NA	8
Hamberberg-van Reenen 2009	Intervention group – resistance exercises. Control group - NA	Experimental group - 2 times a week	8

		Control group - NA	

Source: Authors

Table 3: Pain intensity and disability standardized differences by body site.

Author, year	Site	SMD (95%CI)
Disability		
Pillastrini 2009	RMDQB	-0.61 (-1.08; -0.13)
	ODI	-0.70 (-1.18; -0.22)
	Low back	-0.59 (-1.06; -0.11)
	Neck	0.19 (-0.28; 0.66)
Pain Intensity		
Iqbal 2021	Neck	-1.90 (-2;67; -1.23)
Manrique-Collantes 2020	Neck	-36.83 (NA)*
	Right shoulder	-17.72 (NA)*
	Left shoulder	-12.66 (NA)*
	Upper back	-24.28 (NA)*
	Low back	-23.14 (NA)*
	Hips	-15.95 (NA)*

	Right Knee	-22.82 (NA)*
	Left Knee	-16.67 (NA)*
	Right calf	-6.83 (NA)*
	Left calf	-9.51 (NA)*
	Right foot	-14.56 (NA)*
	Left foot	-13.68 (NA)*
Hamberberg-van Reenen 2009	Right descending trapezius	-0.38 (-1.29; 0.53)
	Left descending trapezius	-0.30 (-1.20; 0.61)
	Right deltoid	-0.32 (-1.23; 0.59)
	Left deltoid	0.33 (-1.24; 0.58)
	Right low back	-0.10 (-0.99; 0.80)
	Left low back	-0.25 (-1.16; 0.65)
	Thoracic	-0.42 (-1.34; 0.49)

* Mean difference. RMDQ = Roland Morris Disability Questionnaire; ODI = Oswestry Disability Index, SMD = Standardized mean difference. CI = Confidence interval.

Source: Authors

Table 4: Risk of bias of included studies.

Author, year	Randomization	Allocation concealment	Blinding of participants	Blinding of personnel	Attriti bias
Hamberg-van Reenen 2009	Unclear	Low	High	Low	Low
Pillastrini 2009	Unclear	Low	High	Low	Low

⚠ Esta tabela possui muitas colunas e foi cortada para impressão. Para visualizá-la completa, acesse o artigo original em: https://revistatopicos.com.br/artigos/physical-activity-and-musculoskeletal-disorders-in-education-workers-a-systematic-review?noblockage

Source: Authors

4. DISCUSSION

We identified four studies evaluating exercise-based interventions for musculoskeletal pain in workplace settings. Although the initial search identified 9,342 articles, only four met our inclusion criteria, highlighting the limited available evidence on this topic. These four studies varied in their target body regions, exercise modalities, and session frequencies. Some interventions were effective in reducing disability caused by pain. However, most of the included studies did not find significant effects on pain intensity across various body regions, including the shoulders, back, hips, knees, calves, feet, or thoracic muscles.

Previous data showed that musculoskeletal pain is a common issue among teachers, with frequent complaints of pain in the neck,

shoulders, hands, and lower back, often linked to high work demands (R. da Rocha et al., [s.d.]). Education professionals, particularly teachers, face various occupational risks due to the wide range of tasks their work involves. Their responsibilities go beyond teaching and include lesson planning, grading, preparing materials, and participating in research or outreach activities (Kraemer et al., 2020). Work-related pain often develops gradually and can be caused by too much work or a poor working environment. This issue is complex and cannot be explained by a single factor (Erick & Smith, 2011). Other factors such as anthropometric variations, stress, unsuitable furniture, and low support from colleagues may also contribute to pain (Chiu & Lam, 2007). These environmental and work-related factors should be considered when designing exercise programs for this group.

Research on musculoskeletal disorders among education professionals can help reduce absenteeism, increase productivity, and decrease turnover, early retirement, and sick leave. These outcomes can lead to lower public costs and benefit society overall (Kraemer et al., 2020). Despite this, there is still limited evidence on the best type of exercise program to prevent or treat musculoskeletal pain in this population (Pillastrini et al., 2009). Our findings also suggest that the evidence is mixed. Low participation, limited frequency of sessions (often just twice a week), small sample sizes, and other factors may explain these inconsistent results (Hamberg-van Reenen et al., 2009).

