

HEALTH IMPACTS OF PROLONGED STANDING AMONG GARMENT INDUSTRY WORKERS IN SRI LANKA: A CROSS-SECTIONAL ANALYTICAL STUDY

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Abstract. Prolonged standing is a common occupational exposure in the garment industry and is linked with several adverse health effects among workers. This study aimed to assess the health impacts of prolonged standing among workers in selected garment industries in Sri Lanka. A descriptive cross-sectional study was conducted among 300 garment industry workers using a structured questionnaire. Data on demographic characteristics, standing duration, break patterns, ergonomic support, and work-related factors were collected and analysed using SPSS. The findings highlight the need for improved ergonomic measures, better break scheduling, and worker awareness. The results revealed that 92% of workers were required to stand for prolonged periods, with the majority standing 7–8 hours or more per day, often without adequate breaks. Musculoskeletal discomfort was most prevalent in the heel/sole, knee, and lower back regions. Statistically significant positive correlations were observed between standing time and discomfort in the upper back ($\rho = 0.171$), lower back ($\rho = 0.134$), knees ($\rho = 0.178$), and heel/sole ($\rho = 0.235$). A moderate positive correlation was identified between standing time and mental exhaustion ($\rho = 0.342$), indicating a substantial psychological impact. Despite these challenges, overall work satisfaction remained high, and only a minority of workers reported health-related leave.

Keywords. *Prolonged Standing; Garment Industry Workers; Occupational Health; Musculoskeletal Disorders; Ergonomics.*

1. INTRODUCTION

1.1 BACKGROUND OF THE STUDY

The garment industry is one of the most significant contributors to the economy of Sri Lanka, providing employment opportunities to a large workforce and playing a vital role in export earnings (Central Bank of Sri Lanka, 2023). A substantial proportion of workers in this sector are engaged in production-line activities such as sewing, cutting, quality inspection, ironing, and packing (International Labour Organization, 2021).

Within this industry, work organization has evolved to improve productivity and efficiency. In some garment factories, a modular production system with job rotation has been implemented, where workers rotate between tasks within a production line (Herath & Wujewardena, 2019). This system promotes continuous workflow and incorporates movement rather than strictly static tasks; however, it generally requires workers to perform their duties in a standing posture throughout most of the workday (International Labour Organization [ILO], 2021; Occupational Safety and Health Administration, 2020).

As a result, Prolonged standing has become a common occupational exposure in garment manufacturing environments. Although standing is often considered a natural posture, maintaining a standing position for extended periods without adequate rest or postural variation can result in adverse health outcomes (Water & Dick, 2015). Production targets, repetitive tasks, and limited opportunities for rest breaks may further intensify this exposure (Tissot et al., 2009).

Prolonged standing is associated with a range of adverse health outcomes, including musculoskeletal discomfort, lower-limb fatigue, back pain, varicose veins, circulatory disorders, and general physical exhaustion (da Costa & Vieira, 2010; Coenen et al., 2017). In this context, ergonomic risk refers to the likelihood of developing injury or adverse health effects due to poorly designed work conditions, including inappropriate work postures, repetitive movements, prolonged static positions, and inadequate workplace layout (ILO, 2019). Over time, such conditions may negatively affect workers' productivity, job satisfaction, and overall quality of life.

Existing literature strongly highlights that prolonged standing in occupational settings is a significant risk factor for work-related musculoskeletal disorders (WMSDs) and lower-limb complications. Studies have shown that workers exposed to prolonged standing are more likely to report pain in the lower back and legs, as well as symptoms of venous disorders, compared to those with more dynamic or seated work patterns (Waters & Dick, 2015; Coenen et al., 2017). Furthermore, inadequate ergonomic interventions and a lack of awareness contribute to the underreporting and poor management of these conditions in industrial settings, particularly in developing countries (ILO, 2019). Despite the presence of basic occupational safety measures in many garment factories, ergonomic risk factors related to prolonged standing and work posture often remain insufficiently addressed.

