Multidimensional Risk Factors Drive Shoulder Musculoskeletal Disorders Among Construction Workers

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ABSTRACT
Shoulder musculoskeletal disorders are a persistent occupational health problem in the construction sector, arising from the interaction of physical, individual, psychosocial, and environmental demands. These conditions reduce functional capacity, impair work performance, and increase long-term health burdens among construction workers. This study aims to synthesize evidence on the prevalence and multidimensional risk factors contributing to shoulder musculoskeletal disorders among construction workers, and to identify protective factors relevant for prevention. A narrative literature review was conducted using seven primary study that met predefined inclusion criteria. Evidence was extracted on worker characteristics, ergonomic exposures, psychosocial conditions, and environmental factors associated with shoulder pain. Findings were integrated to develop a comprehensive understanding of determinants influencing shoulder musculoskeletal disorders. The synthesis indicates that shoulder pain among construction workers is shaped by interconnected determinants. Individual factors such as elevated BMI, older age, and prolonged work experience increase vulnerability through heightened biomechanical strain and reduced recovery capacity. Physical and ergonomic exposures, including non-ergonomic postures, repetitive arm movements, manual handling, high work speed, and heat strain consistently contribute to musculoskeletal overload. Psychosocial pressures, including stress and job dissatisfaction, amplify muscle tension and diminish coping ability, further worsening symptoms. Conversely, regular exercise emerges as a protective factor that enhances musculoskeletal resilience and reduces symptom severity. In conclusion, shoulder musculoskeletal disorders among construction workers are driven by multidimensional and cumulative risk factors. Effective prevention requires integrated interventions combining ergonomic improvements, safe-work training, physical-health promotion, and psychosocial support, with particular attention to high-risk groups such as obese workers, older workers, and those with long occupational tenure.
Keywords: shoulder pain; construction workers; ergonomic risk factors; psychosocial factors; occupational health; physical workload

INTRODUCTION
Musculoskeletal disorders affecting the shoulder constitute a significant occupational health issue in the construction sector. Numerous study have documented the high prevalence of work-related shoulder disorders among construction workers across various countries. A cross-sectional study involving 380 construction workers in Guangdong Province reported a 12-month prevalence of shoulder pain of 22.1% [1]. In Indonesia, a similar study of 409 workers from four construction companies found that 31.5% of respondents experienced shoulder pain within the same period [2]. A one-year longitudinal study examining 267 masons and 232 supervisors revealed a prevalence of shoulder or upper-arm pain of 67% among masons and 57% among supervisors [3]. Furthermore, a study of 43 plastering workers showed that 91% reported shoulder pain or discomfort [4]. Another cross-sectional study involving 1,200 male construction workers in Nigeria identified a shoulder pain prevalence of 14.9% [5,6], while a study of 389 construction workers in Riyadh reported a prevalence of 10.5% [6].

Shoulder pain associated with work-related musculoskeletal disorders in construction workers is influenced by multiple risk factors. Several study have identified age as a contributing factor, with older workers exhibiting higher prevalence rates [1,5]. Work experience and duration of job tasks are also correlated with increased risk of shoulder pain [1]. High physical workload and repetitive movements significantly elevate the likelihood of musculoskeletal disorders [2,3]. Ergonomic factors play a critical role, as non-ergonomic work practices and awkward postures constitute major risk determinants [4]. Work-related fatigue further contributes to increased prevalence of shoulder pain [1]. Beyond physical factors, psychosocial aspects such as psychological stress and mental workload are strong predictors of musculoskeletal disorders [2,5]. Additionally, specific work positions and tasks involving uncomfortable head and arm movements may heighten the risk of shoulder disorders [5].

Musculoskeletal disorders of the shoulder have wide-ranging impacts on workers, companies, and the broader economy. These conditions can reduce work efficiency due to limited mobility and pain that interferes with tasks requiring shoulder movement. Consequently, error rates increase, potentially lowering productivity and work quality [7,8]. Workers experiencing shoulder pain often demonstrate reduced performance and are more likely to take sick leave, contributing to higher absenteeism. In the construction sector, such conditions have led to substantial losses in workdays, with the median number of days lost due to musculoskeletal disorders rising from 8 days in 1992 to 13 days in 2014 [9]. Beyond productivity losses, shoulder pain imposes significant economic burdens on workers and employers. Affected workers may require medical care, rehabilitation, or even surgical intervention, all of which increase healthcare costs [10]. For companies, high rates of compensation claims related to shoulder injuries create considerable financial pressure, particularly in industries with elevated musculoskeletal disorder prevalence [11].