Although this review summarizes the available evidence on exercise interventions for musculoskeletal disorders in education workers, some limitations must be highlighted. The included studies were too different in terms of sample sizes, types of interventions,

comparison groups, and outcomes, which prevented us from conducting a meta-analysis. Although exercise is known to help with conditions such as low back pain, more research is needed to confirm whether these benefits apply to education workers. Future studies should focus on exercise programs specifically designed for the unique demands and workload of teachers and other education professionals. These programs should focus on improving strength, flexibility, and endurance, helping to manage the physical strain associated with teaching.

5. CONCLUSION

The findings suggest that exercise interventions may have a positive effect on reducing disability related to MSDs. However, the evidence regarding their impact on pain intensity across multiple body regions remains inconclusive, with only one study showing significant results for neck pain. Variations in study design, sample sizes, intervention protocols, and adherence levels may have contributed to these inconsistent findings.

Given the occupational risks and high prevalence of MSDs among education professionals, tailored exercise programs present a promising strategy for prevention and management. Nonetheless, further research with larger sample sizes, standardized protocols, and longer follow-up periods is needed to strengthen the evidence base and inform effective intervention strategies in this population.

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[1] Doutorando em Educação Física no Programa de Pós-graduação em Educação da Universidade Federal de Pelotas. Professor EBTT do Campus Paraíso do Tocantins do Instituto Federal do Tocantins. Paraíso do Tocantins, Tocantins, Brasil. E-mail: acesse o artigo original para visualizar o e-mail. Orcid: https://orcid.org/0000-0001-9140-9749. Lattes: http://lattes.cnpq.br/2512288072390388

[2] PHd em Educação Física pela Universidade Federal de Pelotas. Pesquisador Associado no Centro de Síntese de Evidência em Saúde da Brown University - USA. E-mail: cacesse o artigo original para visualizar o e-mail. Orcid: https://orcid.org/0000-0002-3515-9308. Lattes: http://lattes.cnpq.br/3370367168725150.

[3] Doutora em Nutrição e Alimentos pela Universidade Federal de Pelotas. Pelotas, Rio Grande do Sul. Brasil. E-mail: acesse o artigo original para visualizar o e-mail. Orcid: https://orcid.org/0000-0003-3390-0091. Lattes: https://lattes.cnpq.br/3653951644026123.

[4] Doutorando em Educação Física no Programa de Pós-graduação em Educação da Universidade Federal de Pelotas. Professor EBTT do Colégio Militar de Brasília. Brasília, Distrito Federal, Brasil. E-mail: acesse o artigo original para visualizar o e-mail. Orcid:

https://orcid.org/0000-0003-0864-3871. Lattes: https://lattes.cnpq.br/8290320104184503.

[5] Doutorando em Educação Física no Programa de Pós-graduação em Educação da Universidade Federal de Pelotas. Servidor Administrativo da Universidade Federal de Pelotas. Pelotas, Rio Grande do Sul, Brasil. E-mail: acesse o artigo original para visualizar o e-mail. Orcid: https://orcid.org/0000-0001-9785-0914. Lattes: https://lattes.cnpq.br/1095751713182693.

[6] Doutora em Ciências da Saúde pela Universidade Federal de Rio Grande. Professora da Rede Municipal. Chapecó, Santa Catarina, Brasil. E-mail: acesse o artigo original para visualizar o e-mail. Orcid: https://orcid.org/0000-0002-7780-3595. Lattes: https://lattes.cnpq.br/3831937877693253.

[7] PHd em Epidemiologia pela Universidade da California de San Diego - EUA. Professor Titular do Programa de Pós-graduação em Educação Física da Universidade Federal de Pelotas. Pelotas, Rio Grande do Sul, Brasil. E-mail: acesse o artigo original para visualizar o e-mail. Orcid: https://orcid.org/0000-0003-2336-7131. Lattes: http://lattes.cnpq.br/6877841308694432.