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Review Article

Discomfort, fatigue and work-related musculoskeletal disorders associated with prolonged standing among Malaysian manufacturing workers: A mini review

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Abstract

Prolonged standing is one of the crucial occupational risk factors that contributes to discomfort, fatigue, and in the long-term can cause work-related musculoskeletal disorders (WMSDs) among workers. The objective of this article is to disseminate information about the effect of prolonged standing, which can cause muscle discomfort, fatigue, and WMSDs. Prolonged standing without sufficient rest can lead to muscle discomfort, and eventually to fatigue, especially in the back and lower extremities of a worker's body. Prolonged standing without any form of intervention could lead to musculoskeletal disorders among workers. This review shows that the level of body comfort among workers in Malaysia is inadequate due to several factors of which prolonged standing is one. Therefore, ergonomic interventions are crucial to ensure the safety, welfare, and health of workers in the workplace.

Keywords: WMSDs, prolonged standing, ergonomics, discomfort, fatigue

1. Introduction

The development of musculoskeletal disorders (MSDs) has always been related to prolonged static standing among employees in industrial settings. A variety of occupations in manufacturing and the service professions commonly require spending most of the workday in a static and upright position, such as cashiers, food service personnel, hairdressers, operators, and assembly line workers (King, 2002) (Zander, King & Ezenwa, 2004). The objective of this article is to review the effect of prolonged standing that can cause muscle discomfort, fatigue, and the development of MSDs among workers in Malaysia based on previous studies.

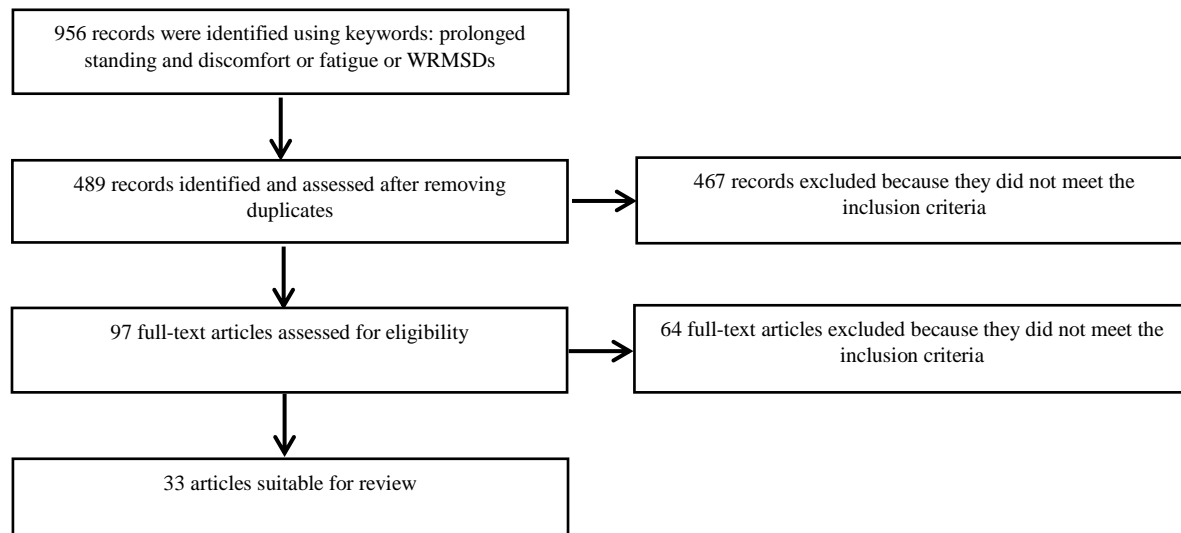
The cases of work-related musculoskeletal disorders (WMSDs) in Malaysia are increasing every year, and the total compensation for WMSDs cases was found to be higher than for other occupational disease cases. According to the statistics provided by the Social Security Organization (SOCSO) Malaysia, out of 2630 cases of occupational diseases in 2013, 694 were ergonomic-related cases. The chairman of the National Institute of Occupational Safety and Health (NIOSH) Malaysia said that for every four cases reported to SOCSO in 2013, one was related to MSDS. The scope of this review is the improper posture during prolonged standing and insufficient rest during work which can lead to muscle discomfort, muscle fatigue, and other health problems. The inclusion criteria for this review were the WMSDs, health problems, and symptoms of muscle discomfort, and fatigue associated with prolonged standing among workers in the manufacturing industry.