1.2 PROBLEM STATEMENT

Although prolonged standing is a routine requirement for some garment industry workers, its health impacts are frequently underestimated. In Sri Lanka, there is a lack of empirical studies that specifically examine prolonged standing as an independent ergonomic risk factor (ILO, 2021). Furthermore, evidence on how prolonged standing affects both physical and mental well-being of garment workers in the local context remains insufficient. Many garment factories rely on general occupational safety measures without conducting specific ergonomic assessments or implementing targeted interventions to mitigate standing - related risks (ILO, 2019).

Therefore, the key research gap lies in the lack of focused, context-specific evidence on the impact of prolonged standing, particularly regarding exposure patterns and associated health outcomes. Addressing this gap is essential to generate evidence-based recommendations for improving workplace ergonomics, reducing preventable health issues, and enhancing worker well-being and productivity in the garment sector.

1.3 RESEARCH OBJECTIVES

1.3.1 AIM OF THE STUDY

To assess the health impacts of prolonged standing among workers in selected garment industries in Sri Lanka.

1.3.2 SPECIFIC OBJECTIVES

- To identify the prevalence and duration of prolonged standing and the adequacy of rest breaks during working hours among garment industry workers.
- To evaluate the relationship between prolonged standing and physical discomfort among workers.
- To examine the association between prolonged standing and mental exhaustion.

2. LITERATURE REVIEW

This section reviews existing literature on prolonged standing in the garment industry, focusing on its ergonomic implications and associated health outcomes among workers. Laboratory-based systematic reviews have demonstrated a clear association between prolonged standing and the development of low back and lower limb symptoms, with clinically relevant discomfort reported within 40–70 minutes of continuous standing. Physiological mechanisms such as lower limb blood pooling, reduced venous return, and sustained trunk flexion contribute to discomfort and pain during prolonged standing (Coenen et al., 2017; Chester et al., 2002). Comparative studies further show that stationary standing produces greater muscle fatigue in the legs and lower back than dynamic standing. Dynamic postures that allow weight shifting and movement have been shown to reduce fatigue and perceived discomfort, emphasizing the importance of postural variability during standing work (Balasubramanian et al., 2009; Botter et al., 2016).

The garment and textile industry has been widely recognized as a high-risk sector for work-related musculoskeletal disorders due to repetitive tasks, constrained workspaces, awkward postures, and prolonged standing. Studies conducted among garment workers in countries such as Turkey, Cambodia, Botswana, and Portugal consistently report high prevalence rates of MSDs affecting the neck, shoulders, lower back, knees, and feet (Öztürk & Esin, 2011; Leap et al., 2016; Sealetsa & Thatcher, 2011; Azevedo et al., 2020). In several studies, more than two-thirds of sewing machine operators reported musculoskeletal pain or discomfort within a 6–12 month period. Ergonomic assessments using tools such as the Rapid Upper Limb Assessment (RULA) and Rapid Entire Body Assessment (REBA) frequently classify garment workers' postures as high risk, requiring immediate intervention. Longitudinal evidence also suggests that musculoskeletal conditions such as rotator cuff tendinitis and myofascial pain syndrome may persist over time, especially with increasing years of service and exposure to repetitive and standing work (Kaergaard & Andersen, 2000).

Studies conducted in Sri Lanka provide important insights into ergonomic risks and health outcomes among garment workers. Ergonomic evaluations of standing sewing machine operators report a high prevalence of musculoskeletal symptoms, with lower limb discomfort often more pronounced than upper body symptoms. Foot, knee, lower leg, and lower back pain have been consistently identified as the most commonly affected body regions, highlighting the impact of prolonged standing (Nagaraj et al., 2019; Sakthi Nagaraj & Jeyapaul, 2018). Ergonomic studies using REBA and the Cornell Musculoskeletal Discomfort Questionnaire have shown that prolonged standing, combined with poorly designed workstations and mismatches between machine height and workers' anthropometric dimensions, significantly contributes to musculoskeletal discomfort. Dynamic posture analysis among Sri Lankan sewing machine operators revealed that

although some workers adopt movement-based strategies, more than half still report pain or discomfort related to their work activities, with foot and ankle pain remaining prevalent across posture types (De Silva et al., 2025). Some studies have reported comparatively lower prevalence rates of musculoskeletal symptoms among female garment workers in Sri Lanka; however, these findings may reflect underreporting influenced by sociocultural factors and limited healthcare utilization (Lombardo et al., 2012). Nevertheless, back and knee pain remain the most frequently reported complaints.