Based on this background, this study aims to identify the risk factors and prevalence of shoulder musculoskeletal disorders in the construction sector. By understanding the factors contributing to the high incidence of shoulder pain, the findings of this review are expected to serve as a foundation for construction companies and stakeholders in designing more effective prevention strategies, thereby reducing musculoskeletal disorder rates and improving worker well-being.

METHODS
The present study adopted a literature review approach grounded in the methodological principles of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). The process began with an extensive search across five major scholarly databases; Scopus, PubMed, Taylor & Francis Online, ProQuest, and ScienceDirect which collectively produced an initial pool of 1,628 articles. This broad search was guided by a predefined strategy that incorporated a combination of relevant keywords, including “musculoskeletal disorder,” “work-related musculoskeletal disorder,” “musculoskeletal symptom,” “risk factors,” “psychosocial factors,” and “construction.” These terms were selected to

ensure comprehensive coverage of study examining musculoskeletal conditions among construction workers, particularly those focusing on shoulder-related disorders.

Following the initial retrieval, all duplicate records were removed to prevent redundancy and ensure accuracy in the screening process. The remaining articles were then subjected to an initial screening phase, during which titles and abstracts were carefully reviewed to determine their relevance to the topic. Study that appeared to meet the preliminary criteria were subsequently evaluated through a full-text assessment. This step allowed for a more detailed examination of each article's methodological rigor, scope, and alignment with the objectives of the study.

The inclusion criteria were established to ensure that only high-quality and relevant study were incorporated into the final analysis. Eligible articles were required to be peer-reviewed and published between 2014 and 2024, ensuring that the review captured contemporary evidence. Only primary study focusing on musculoskeletal disorders among construction workers were considered, with particular emphasis on those examining shoulder-specific conditions. Furthermore, study needed to report prevalence data or analyze individual and ergonomic risk factors, and all included articles had to be written in English. Conversely, articles were excluded if they were published in languages other than English, appeared before 2014, constituted non-primary study such as reviews, or lacked direct relevance to shoulder-related musculoskeletal disorders within the construction sector.

The overall selection process is illustrated in the PRISMA flow diagram presented in Figure 1, which outlines the sequential stages of identification, screening, eligibility assessment, and final inclusion. Through this systematic and rigorous process, seven study were ultimately deemed suitable for inclusion in the final analysis. These study formed the empirical foundation for exploring the prevalence and risk factors associated with shoulder pain among construction workers, offering insights into both individual and occupational determinants of musculoskeletal burden in this high-risk industry.