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Many risk factors are related to WMSDs, such as bending, twisting, heavy lifting, repetitive or static motion, unsuitable workplace design, extended working hours without adequate rest time, working environment, and psychosocial factors (Institute of Occupational Safety and Health, 2016). These are classified as occupational risk factors. Prolonged standing is an important occupational risk factor that can lead to WMSDs.

2. Methodology

A review article checklist was used to conduct the systematic review to ensure complete, transparent, and unbiased reporting.



2.1 Work-related musculoskeletal disorders (WMSDs)

Among the common health problems in the occupational field are MSDs (Guo, Chang, Yeh, Chen, & Guo, 2004; Halim *et al.*, 2014). MSDs are also one of the most common health problems to cause disability in the workplace (Karimi *et al.*, 2016). Basically, MSDs are a condition in which the muscles are under stress. This is due to muscles being exposed to static and repetitive motions over an extended period of time, which results in damage to the ligaments, tendons, and joints (Sholihah *et al.*, 2015). Common symptoms of MSDs are weakness, pain, numbness, skin colour change, tingling, swelling, redness, stiffness, and muscle tightness.

Previous studies reported that the most frequent body parts of workers affected by MSDs are the head, lower back, waist, shoulder, neck, hand, wrist, leg, and foot (Guo *et al.*, 2004; Santos *et al.*, 2014). The issue of MSDs should be solved to ensure that people can physically continue their work life for a longer time without the burden of any type of disease, especially MSDs (Oakman, Rothmore, & Tappin, 2016). Healthy workers, in terms of physical activities may increase their job performance with high productivity and concentration to prevent accidents from happening in the workplace (Jalil *et al.*, 2015).

2.2 Ergonomics

Ergonomics and WMSDs are an interrelated discipline. Ergonomics is a multidisciplinary science that is

related to a safe, healthy, and convenient workplace that fits the workers and their jobs (Andayasari & Anorital, 2009). According to the Occupational Safety and Health Administration, ergonomics means that the relationship between the physical aspects of the environment, e.g., workplace design, and the human factors, e.g., body posture of workers, do not cause a disturbance. The main aim is to create an ergonomic workplace that suits the abilities and limitations of the worker including the worker's body size and other factors. Previous studies have reported that the number of MSDs among workers is increasing due to work posture, poor ergonomics, manual lifting, and working in a prolonged standing position (Deros, Daruis, & Basir, 2015; Karimi *et al.*, 2016).

Ergonomics constitute a crucial intervention for occupational risk factors. Ergonomic interventions reduce the workers exposure to occupational risk factors over a long period of time that would otherwise lead to discomfort, muscle fatigue, and stress, both physical and emotional, that could cause MSDs. Previous studies have also shown that ergonomics is needed to tackle the issue of MSDs (Boschman, Dresen, & Molen, 2015; Woo, White, & Lai, 2016). "Ergonomic risk" is a new term that has been used to identify the possible risk factors in the work process that may lead to the development of WMSDs (Veselinovic *et al.*, 2016).

2.3 Prolonged Standing

Working in a standing position is common in many occupations. Some occupations require workers to stand for an extended period of time to perform their jobs because they need to handle heavy products and equipment, reach for goods

and materials, and pull and push excessive loads (Omar, 2012; Zein *et al.*, 2015). To perform such work from a sitting position may make their job more difficult in terms of the limitation of body movement. Occupations that usually involve prolonged standing include assembly line workers, sales promoters, and machine operators (Canadian Center of Occupational Health and Safety, 2016). Statistics show that half of the labourers in the United Kingdom (UK), of which there are more than 11 million, face health risks caused by prolonged standing (Hazard, 2005). This is similar to the situation in Malaysia, where most workers are subjected to prolonged standing.