The Sri Lankan garment workforce is predominantly female, making gender-related ergonomic risks particularly relevant. Research indicates that female workers experience higher rates of musculoskeletal discomfort, particularly in the lower limbs and upper body, possibly due to differences in body dimensions, muscle strength, and task allocation (Öztürk & Esin, 2011; Leap et al., 2016). Studies examining fatigue and posture adaptation also suggest that males and females adopt different movement strategies when exposed to prolonged standing and repetitive tasks. In addition to physical factors, psychosocial elements such as job stress, workload pressure, and low social support have been shown to influence the development and persistence of musculoskeletal disorders. High stress levels and poor perceived general health are significantly associated with neck and shoulder disorders among sewing machine operators (Kaergaard & Andersen, 2000).

A substantial body of literature emphasizes the effectiveness of ergonomic interventions in reducing the adverse health impacts of prolonged standing. Commonly recommended measures include adjustable workstation heights, anti-fatigue mats, inclined worktables, sit-stand or dynamic workstations, job rotation, stretching exercises, and scheduled rest breaks. Studies comparing static standing with dynamic or sit-stand configurations consistently demonstrate reductions in fatigue, discomfort, and musculoskeletal risk (Balasubramanian et al., 2009; Chester et al., 2002; Botter et al., 2016). In the Sri Lankan context, leading apparel organizations have introduced ergonomics-based management practices such as 5S, Kaizen, and structured training programs, contributing to improvements in workplace ergonomics (Abeysekera & Illankoon, 2016). However, risks related to prolonged standing and lower limb discomfort continue to be reported. International intervention studies also show that systematic workstation redesign using ergonomic assessment tools can significantly reduce MSD prevalence, absenteeism, and productivity losses in textile industries.

Overall, existing literature identifies prolonged standing as a significant occupational health risk among garment workers, particularly contributing to musculoskeletal disorders affecting the lower back and lower extremities. Both international and Sri Lankan studies highlight the high prevalence of pain and discomfort associated with standing work. However, most available studies are primarily focused on general ergonomic risk, with limited attention to the specific contribution of prolonged standing as an independent exposure. There remains limited context-specific research examining the health impacts of prolonged standing among workers in garment industries in Sri Lanka, particularly focusing on workers' subjective health experiences and workplace practices. Therefore, the present study seeks to address this gap by examining the health impacts of prolonged standing among garment industry workers in Sri Lanka.

3. METHODOLOGY

A descriptive cross-sectional quantitative study design was employed to assess the health impacts of prolonged standing among garment industry workers. This design was considered appropriate as it allows the collection of data at a single point in time to examine exposure to prolonged standing and its associated health outcomes (Levin, 2006). Quantitative questionnaire-based methods are widely used in occupational health research to systematically capture workers' perceptions, symptoms, and workplace conditions in a standardized and comparable manner (Creswell, 2014)

The study was conducted in six selected garment industries in Sri Lanka, representing typical production settings within the industry. Of these, three factories were located in the western province, two in the northern province, and one in the southern province. The garment industry sector was specifically selected because prolonged standing is a routine and unavoidable occupational exposure in many production tasks. Sri Lanka was selected for this study because the apparel industry is one of the country's large export-oriented manufacturing sectors and a major source of employment. Factories were selected using purposive sampling based on the presence of work processes requiring prolonged standing. These factories were chosen because many tasks, such as sewing, quality inspection, ironing, cutting, and packing, require workers to stand for extended periods. The selected industries represent typical working conditions within the Sri Lankan garment sector. The study was carried out over one year, covering all stages from data collection to analysis.