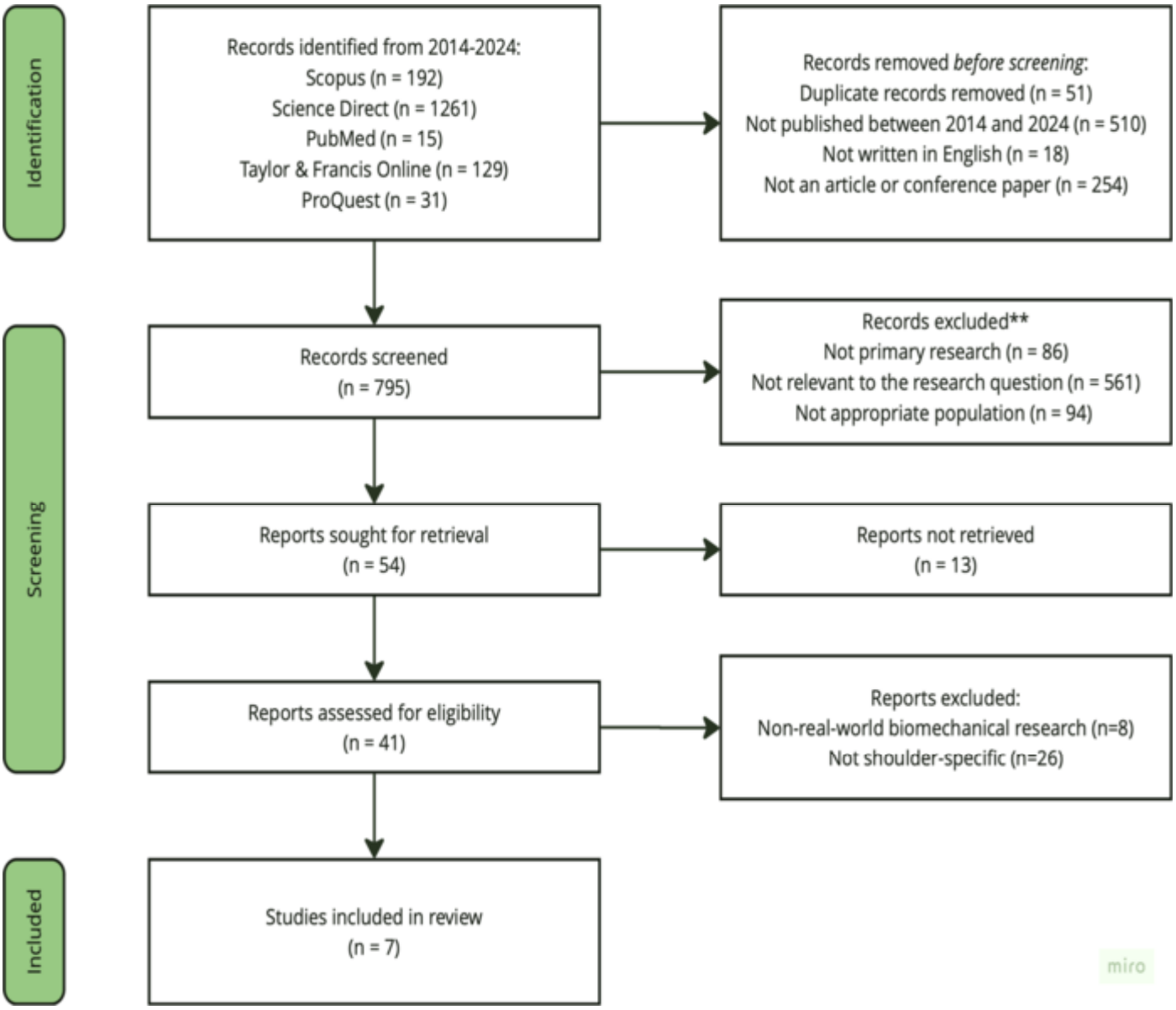

Figure 1. PRISMA flow diagram of the literature search and study selection process

In conducting this literature review, ethical considerations were carefully observed despite the absence of direct involvement with human participants. The study adhered to principles of responsible scholarship by ensuring accurate representation of all included study, maintaining transparency in methodological procedures, and applying the PRISMA framework to promote reproducibility and clarity. Intellectual property rights were respected through the use of legitimate academic access channels, and all sources were cited appropriately to avoid plagiarism. The evaluative process also included critical appraisal of methodological quality to prevent the dissemination of biased or misleading interpretations.

RESULTS

This study analyzed seven pieces of literature that examined the prevalence and risk factors of shoulder-related musculoskeletal disorders in the construction sector. The purpose of this review was to understand the determining factors contributing to the prevalence of such disorders. The following section presents the characteristics of the study forming the basis of the analysis.