A work task can be classified as prolonged work in the upright position when workers need to spend more than 50% of their total working hours to complete the work task in a standing position without leaving the work area (Halim *et al.*, 2012). Furthermore, an awkward standing position can increase the likelihood of developing pain in the back and lower limbs during working hours (Kaka *et al.*, 2016). A study by Sartika and Dawal (2010) stated that after 90 minutes of prolonged standing, muscle fatigue occurs in the lower back and legs: soleus muscle (after 5 minutes), thoracic erector spinae muscles (after 35 minutes), and lumbar erector spinae muscles (after 30 minutes). A study by Gregory and Callaghan (2008) stated that the development of muscle discomfort could arise within 15 minutes of standing in an awkward bending or twisting posture. In Malaysia, most manufacturing workers spend approximately 8 to 12 hours in the workplace. Therefore, there is considerable risk that these workers will be exposed to muscle fatigue due to prolonged standing.

2.4 Discomfort

Discomfort, injury, and pain occur when the physical tasks require high physical energy that exceeds the capability of the human body (Korhan, 2012). In a previous study, it was concluded that discomfort has a significant relationship with prolonged standing, especially in the lower extremities of the individual (Halim *et al.*, 2012). It has also been reported that muscle stress and mental discomfort in the lower extremities are caused by prolonged standing at workstations, without sufficient rest and improper footwear (Omar, 2016). Discomfort occurs when there is limited blood circulation in the lower legs. If the workers perform prolonged standing work without any preventive measures, the workers experience discomfort in the lower limb muscles (thighs and legs), lower back, and feet (Halim & Omar, 2011). Many countries consider this discomfort to be a serious issue that is related to the socio-economics of the workers (Zander *et al.*, 2004). Injury in the workers leads to high medical costs and health recovery takes time due to treatment and rehabilitation with eventual return to the work phase. Furthermore, the psychosocial issues need to be considered (Murad, Farnworth, & O'Brien, 2012).

Another study showed a significant relationship between muscle discomfort and time, which indicates that the discomfort level for the whole body increases over time. The change in the level of discomfort is usually noticed in the first 30 minutes and after 90 minutes of standing. Among the highly affected body parts are the lower back, hips, lower leg, upper back, ankle, and foot (Aziz *et al.*, 2015; Lin *et al.*, 2012; Sartika & Dawal, 2010). Similarly, another previous study

showed that 50% of healthy respondents experienced low back discomfort after prolonged standing for 2 hours (Gregory & Callaghan, 2008). A study by Chester *et al.* (2002) showed that the feet experienced the most discomfort in the standing posture after 90 minutes, followed by sitting and the sitting/standing posture. When workers stand for extended working hours, they have a high tendency to lean their body backward to reduce the pain and muscle discomfort when working (Sartika & Dawal, 2010).

2.5 Fatigue

In a previous study, it was concluded that body fatigue had a significant relationship with prolonged standing, especially in the lower extremities of an individual (Halim *et al.*, 2012). Fatigue occurs when there is limited blood circulation, especially in the lower leg area and static muscles. The reduction in blood circulation to the area may cause blood pooling, which is usually called lower leg swelling (Zander *et al.*, 2004). Previous studies also stated that there are significant differences between the effect of fatigue and absence through long-term sickness. Fatigue can also cause disease if workplace improvements are not taken seriously by the employer (Deros, Daruis, & Basir, 2015; Janssen *et al.*, 2016).

2.6 Health Problems

Working in a prolonged standing position without sufficient rest can lead to many health problems such as swelling of the leg, general muscular fatigue, low back pain, and other health problems (Canadian Centre for Occupational Health and Safety [CCOHS], 2016). A study by Sholihah *et al.* (2016) stated that people standing in the wrong posture for an extended duration of time could lead to MSDs. This is because the muscles tend to work in a static position which leads to an increase in the tension of the muscles and a decrease in the elasticity of the tissue. Static contraction in the leg and back can also occur because of prolonged standing (Gregory & Callaghan, 2008; Halim *et al.*, 2012;).