The study population consisted of production-level workers employed in the selected garment industries. Inclusion criteria included workers whose job roles required prolonged standing during normal working hours. A total of 300 workers participated in the study. A convenience sampling technique was used to recruit participants due to practical limitations such as work schedules and worker availability during data collection.

Data were collected using a structured questionnaire consisting of closed-ended and ranking questions measured on nominal and ordinal scales. The questionnaire was developed based on established ergonomic and occupational health literature and adapted to suit the local context. Content validity was ensured through expert review, and reliability was assessed through pre-testing, with necessary modifications made to improve clarity and consistency. The questionnaire was provided in the local language where necessary. The questionnaire gathered information on demographic and work-related characteristics, duration and patterns of standing, availability of breaks and job rotation, and physical discomfort and mental exhaustion. Data collection was conducted during working hours with prior permission from management.

Collected data were coded and analyzed using IBM SPSS Statistics. Descriptive statistics (frequencies, percentages, and modes) were used to summarize variables. Inferential statistical methods, including Spearman's rank correlation and Chi-square tests, were used to assess relationships and associations between standing duration and health outcomes. These methods were selected as they are appropriate for analyzing ordinal and categorical data and are commonly used in similar occupational health studies.

4. RESULTS & DISCUSSIONS

4.1 DEMOGRAPHIC CHARACTERISTICS OF THE STUDY POPULATION

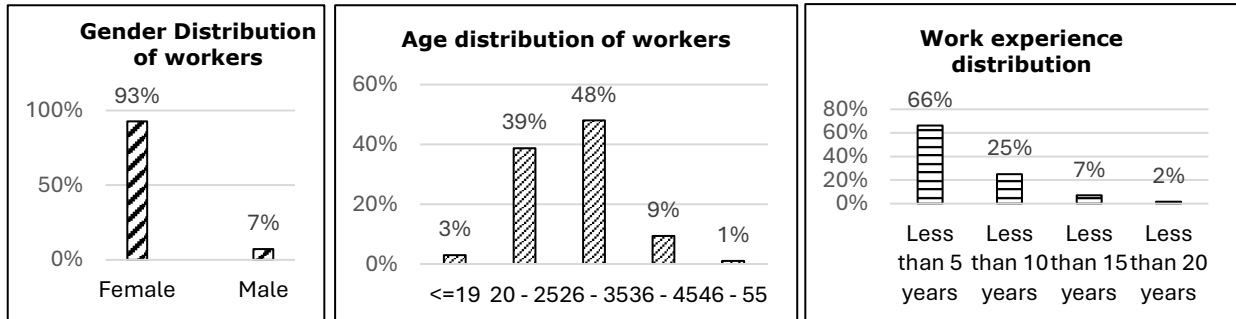


Figure 1: Demographic characteristics of study population

Among the 300 respondents, the majority were female (92.7%), while males accounted for 7.3%, reflecting the typical workforce composition of the garment industry in Sri Lanka. Most workers were aged 20–35 years (about 87%), indicating a predominantly young workforce. In terms of work experience, 66.3% had less than five years of service, while only a small proportion had more than 15 years, suggesting limited long-term exposure to occupational hazards.