Table 1. Characteristics of the study

Authors	Year	Title	Design	Population	Findings
Gajbhiye et al. [12]	2023	Pervasiveness of work-related musculoskeletal disorders on Indian construction workers	Cross-sectional study	465 construction workers from various locations in India	Significant associations were found between musculoskeletal disorders and individual factors (age, BMI, habits), physical factors (non-ergonomic posture, load-lifting activities), and psychosocial factors (workload, stress). Prevalence: lower back pain (72.9%), shoulder pain (49.68%), arm/hand pain (47.31%), and others.
Kusmasari & Yassierli [13]	2019	Psychosocial risk factors for musculoskeletal symptoms of construction workers	Cross-sectional study	45 construction workers in Indonesia	High prevalence of shoulder pain (66% in 7 days, 71% in 12 months), followed by ankle, knee, upper-back, and neck pain. Body weight and BMI were significantly associated with upper-back and shoulder pain, while reward was associated with knee pain. Psychosocial factors significantly affected musculoskeletal symptoms.
Kusmasari et al. [14]	2019	The association of worker characteristics and occupational factors with musculoskeletal complaints of building construction workers in Indonesia	Cross-sectional study	33 male construction workers aged 18–56 years	Shoulder complaints had the highest prevalence (64.52%) in the past 12 months. Significant associations were found between ethnicity and shoulder complaints (OR 12) and between daily working hours and knee complaints (OR 1.63).
Lee et al. [1]	2023	Prevalence and associated factors of work-related musculoskeletal disorders symptoms among construction workers	Cross-sectional study	380 construction workers in South China	WRMSD prevalence was 57.9%. Highest prevalence occurred in the neck (24.7%), followed by the shoulder (22.1%), upper back (13.4%), and lower back (12.6%). Risk factors included age, work experience, exercise habits, fatigue, and work position.
Neeraja et al. [15]	2014	The factors associated with MSDs among construction workers	Cross-sectional study	220 construction workers in Hyderabad and Secunderabad, India	Musculoskeletal disorders of the neck, shoulder, and upper back were significantly associated with physical demands (manual handling and repetitive tasks), psychosocial demands, job dissatisfaction, and poor physical fitness.
Park & Jeong [16]	2021	Older male construction workers and sustainability: work-related risk factors and health problems	Cross-sectional study	1,519 male construction workers in South Korea	Older workers (≥60 years) reported higher exposure to occupational hazards (e.g., repetitive movements, high temperatures, dust/fumes) and higher musculoskeletal pain (upper extremities 50.4%, lower extremities 35.1%, back pain 23.5%). Depression symptoms (41.9%) and general fatigue (40.3%) were also higher in this group.
James et al. [17]	2023	Occupational hazards under a warmer planet: A cross-sectional study on occupational dermatitis, musculoskeletal disorders, and heat strain score index among construction workers	Cross-sectional study	82 construction workers in Kottayam, Kerala	Musculoskeletal symptoms prevalence was 51.2%, with shoulder pain (18.3%) and lower-back pain (18.3%) as the main complaints. Occupational dermatitis was reported by 12.2% of workers. Heat strain score index classified workers into green (69.5%), yellow (28%), and red zones (2.5%). A significant association was found between heat strain and shoulder pain ($p = 0.029$).

The prevalence of shoulder pain in the construction industry varied substantially, ranging from 18.3% to 72% [1,12–17]. The study by Kusmasari & Yassierli (2019) and Kusmasari et al. (2019) reported the highest prevalence, reaching 66%–72% within the past 12 months [13,14]. These high figures may be attributed to small sample sizes and the intense physical demands of construction work at the study sites. Moderate prevalence was reported in the study by Gajbhiye et al. (2023) and Park & Jeong (2021), at 49.68% and 42.6%, respectively [12,16]. Key contributing factors in these populations included repetitive work patterns, non-ergonomic postures, and cumulative physical strain over time. Park & Jeong (2021) further demonstrated that older workers were more vulnerable to musculoskeletal disorders, including shoulder pain [16]. Lower prevalence was found in the study by Lee et al. (2023) and James et al. (2023), at 22.1% and 18.3% [1,17]. Meanwhile, Neeraja et al. (2014) reported gender-based differences, with female workers exhibiting higher shoulder pain prevalence (27%) compared to male workers (18%) [15].

Across the study, the contributing factors to shoulder pain can be grouped into four major categories: individual factors, ergonomic/physical activity factors, psychosocial factors, and work environment factors. Individual factors include personal characteristics such as increased body mass index [13], age [16], work experience [1], and exercise habits [1], which may reduce risk. Workers with higher BMI were more likely to experience shoulder pain (OR 1.31; 95% CI: 1.01–1.71) [13]. Older workers also had higher risk of musculoskeletal disorders, including shoulder pain ($p < 0.001$) [16]. Longer work experience contributed to increased risk, with workers having 6–15 years of experience showing higher risk compared to those with less than five years (OR 3.24; 95% CI: 1.78–5.89) [1]. Regular exercise habits were identified as a protective factor, reducing the risk of shoulder pain (OR 0.48; 95% CI: 0.28–0.80) [1].

