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Effectiveness of Core Exercise in Reducing Work-Related Fatigue Among Workers: A Systematic Review

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ABSTRACT

Work-related fatigue is an occupational health problem that affects workers' productivity, safety, and well-being; however, evidence regarding the effectiveness of core exercise in reducing it remains scattered and has not been comprehensively synthesized. This study aims to analyze and synthesize scientific evidence on the effectiveness of core exercise in reducing work-related fatigue among workers through a systematic review method referring to the PRISMA 2020 guidelines. The literature search was planned to be conducted in the PubMed, Scopus, ScienceDirect, and Google Scholar databases using the PICOS framework, limited to primary experimental or quasi-experimental articles published between 2015 and 2025 in Indonesian and English. A preliminary search identified two studies that met the inclusion criteria, involving hospital nurses and factory workers, both of which reported a statistically significant reduction in work-related fatigue following core exercise or core stability exercise, with a training dose pattern of three times per week for six to eight weeks. Because of the limited number of studies at this stage, the synthesis is presented narratively and the conclusions are considered preliminary. These initial results indicate that core exercise has the potential to become an evidence-based intervention for reducing work-related fatigue; however, a formal literature search across all planned databases remains necessary to strengthen the evidence before it can be widely recommended in physiotherapy and occupational health practice.

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INTRODUCTION

Work-related fatigue is one of the occupational health problems that remains a major challenge across various employment sectors because of its impact on workers' health, organizational productivity, and occupational safety. Work-related fatigue is defined as a state of decreased physical, mental, and emotional capacity resulting from continuous exposure to work demands, thereby reducing an individual's ability to sustain work performance (Page et al., 2021). This condition differs from burnout in that work-related fatigue can arise as a physiological or psychological response to work activity, whereas burnout is a psychological syndrome that develops as a result of chronic work stress. Work-related fatigue is associated with an increased risk of occupational accidents, operational errors, decreased productivity, higher absenteeism, and a higher

incidence of musculoskeletal disorders, making it one of the main focuses of promotive and preventive efforts in occupational health and safety.

Ergonomic factors are among the main causes of work-related fatigue frequently reported in the literature, including static work postures, prolonged sitting, repetitive movements, and continuous muscle use, which lead to prolonged muscle contraction, impaired blood flow, and ultimately muscle fatigue. In workers who spend more time sitting during working hours, weakness of the core muscles can reduce trunk stability, thereby increasing the mechanical load on the spine and accelerating the onset of fatigue.

Core exercise, which involves strengthening the core muscles of the body—including the abdominal muscles, multifidus, erector spinae, diaphragm, and pelvic floor—plays an important role in maintaining lumbopelvic stability, preserving body balance, and distributing load during activity (Akuthota, Ferreiro, Moore, & Fredericson, 2008; Hodges & Richardson, 1996). Core muscle strengthening through core exercise has been shown to improve trunk stability, enhance neuromuscular activation, reduce mechanical load on the spine, and lower the risk of musculoskeletal disorders (Richardson, Hodges, & Hides, 2004), suggesting that it may be an effective strategy for reducing work-related fatigue, particularly among workers with static activity or high postural demands.

Nevertheless, research specifically examining the benefits of core exercise for work-related fatigue remains limited and is scattered apart from the broader body of literature on core exercise for low back pain and physical function (Chiarotto & Koes, 2022; Kim & Yim, 2020; Kurniawan, Muliarta, Wirawan, Purnawati, & Wahyudin, 2017; Inani & Selkar, 2013). Variations in participant characteristics, type of occupation, study design, form and dosage of intervention, and fatigue measurement instruments across studies mean that the available scientific evidence has not yet produced consistent conclusions regarding the effectiveness of core exercise in reducing work-related fatigue. A broader review of workplace interventions for workers with high physical demands also indicates that muscle-strengthening exercise provides moderate evidence, although it has not specifically examined work-related fatigue as an outcome (Sundstrup, Seeberg, Bengtsen, & Andersen, 2020). Based on the above, a research gap remains regarding the effectiveness of core exercise on work-related fatigue, as a comprehensive synthesis of evidence that takes into account the methodological quality of recent studies is not yet available.