4.2 PREVALENCE OF PROLONGED STANDING

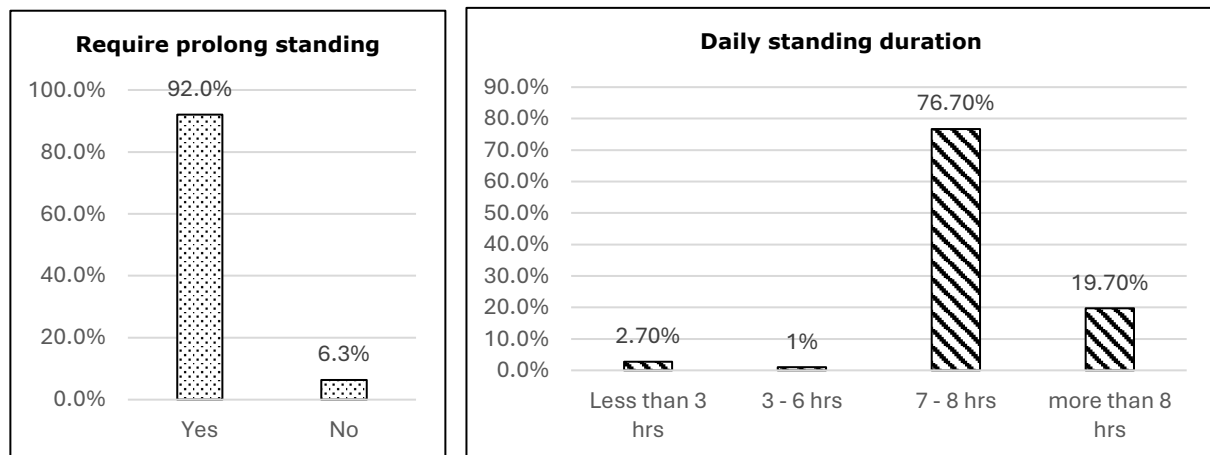


Figure 2: Prevalence of prolonged standing

A large majority of workers (92%) reported that their jobs require prolonged standing, confirming that standing is a central component of the work system, while only 6.3% indicated that standing was not required. Regarding daily standing duration, 70% of respondents reported standing for 7–8 hours per day and 19.7% for more than 8 hours, while less than 3% stood for under 3 hours. This indicates that most workers stand for nearly the entire work shift, which aligns with recognized risk factors for musculoskeletal fatigue and lower-limb discomfort.

Continuous standing without adequate rest was also common. About 30.5% of workers reported standing continuously for 2–3 hours, 28.5% for 3–4 hours, and 7.7% for more than 4 hours without breaks. These findings suggest inadequate micro-breaks, which may increase circulatory load and musculoskeletal stress, contributing to long-term health risks.

4.6 MUSCULOSKELETAL DISCOMFORT ASSOCIATED WITH PROLONGED STANDING

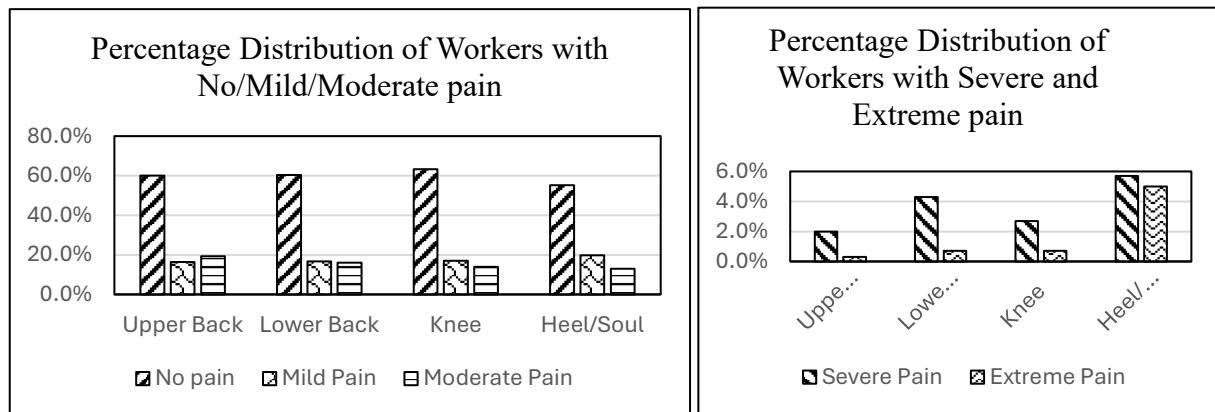


Figure 3: Percentage Distribution of Workers with upper back, lower back, knee and heel/soul pain

The majority of workers reported no pain across all body regions. However, a considerable proportion experienced mild to moderate pain, particularly in the lower back and knees; these areas show comparatively higher levels of discomfort, suggesting they are most affected by prolonged standing. Although severe and extreme pain levels are relatively low, their presence, especially in the heel/sole and lower back, signals the potential progression of musculoskeletal strain. Overall, the pattern suggests that while acute severe symptoms are limited, early-stage discomfort is widespread and may develop into more serious conditions if preventive ergonomic measures are not implemented.