The body muscles cannot work in only a static position for extended working hours. Other problems faced by people who spend most of the time working in the upright position are poor circulation, foot problems, swelling of the feet and legs, joint problems, chronic venous insufficiency, high stroke risk, carotid atherosclerosis, and circulatory problems (Halim & Omar, 2011). Other health problems related to prolonged standing include low back pain, stiffness in the shoulder and neck, arthritis in the hips and knees, and high blood pressure (Johnson, 2016).

A study by Wong, David & Callaghan (2008) proved that 65% of asymptomatic respondents experienced low back pain caused by prolonged standing. Another study by Lafond *et al.* (2009) also reported an association between prolonged standing and the symptoms of low back pain in the industrial worker population. Loss in productivity and workdays are mainly caused by back pain problems which constitute a major work-related musculoskeletal disorder (WRMSD) (Aziz *et al.*, 2015). However, it is not only low back pain that results from prolonged standing. Chester, Rys & Konz (2002) stated that sitting/standing causes discomfort in the hips, upper back, and upper legs, while prolonged

standing causes discomfort in the lower body, especially in the feet.

3. Results and Discussion

Many internal and external factors contribute to the development of MSDs among workers in Malaysia, such as gender, geographic, work organization, and sociocultural and economic systems. A previous study reported significant differences in the development of MSDs arising from the work-life balance for employees in Malaysia (Maakip, Keegel, & Oakman, 2017). Muscle discomfort and muscle fatigue are the early symptoms that lead to WMSDs, such as disc herniation, damage to the ligaments and tendons, and others, which may lead to a permanent condition.

Prolonged standing can lead to MSDs among workers who work for extended working hours. Workers in the manufacturing industry in Malaysia tend to work continuously for 1-2 hours without properly designed workstations which can lead to physical and psychosocial hazards (Aziz *et al.*, 2015). An earlier study showed a strong association between the risk of MSDs and physical hazards compared to psychosocial hazards in Malaysia (Maakip *et al.*, 2017). Therefore, interventions should be implemented to reduce the exposure of workers to hazards and risks that are associated with occupational injuries, especially MSDs due to prolonged standing (Oakman *et al.*, 2016). In Malaysia, most employees adopt a poor working posture when performing their tasks because of the task requirements and workspace design. These awkward postures can lead to the development of MSDs, which are commonly found in the shoulder and back region among manufacturing workers (Zein *et al.*, 2015). Since the major risk factors of MSDs have been identified, i.e. prolonged work, awkward posture, and repetitive tasks, employers should introduce ergonomic interventions to reduce the possibility of exposure to MSDs. Ergonomic interventions have been considered to be a solution to MSDs by adjusting the work environment to fit the worker. Moreover, shortening the period of exposure to the hazard can reduce the occurrence of muscle fatigue and lead to increased productivity, as well as reduced costs of treatment for MSDs, and the loss of man-hours among workers (Aziz *et al.*, 2015).

Previous studies have found that ergonomic interventions, such as the use of anti-fatigue mats, shoe insoles, sloping surface, and footrests, have the potential to lessen the discomfort and pain, especially in the lower limbs (King, 2002; Sousa *et al.*, 2016; Wong & Callaghan, 2010). King (2002) stated that there were significant differences between the level of discomfort and the conditions of the floor, as standing on a softer surface was more comfortable and could reduce fatigue compared to standing on a hard surface. Mats and insoles provide more comfort for workers during prolonged standing (Gregory & Callaghan, 2008).

A study by Sousa *et al.* (2016) stated that wearing stable shoes in an upright position has the potential to increase the performance and effectiveness of the worker's system of postural control compared to standing barefoot. A study by Wong and Callaghan (2010) stated that a sloping surface significantly reduced low back pain during prolonged standing work. Several previous studies have also acknowledged the

effectiveness of anti-fatigue mats which reduced muscle discomfort, especially in the feet (Cham & Redfern, 2001; Zander *et al.*, 2004).

4. Conclusions

Prolonged standing is one of the crucial occupational risk factors that contributes to WMSDs among workers. Prolonged standing without sufficient rest can lead to muscle discomfort, and eventually to fatigue, especially in the back and lower extremities of the worker's body. Prolonged standing without any form of intervention can lead to MSDs among workers. Therefore, ergonomic interventions are essential to ensure the safety, welfare, and health of workers in the workplace.

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