Table 2. Prevalence and risk factors of shoulder pain among construction workers

Authors	Year	Population	Shoulder pain prevalence (%)	Main contributing factors	Statistical measures
Gajbhiye et al. [12]	2023	465 construction workers in India	49.68	Non-ergonomic posture; work speed; physically exhausting activities; coworker social support; traumatic incidents at work	OR 7.09 (3.74–13.46); OR 1.88 (1.21–2.93); OR 1.33 (0.86–2.08); OR 1.45 (0.72–2.93); OR 2.30 (1.27–4.17)
Kusmasari & Yassierli [13]	2019	45 construction workers in Indonesia	66 (7 days), 72 (12 months)	Body mass index (BMI)	OR 1.31 (1.01–1.71)
Kusmasari et al. [14]	2019	33 male construction workers in Indonesia	64.52 (12 months), 25.0 (6 months), 38.46 (7 days)	Type of work	OR 1.28 (0.98–1.66)
Lee et al. [1]	2023	380 construction workers in South China	22.1	Exercise habits; work experience; job demands; perceived work fatigue	OR 0.48 (0.28–0.80); OR 3.24 (1.78–5.89); OR 0.55 (0.33–0.90); OR 4.87 (1.52–15.54)
Neeraja et al. [15]	2014	220 construction workers in India	18.0 (male), 27.0 (female)	Manual handling; repetitive work; psychological demands; job dissatisfaction	OR 2.96 (1.81–4.85); OR 2.01 (1.25–3.24); OR 1.69 (1.02–2.79); OR 1.68 (1.03–2.74)
Park & Jeong [16]	2021	1,519 male construction workers in South Korea	42.6	Age	$p < 0.001$
James et al. [17]	2023	82 construction workers in Kerala	18.3	Heat strain	$p = 0.029$

Ergonomic and physical activity factors included work demands such as non-ergonomic posture, work speed, physically exhausting activities [12], job type [14], manual handling, and repetitive work [15]. Non-ergonomic posture was the strongest contributing factor (OR 7.09; 95% CI: 3.74–13.46) [12]. Manual handling tasks, such as lifting heavy loads or working with arms above shoulder height, also posed high risk (OR 2.96; 95% CI: 1.81–4.85) [15]. Repetitive work showed significant association with shoulder pain (OR 2.01; 95% CI: 1.25–3.24) [15], while high work speed increased risk (OR 1.88; 95% CI: 1.21–2.93) [12]. Job type contributed to risk (OR 1.28; 95% CI: 0.98–1.66) [14], although not all job categories carried equal risk. Physically exhausting activities were also associated with shoulder pain (OR 1.33; 95% CI: 0.86–2.08) [12].

Psychosocial factors included job demands, perceived work fatigue, psychological demands, job dissatisfaction [15], and coworker social support [12]. Perceived work fatigue significantly increased the risk of shoulder pain (OR 4.87; 95% CI: 1.52–15.54) [1]. High psychological demands were also associated with increased risk (OR 2.08; 95% CI: 1.20–2.62) [1]. Job dissatisfaction increased the likelihood of shoulder pain (OR 1.83; 95% CI: 1.10–3.04) [15]. Coworker social support showed a weaker association (OR 1.45; 95% CI: 0.72–2.93) [12]. From the environmental perspective, heat strain contributed to shoulder pain risk. Workers experiencing heat strain showed a significant association with shoulder pain ($p = 0.029$) [17].

DISCUSSION

Shoulder pain among construction workers results from a complex interaction of multiple interrelated factors. Workers with a higher Body Mass Index (BMI) are more susceptible to shoulder pain due to increased mechanical load and pressure on the musculoskeletal system. Study have shown that body weight and BMI are significantly associated with symptoms of upper-back and shoulder pain, indicating that higher body weight can impose greater stress on the shoulder joint and surrounding muscles. This condition contributes to the development of musculoskeletal disorders, including shoulder pain [3,14,18]. Furthermore, the nature of construction work, which often involves repetitive overhead movements, can exacerbate these symptoms because high physical demands place additional strain on the shoulder, particularly among workers with higher

BMI [14]. Obesity is also associated with physical limitations and greater fatigue, which can increase the risk of occupational injuries [19]. Physiological changes in individuals with obesity, such as suboptimal muscle activation and increased torque loss, lead to greater central fatigue during physical activity, thereby affecting shoulder endurance and increasing injury risk [20]. This heightened central fatigue suggests that obese workers have reduced capacity to sustain prolonged physical activity, further increasing the likelihood of shoulder injury [20].