4.7 MENTAL AND PSYCHOLOGICAL EFFECTS OF PROLONGED STANDING

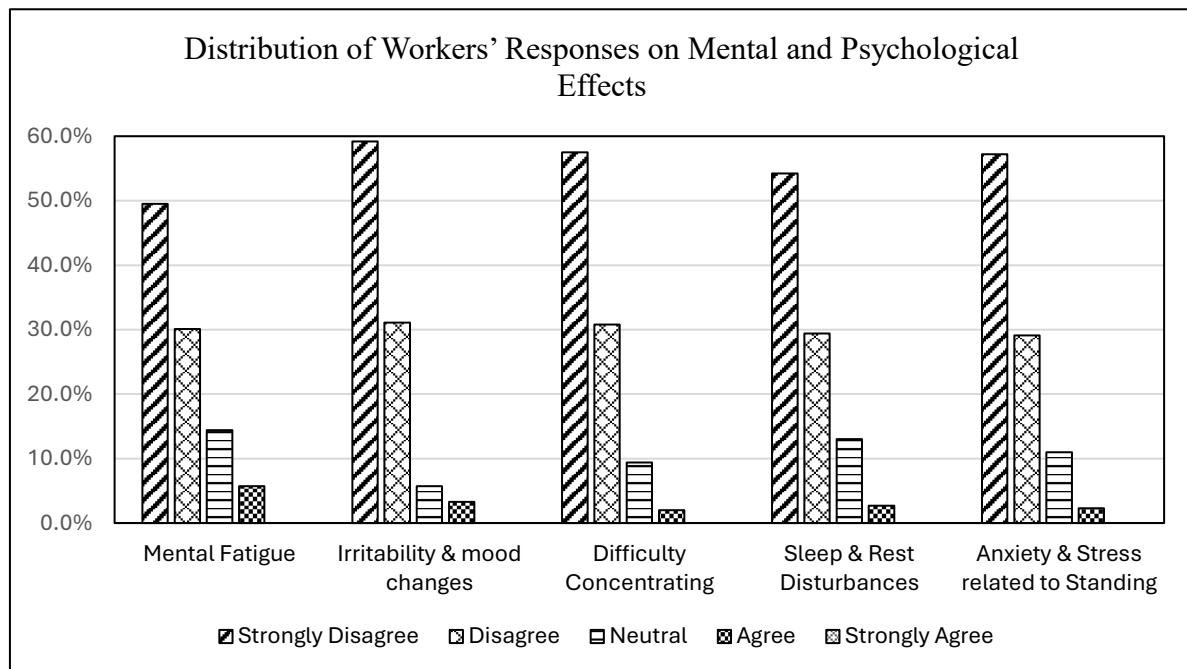


Figure 4: Percentage Distribution of Workers' response on mental and psychosocial effects

Most workers did not report strong psychological effects related to prolonged standing. Nearly half (49.5%) strongly disagreed, and 30.1% disagreed that standing caused mental fatigue, although about 20.1% reported neutral to agreeing responses, suggesting that a minority experience mental tiredness. Similarly, 90.3% disagreed that standing makes them irritable or moody, with only 3.3% agreeing. Most respondents (88.3%) also reported that prolonged standing does not affect their concentration, though 11.4% indicated some difficulty concentrating. Regarding sleep and rest, 83.6% disagreed that standing affects sleep patterns, while 15.7% reported possible effects. In addition, 86.3% disagreed that they feel anxious or stressed due to prolonged standing, while 13.6% reported neutral to agreeing responses. Overall, psychological impacts appear limited but are present among a small proportion of workers.