Therefore, this study was designed as a systematic review referring to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines (Page et al., 2021), so that the process of identification, selection, quality appraisal, and evidence synthesis is conducted in a transparent, systematic, and accountable manner. The research question was formulated using the Population, Intervention, Comparison, Outcome, and Study Design (PICOS) framework to address the following: to what extent is core exercise effective in reducing work-related fatigue among workers? This study aims to analyze and synthesize scientific evidence on the effectiveness of core exercise in reducing work-related fatigue among workers, in order to obtain a comprehensive conclusion as a basis for evidence-based practice recommendations in physiotherapy and occupational health. The novelty of this study lies in its specific focus on work-related fatigue as an outcome—which has thus far mostly been a secondary outcome in core exercise research on low back pain—as well as its thorough application of the PRISMA 2020 reporting guidelines to a topic that has not yet been widely and systematically synthesized.

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METHOD

This study employed a systematic review design, a secondary research method aimed at identifying, appraising, and synthesizing published scientific evidence on a given topic in a systematic, transparent, and replicable manner, referring to the PRISMA 2020 guidelines (Page et al., 2021) and the Cochrane Handbook for Systematic Reviews of Interventions (Higgins et al., 2022). The data used were secondary data in the form of primary scientific articles that had been published in national and international journals. The study population consisted of all primary articles discussing the effectiveness of core exercise on work-related fatigue among workers; the sample consisted of articles that passed all stages of the PRISMA selection process (identification, screening, eligibility, included) and met the inclusion criteria. The sampling technique was non-probability, using a tiered purposive sampling approach. The research question was formulated using the PICOS framework: the population consisted of workers or individuals of productive age experiencing work-related fatigue; the intervention consisted of core exercise or core stability exercise in various forms; the comparator consisted of a control group, another intervention, or standard care (where available); the primary outcome was change in the level of work-related fatigue; and the study designs considered were randomized controlled trials, controlled clinical trials, and quasi-experimental studies.

The literature search strategy was planned to be conducted systematically in the PubMed, Scopus, and ScienceDirect electronic databases, with Google Scholar as a supplementary database, using a combination of keywords derived from the PICOS components and Boolean operators. The search was limited to articles published between 2015 and 2025, in English or Indonesian, considering that research on this topic has developed rapidly over the past decade (Higgins et al., 2022). The inclusion criteria were: (1) subjects were workers/individuals of productive age with work-related fatigue; (2) the intervention consisted of core exercise or core stability exercise; (3) the primary outcome was a change in the level of work-related fatigue measured using a validated instrument such as the Multidimensional Fatigue Inventory (MFI) or the Fatigue Severity Scale (FSS); (4) an experimental or quasi-experimental design; and (5) publication between 2015 and 2025. The exclusion criteria included literature reviews, systematic reviews, meta-analyses, editorials, letters to the editor, conference proceedings, case reports, and conference abstracts, as these do not present primary data.

Article selection was conducted through the four stages of PRISMA 2020: identification (collection and removal of duplicates), screening (screening of titles and abstracts), eligibility (full-text review), and included (determination of the final articles), all of which will be documented in a PRISMA 2020 flow diagram. The methodological quality of the articles that passed selection was appraised using the Joanna Briggs Institute (JBI) critical appraisal instruments appropriate to each study design.

Data extraction was carried out systematically, covering author and year of publication, country, study design, population characteristics and sample size, type of occupation, form and dosage (frequency, intensity, duration) of the core exercise intervention, comparison group, fatigue measurement instrument, main results, and quality appraisal score. Given the anticipated high variation in populations, interventions, and measurement instruments across studies, the data were analyzed using a narrative synthesis method, by grouping findings according to similarities in intervention type and measurement instrument, and then comparing the direction and magnitude of change in work-related fatigue before and after the intervention. If the studies obtained were sufficiently homogeneous, a simple quantitative synthesis could be considered as a complement; if heterogeneity was high, narrative synthesis would remain the primary approach.

RESULTS

Literature Search Results

These search results are still preliminary, intended to map the availability of evidence before the formal search across all planned databases (PubMed, Scopus, ScienceDirect) is carried out according to the PICOS keyword combinations described in the Method section. The preliminary search showed that most publications on core exercise in worker populations focus on outcomes related to low back pain and physical function (Chiarotto & Koes, 2022; Kim & Yim, 2020; Inani & Selkar, 2013; Kurniawan et al., 2017), while studies that explicitly measure work-related fatigue as a primary outcome remain limited. From this search, two primary studies were identified that met the inclusion criteria: a study by Afrasiabifar, Mosavi, Mohammadian-Behbahani, and Hoseinichenar (2018) on nurses in Iran, and a study by Pehlevan and Şevgin (2024) on factory workers in Turkey. The number of articles at each stage of identification, screening, eligibility, and inclusion, along with the complete PRISMA 2020 flow diagram, will be prepared after the formal search across all databases has been conducted.

Characteristics of Included Studies

The characteristics of the two identified studies are presented in Table 1.