Older workers experience more pronounced effects of shoulder pain due to various factors, including longer exposure to physical hazards, repetitive movements, and cumulative musculoskeletal strain. Study indicate that older construction workers report higher levels of upper-extremity pain, including shoulder pain, compared to younger workers. Additionally, the prevalence of musculoskeletal disorders in this group is high, with many experiencing pain in one or more body regions, including the shoulder. The combination of demanding work conditions and age-related physiological changes makes older workers more vulnerable to shoulder pain [16]. As individuals age, declines occur in physical strength, flexibility, and recovery capacity, increasing susceptibility to injury [21,22]. A longitudinal study of workers aged 50 years and older in the United States found that occupational injury risk increased significantly in this age group, particularly when their jobs involved heavy physical activities such as lifting, bending, or prolonged kneeling [21]. Moreover, the prevalence of chronic shoulder pain increases with age, with study demonstrating significant correlations between older age and the development of shoulder pain [23,24]. Physiological changes in the musculoskeletal system; such as muscle atrophy, reduced bone mineral density, tendon degeneration, and loss of articular cartilage further elevate the risk of shoulder injury and pain among older workers [25]. Reduced muscle recovery capacity can also prolong the duration and severity of shoulder injuries [22]. Additional factors that worsen this condition include chronic inflammation and oxidative stress, which are more prominent in older individuals and can hinder healing processes, leading to prolonged pain [22].

Work experience influences shoulder pain due to cumulative exposure to risk factors associated with work-related musculoskeletal disorders. Workers with longer work experience tend to have a higher risk of shoulder disorders compared to those who have worked for shorter periods. Study show that workers with 5 to 15 years of experience are more likely to experience shoulder disorders than those with less than five years of experience. This is attributed to prolonged exposure to physical demands and repetitive tasks, which over time can lead to muscle fatigue, excessive joint stress, and increased risk of musculoskeletal injury [1]. Long-term exposure to physical job factors, such as repetitive movements and vibration, has been shown to predict the development of chronic shoulder disorders over time [26]. Research on organizational influences on rotator cuff tendinopathy found that the average work tenure among affected workers was 22 years, indicating that prolonged occupational exposure significantly contributes to shoulder disorders [27].

Exercise habits serve as a protective factor against shoulder pain by improving muscle strength and flexibility, enhancing musculoskeletal function, and alleviating symptoms associated with work-related musculoskeletal disorders. Workers who regularly engage in physical activity tend to have lower risk of musculoskeletal disorders affecting the shoulder, upper back, and lower back compared to those who rarely or never exercise. Regular physical exercise contributes to overall physical health and increases resilience against injury. Additionally, physical activity helps maintain postural balance, reduce muscle tension, and improve blood circulation to musculoskeletal tissues [1]. Experimental study show that an eight-week home-based exercise program involving shoulder stretching and strengthening significantly improved Shoulder Rating Questionnaire (SRQ) scores and reduced pain and disability among construction workers with Shoulder Impingement Syndrome (SIS) [28]. A systematic review and meta-analysis of 23 study further found that exercise interventions had positive effects in reducing pain and disability associated with work-related musculoskeletal disorders, with moderate to large effectiveness based on Visual Analog Scale (VAS) pain measurements [29]. Similar findings were reported in a prospective cohort study, which noted that participation in home exercise programs was associated with reduced incidence of shoulder pain, although factors such as history of neck pain and exposure to extreme work environments remained significant [30].

Non-ergonomic working posture is one of the primary risk factors in the development of shoulder musculoskeletal disorders. Awkward working positions; such as bending, overhead lifting, or maintaining static postures for prolonged periods increase stress and strain on shoulder muscles and joints, leading to discomfort and pain. In the construction industry, workers frequently operate under non-ergonomic conditions, contributing to higher incidence of shoulder injuries compared to other sectors [12]. Activities such as lifting, carrying, and working with arms elevated above shoulder height are strongly correlated with increased risk of musculoskeletal disorders affecting the shoulder, neck, and upper back [15]. Study show that non-ergonomic postures, such as forward head position or rounded shoulders, can alter shoulder kinematics and muscle recruitment patterns, reducing arm mobility and increasing activation of the upper trapezius, lower trapezius, and serratus anterior muscles. This increases biomechanical load during arm movements and elevates injury risk [31]. Additionally, combinations of shoulder flexion or extension with elbow flexion significantly increase discomfort and risk of upper-extremity musculoskeletal disorders [32].

High work speed is a significant risk factor in the development of shoulder pain. Workers who perform tasks at a rapid pace experience increased physical strain, which can lead to muscle tension and greater mechanical load on the shoulder [12]. A cross-sectional study in Nigeria involving 1,200 male construction workers found that high work speed significantly increased the risk of musculoskeletal disorders [5]. Similarly, research in China involving 55,749 workers across 15 industries found that high-speed work environments were associated with elevated prevalence of shoulder pain, particularly in sectors requiring rapid task completion, such as biopharmaceutical manufacturing and aviation services [33]. Insufficient rest time between fast-paced tasks leads to accumulated fatigue, contributing to persistent shoulder pain that may progress into chronic conditions [1,14,33]. Study also show that novice workers, such as carpenters who work faster to keep up with more experienced colleagues, experience increased shoulder muscle activity and higher energy expenditure, significantly elevating shoulder injury risk [34].