4.8 RELATIONSHIP BETWEEN STANDING TIME AND MUSCULOSKELETAL DISCOMFORT

Spearman's rank correlation analysis showed significant positive relationships between standing time and discomfort in several body regions. Weak but statistically significant correlations were observed with upper back pain ($\rho = 0.171, p = 0.003$), lower back pain ($\rho = 0.134, p = 0.021$), and knee pain ($\rho = 0.178, p = 0.002$). The strongest association was found with heel/sole discomfort ($\rho = 0.235, p < 0.001$), indicating that foot discomfort increases with longer standing duration. These findings confirm that prolonged standing is associated with musculoskeletal strain, particularly affecting the lower extremities.

Table 1: Relationship between standing time and musculoskeletal discomfort

Correlations

		Upper Back	Lower back	Knee	Heel/Sole	
Spearman's rho	Standing Time	Correlation Coefficient	.171**	.134*	.178**	.235**
		Sig. (2-tailed)	0.003	0.021	0.002	0.000
		N	294	294	293	296

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

4.9 RELATIONSHIP BETWEEN STANDING TIME AND MENTAL EXHAUSTION

A moderate and statistically significant positive correlation was found between standing time and mental exhaustion ($\rho = 0.342, p < 0.001$). This suggests that workers who stand longer during their shifts are more likely to experience higher levels of mental fatigue. The stronger relationship compared with most musculoskeletal outcomes indicates that prolonged standing contributes not only to physical strain but also to psychological fatigue.

5. CONCLUSION AND RECOMMENDATION

This study examined the health impacts of prolonged standing among workers in selected garment industries in Sri Lanka, addressing the identified gap related to limited context specific evidence on standing duration, work practices, and associated health outcomes. The findings show that prolonged standing is a common and unavoidable aspect of garment factory work, with most workers standing for 7–8 hours or more per day, often with long uninterrupted periods. The workforce was predominantly young and female with relatively short work experience, indicating early-stage occupational exposure. Although younger workers may tolerate physical demands better, the results indicate that prolonged standing already contributes to musculoskeletal discomfort and mental exhaustion, suggesting potential long-term risks if preventive measures are not strengthened.

Consistent with existing literature, musculoskeletal discomfort was most prevalent in the heel/sole, knee, and lower back regions, confirming that prolonged static standing places substantial strain on the lower extremities and lumbar area. Correlation analysis showed significant positive relationships between standing time and discomfort in the upper back, lower back, knees, and particularly the heel/sole region, where the strongest association was observed. A notable finding of this study is the clear emphasis on lower-limb discomfort, particularly foot-related pain, which is often underexplored compared to upper body symptoms in similar studies.

The study also identified a moderate positive relationship between standing time and mental exhaustion, indicating that prolonged standing contributes not only to physical strain but also to psychological fatigue. Although severe mental stress was uncommon, some workers experienced moderate mental exhaustion, particularly when standing was combined with long working hours and repetitive tasks. This combined assessment of

physical and mental outcomes represents an important contribution, as many previous studies have focused primarily on physical health effects.

Overall, this study found that prolonged standing is a common occupational exposure among garment workers and is significantly associated with musculoskeletal discomfort, as well as moderate mental exhaustion. The findings highlight that prolonged standing affects both physical and psychological well-being, emphasizing the need for ergonomic and workplace interventions to reduce long-term health risks. Although this study identified important patterns related to prolonged standing and worker health, detailed inferential analyses examining associations between demographic characteristics, work-related factors, and musculoskeletal or psychological outcomes were limited. Future studies with larger sample sizes and more comprehensive analytical approaches are recommended to further explore the relationships between job role, standing duration, break patterns, and health outcomes among garment workers. Future research should also focus on longitudinal studies, intervention-based evaluations, and comparisons between sitting, standing, and sit-stand work systems. Addressing prolonged standing through combined engineering, administrative, and educational measures will help promote healthier and more sustainable working conditions in the garment industry.

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