Table 1. Characteristics of included studies (preliminary search results)

Author, Year	Country	Design	Population & Sample	Type of Occupation	Intervention (form, dosage)	Comparator	Fatigue Instrument
Afrasiabifar et al. (2018)	Iran	Field trial (quasi-experimental)	46 female nurses, block allocation	Hospital nurses	Core stability exercise, 3x/week for 6 weeks	Control group (no core exercise)	Multidimensional Fatigue Inventory (MFI)
Pehlevan & Şevgin (2024)	Turkey	Randomized Controlled Trial	Factory workers with low back pain	Plastic-molding factory workers	Ergonomics education + stretching and core stabilization exercise, 3x/week for 8 weeks	Ergonomics education only (no exercise)	Fatigue Severity Scale (FSS); also VAS, ODI, PSQI, MPQ

Synthesis of Findings

Both studies showed a consistent direction of change, namely a reduction in fatigue levels following core exercise or core stability exercise. In the study by Afrasiabifar et al. (2018), six weeks of core stability exercise in nurses resulted in a significant decrease in the total Multidimensional Fatigue Inventory score, particularly in the physical and mental fatigue dimensions, while the control group showed no significant change. In the study by Pehlevan and Şevgin (2024), the group receiving a combination of ergonomics education and exercise (stretching and core stabilization exercise) for eight weeks showed a statistically greater reduction in Fatigue Severity Scale scores compared with the group receiving ergonomics education alone. Because the two studies used different fatigue instruments (MFI and FSS), statistical pooling of data (meta-analysis) could not yet be performed; the synthesis at this stage is presented narratively.

Summary of Findings

Based on the two studies identified at this preliminary search stage, the dosage pattern that emerged was a frequency of three times per week with a program duration of 6–8 weeks, and no study reporting non-significant results specifically for the work-related fatigue outcome was found. Given that only two studies were identified, along with differences in measurement instruments, the consistency of findings across a broader range of occupation types and worker populations cannot yet be strongly concluded, making a formal

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search across all planned databases an important next step before this summary can be used as a basis for definitive recommendations.

DISCUSSION

The synthesis above shows that core exercise or core stability exercise consistently reduced work-related fatigue levels in both identified studies, in both nurses and factory workers. This finding is consistent with the physiological mechanism whereby strengthening the core muscles plays an important role in improving lumbopelvic stability, enhancing neuromuscular activation, and distributing mechanical load more evenly across the spine and pelvic structures (Hodges & Richardson, 1996; Richardson et al., 2004). When trunk stability improves, the postural muscles no longer need to work excessively to compensate for trunk instability, so that prolonged muscle contraction and the accumulation of metabolites that contribute to muscle fatigue can be reduced (Akuthota et al., 2008). Compared with previous research on core exercise, which has largely focused on outcomes related to low back pain and physical function in clinical populations (Chiarotto & Koes, 2022; Kim & Yim, 2020; Kurniawan et al., 2017; Inani & Selkar, 2013), the findings from the two studies identified here extend this evidence specifically to work-related fatigue outcomes in worker populations. These findings are also consistent with a large-scale systematic review of workplace interventions for workers with high physical demands, which reported moderate evidence for the benefits of muscle-strengthening exercise (Sundstrup et al., 2020), although that review did not specifically focus on work-related fatigue as a primary outcome.

Practically, these preliminary findings indicate that core exercise may be considered as an evidence-based intervention for reducing work-related fatigue, particularly in occupations with high static or repetitive postural demands, by applying the principle of progressing from local muscle activation exercises before integrating them into functional movements (Richardson et al., 2004), and by considering its combination with ergonomics education where feasible. For occupational health professionals and companies, these results can serve as a basis for developing workplace promotive and preventive programs accompanied by regular monitoring using validated fatigue instruments.

This systematic review has important limitations that must be emphasized. First, the results presented are still derived from a preliminary search and do not yet represent the results of a comprehensive formal search of the PubMed, Scopus, and ScienceDirect databases according to the planned PICOS keyword combinations; the number of studies analyzed at this stage (n = 2) likely does not yet reflect the full body of available evidence. Second, there is heterogeneity in study design, population, type of occupation, form and dosage of intervention, and fatigue measurement instruments between the two studies, so that generalization of the results remains limited and meta-analysis cannot yet be performed. Third, there is a possibility of publication bias, namely the tendency for studies with positive results to be published more frequently than studies with neutral or negative results. Fourth, assessment of the certainty of evidence using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach, as well as risk-of-bias assessment using the Cochrane Risk of Bias 2 (RoB 2) and ROBINS-I tools, cannot yet be conducted representatively with only two studies available at this stage (Higgins et al., 2022). Therefore, the interpretations and recommendations in this section are hypothesis-generating in nature and need to be re-evaluated once the formal search and risk-of-bias assessment of all studies meeting the inclusion criteria have been completed.