Physically exhausting activities are a major risk factor in the development of shoulder pain. High physical workload without adequate rest can lead to accumulated muscle fatigue, increasing biomechanical load on various body regions, including the shoulder, neck, lower back, hands, and arms [12]. Research shows that physical fatigue contributes to reduced postural stability and motor performance, increasing the risk of shoulder injury due to impaired movement control [35,36]. The impact of physically exhausting activities on motor control can be measured through changes in movement patterns, indicating increased risk of musculoskeletal injury [35]. Study using electromyography (EMG) demonstrate that repetitive lifting and other heavy tasks substantially increase muscle tension, ultimately contributing to higher risk of shoulder pain [36,37].

Job type in the construction industry is significantly associated with increased risk of shoulder musculoskeletal disorders, particularly within the past seven days [14]. Each job type has different physical demands, requiring specific ergonomic interventions [38]. Certain construction jobs, such as carpentry and masonry, have higher incidence of shoulder disorders compared to other occupations. Tasks requiring intensive shoulder muscle activity, such as deck building and bar installation, contribute to increased injury risk among workers [34,39]. In addition to carpenters, workers involved in bricklaying and plastering also face high risk of shoulder pain. Activities in these fields often involve repetitive movements and prolonged shoulder positioning, increasing the incidence of musculoskeletal complaints [4,40].

Manual handling is one of the contributing factors to increased risk of shoulder pain. Workers exposed to physical load from manual lifting activities have higher probability of musculoskeletal disorders affecting the neck, shoulder, and upper back compared to workers not exposed to such activities [15]. Lifting and moving heavy materials without appropriate ergonomic support can cause excessive stress on the shoulder joint, increasing the risk of musculoskeletal injury. This factor becomes more significant when workers lack training in proper lifting techniques, increasing the likelihood of injury due to non-ergonomic working posture [41]. Construction workers frequently perform repetitive manual lifting tasks requiring high force, such as lifting, carrying, and moving construction materials. These activities increase muscle activity and tension in the shoulder, contributing to musculoskeletal disorders [42–45]. Several study have confirmed the high prevalence of shoulder pain among construction workers. One study reported that 60% of workers experienced shoulder discomfort within the past year, indicating that manual lifting activities have substantial impact on shoulder health [44]. These activities also increase biomechanical load on shoulder muscles, particularly the upper trapezius and levator scapulae, which often experience increased activation and fatigue due to repetitive tasks. Biomechanical load increases with heavier materials and higher lifting frequency, accelerating shoulder injury and increasing musculoskeletal disorder risk [46,47].

Repetitive work is a major risk factor in the development of musculoskeletal disorders. Activities involving repeated movements, especially under non-ergonomic conditions, can cause cumulative biomechanical stress on muscles and joints, contributing to increased risk of musculoskeletal disorders affecting the shoulder, neck, and upper back [15]. Study show that low-intensity but repetitive work over long periods can reduce proprioceptive accuracy, the body's ability to sense shoulder position. This reduction can impair motor control and create an injury cycle leading to musculoskeletal disorders. Additionally, female workers tend to have lower proprioceptive accuracy than male workers, which may explain higher incidence of musculoskeletal disorders among female workers [48]. Biomechanical modeling and simulation study have demonstrated that repetitive tasks increase muscle contraction forces and joint reaction forces in the shoulder. This increased biomechanical load leads to higher risk of musculoskeletal injury due to continuous stress on muscle and joint structures [49]. Excessive muscle activation during repetitive arm movements can also cause soft-tissue damage, ultimately triggering musculoskeletal disorders [50].

Psychosocial factors also play a role in the occurrence of shoulder pain. High mental stress can lead to increased muscle tension and impaired motor coordination, contributing to the development of shoulder pain [51]. Simultaneous physical and mental demands influence physiological responses, particularly in postural muscles such as the shoulder. This condition causes faster fatigue and reduced muscle capacity, increasing injury risk [52]. Study among construction workers show that high psychological burden exacerbates the effects of physical workload. As a result, workers with higher stress levels have greater prevalence of musculoskeletal disorders [53]. Psychological stress can also trigger anxiety and increase muscle tension, reducing physical endurance. This condition makes workers more sensitive to pain, worsening musculoskeletal disorders [15,54].