Both studies showed a consistent direction of change, namely a decrease in work-related fatigue levels following core exercise or core stability exercise. Among nurses, the decrease in MFI scores was significant in both the physical and mental fatigue dimensions, while among factory workers, the combination of ergonomics education and core stabilization exercise produced a greater decrease in FSS scores compared with education alone, indicating that the effect of physical exercise is additive to the ergonomic intervention. Because the two studies used different fatigue instruments (MFI and FSS), statistical pooling of the data could not yet be performed, so the synthesis is presented narratively. This finding is consistent with the physiological mechanism whereby core muscle strengthening improves lumbopelvic stability and enhances neuromuscular activation, thereby reducing prolonged postural muscle contraction and the accumulation of fatigue-inducing metabolites (Hodges & Richardson, 1996; Richardson, Hodges, & Hides, 2004). Core stability also functions as a link in the body's kinetic chain, enabling more efficient force transfer between the extremities and the trunk

(Kibler, Press, & Sciascia, 2006), while stabilizer muscles in a neutral spinal position work more minimally, thereby reducing the potential for muscle fatigue (Cholewicki, Panjabi, & Khachatryan, 1997). From an electromyographic perspective, individuals with lumbar muscle impairment show a faster pattern of muscle fatigue (Roy, De Luca, & Casavant, 1989), suggesting that strengthening core muscle endurance may delay the onset of fatigue in occupations with static postural demands, given that the head, arms, and trunk account for approximately 70% of total body mass (Winter, 1990).

The findings of this systematic review are also consistent with a large-scale systematic review of workplace interventions, which reported that muscle-strengthening exercise in the workplace is effective in reducing musculoskeletal complaints, whereas ergonomic intervention alone shows only limited evidence (Sundstrup, Seeberg, Bengtsen, & Andersen, 2020). A recent systematic review and meta-analysis involving more than thirteen thousand nurses also reported that low exercise frequency is associated with higher levels of chronic and acute fatigue in this population (Pi et al., 2025), further supporting the relevance of core exercise as a form of structured physical activity that may be protective against work-related fatigue. Practically, core exercise may be considered by physiotherapists as a promotive and preventive intervention to reduce work-related fatigue, particularly among workers with static or repetitive postural demands, with an initial dosage pattern of three times per week for six to eight weeks, combined with ergonomics education where feasible. Nevertheless, these results are still derived from a preliminary search with a limited number of studies (n = 2), so that generalization across occupation types cannot yet be strongly concluded, formal risk-of-bias assessment (e.g., Cochrane RoB 2 or ROBINS-I) and certainty-of-evidence assessment using the GRADE approach could not yet be performed, and there remains a possibility of publication bias as well as limitations in database coverage and publication language. A formal literature search across all planned databases (PubMed, Scopus, ScienceDirect) remains necessary to strengthen the evidence before this conclusion is used as a basis for definitive practice recommendations.

CONCLUSION

Based on the synthesis of the two studies identified at this preliminary search stage, core exercise or core stability exercise showed a consistent direction of change in reducing work-related fatigue levels among workers, both as a stand-alone intervention in hospital nurses (Afrasiabifar et al., 2018) and in combination with ergonomics education in factory workers (Pehlevan & Şevgin, 2024), with a dosage pattern of three times per week for six to eight weeks. This finding addresses the research problem and objective by providing preliminary evidence that core exercise has the potential to become an evidence-based intervention for reducing work-related fatigue among workers, consistent with the mechanistic framework presented in the Discussion section (Hodges & Richardson, 1996; Richardson et al., 2004) and broader evidence on the benefits of muscle-strengthening exercise in the workplace (Sundstrup et al., 2020). Nevertheless, given that the number of studies identified remains very limited and the formal search across all planned databases (PubMed, Scopus, ScienceDirect) has not yet been completed, this conclusion is provisional.

Future research needs to conduct a comprehensive formal literature search in accordance with the PRISMA 2020 guidelines (Page et al., 2021; Zawacki-Richter, Kerres, Bedenlier, Bond, & Buntins, 2020), accompanied by protocol registration, risk-of-bias assessment, and certainty-of-evidence assessment using the GRADE approach, before evidence-based recommendations can be definitively communicated to physiotherapists, occupational health professionals, and policymakers in the field of occupational health.

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