Job dissatisfaction serves as a risk factor in the development of shoulder musculoskeletal disorders. Workers with low job satisfaction tend to experience higher psychosocial stress, which is a significant predictor of shoulder pain, especially in the construction sector [15]. Study show that psychosocial factors, including job dissatisfaction, have stronger associations with neck and shoulder pain than physical workload factors [55]. Furthermore, interactions between physical and psychosocial factors; such as job satisfaction increase the likelihood of musculoskeletal symptoms in the neck and shoulder [55]. Job satisfaction also acts as a moderator in the relationship between physical demands and musculoskeletal symptoms, where high job satisfaction can reduce the negative effects of physical demands on upper-extremity musculoskeletal disorders, including shoulder pain [56]. Conversely, job dissatisfaction is associated with increased neck and shoulder pain, as found among workers with high workload, such as teachers and construction workers [57]. Job dissatisfaction can increase stress, leading to muscle tension and reduced recovery capacity from physical strain [58,59]. High psychological stress also contributes to increased pain sensitivity, making workers more aware of discomfort and potentially reporting higher levels of pain [58,59].

Social support in the workplace plays an important role in reducing the risk of shoulder musculoskeletal disorders. Workers who feel they do not receive assistance from coworkers or supervisors are more vulnerable to physical and mental fatigue, which can accelerate musculoskeletal injury. Lack of social support has been shown to contribute to increased risk of pain in various body regions, including the shoulder, neck, and lower back [12]. Support from supervisors and coworkers can help reduce perceived workload and work-life conflict. Reduced stress may improve workers' ability to manage physical demands, thereby lowering the incidence of shoulder musculoskeletal disorders [60]. Study also show that social support correlates with better recovery outcomes after occupational injury. Workers with higher levels of social support tend to experience less stigma, have more positive outlooks on the future, and report higher job satisfaction. These factors can accelerate recovery and improve management of shoulder musculoskeletal disorders [61].

Heat strain has a significant impact on shoulder pain. When workers are exposed to high temperatures, the body must work harder to maintain thermal balance, resulting in increased physiological stress, including greater muscle fatigue and impaired coordination. Study show that workers with shoulder pain have higher levels of heat strain compared to those without pain [17]. Prolonged heat exposure is also associated with various health effects, such as fatigue, dehydration, and reduced concentration, which can increase the risk of musculoskeletal injury [62,63]. A study among construction workers in Japan found that heat strain peaked during the first half of the daytime shift, with increased numbers of workers experiencing dehydration due to inadequate fluid intake [64]. Dehydration can impair muscle function and increase the risk of cramps and muscle tension [63]. High environmental temperatures are also associated with increased incidence of occupational injuries, including those affecting the musculoskeletal system [65,66]. Heat-related fatigue can cause workers to adopt improper lifting techniques and non-ergonomic working postures, increasing stress on shoulder muscles and joints [62,63]. Extreme heat exposure can also increase heart rate and reduce muscle coordination, affecting overall physical performance [67]. Study further show that high Wet-Bulb Globe Temperature (WBGT) levels correlate with increased cardiovascular strain, which can affect work capacity and elevate injury risk [68]. Consequently, workers in hot environments often experience reduced productivity, which may contribute to suboptimal work techniques and increased shoulder strain [68].

CONCLUSION

Shoulder pain among construction workers emerges from the combined influence of individual, physical, psychosocial, and environmental factors. Workers with higher body mass, older age, and long occupational tenure tend to face greater biomechanical strain, making them more vulnerable to chronic shoulder problems. Physically demanding tasks; such as non-ergonomic postures, repetitive movements, manual handling, and exposure to heat further intensify musculoskeletal load and accelerate fatigue. Psychosocial pressures, including stress and job dissatisfaction, amplify muscle tension and reduce recovery capacity, thereby worsening symptoms. In contrast, regular exercise consistently appears as a protective factor that enhances musculoskeletal resilience. Overall, these patterns underscore the need for ergonomic improvements, safe-work training, physical-health promotion, and stress-management strategies, particularly for high-risk groups such as obese workers, older workers, and those with prolonged exposure to demanding construction tasks.

Ethical consideration, competing interest and source of funding

-The study did not require formal ethical clearance, yet every stage of the review was carried out with strict adherence to scholarly integrity, academic transparency, and full acknowledgment of the intellectual contributions of the original authors.
-There is no conflict of interest related to this research.
-Source of funding is authors.

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