


Risk Factors of Musculoskeletal Disorders (MSDs) among Kota Kinabalu, Sabah Firefighters: A Preliminary Study

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Received : April 11, 2023

Revised : April 13, 2023

Accepted : April 14, 2023

Online : July 6, 2023

Abstract

This study examined the relationship between predictors such as demographical aspect, task characteristics, physical demands, work-life balance, workstyle, psychosocial factors, and MSD among firefighters that was conducted at four fire stations under Kota Kinabalu Zone in Sabah (n=130 firefighters participated). The questionnaires used in the present study consist of a demographical aspect, task characteristics scale, physical demands scale, work-life balance scale, workstyle scale, Work Organization Assessment Questionnaire, Mental Health Scale, and musculoskeletal disorders (MSDs). The data was analysed with the use of SPSS version 22.0. The results show that task characteristics, physical demands, work-life balance, workstyle, and Mental Health Scale were significantly related to MSDs among Kota Kinabalu, Sabah firefighters. Firefighters did experience MSD due to overweighted equipment, lack of rest, accidents, and traumatic events like death among victims or teammates, which lead to depression and stress.

Keywords *Musculoskeletal Disorder, Mental Health, Stress, Work-Life Balance*

INTRODUCTION

The workplace is unequivocally a key determinant of the health and safety of employees since they spend much of their time at work. High-risk jobs are usually connected with health-related problems, and employees are exposed to workplace environment hazards (Lavender et al., 2000). Musculoskeletal disorders (MSDs) are also an outcome of high risk jobs. According to the Centers for Diseases Control and Prevention (CDC) 2020, musculoskeletal disorders (MSDs) are the injury of the muscles, nerves, tendons, joints, cartilage, and spinal discs. Whilst work-related musculoskeletal disorders (WMSD) are disorders caused by the work environment and the execution of tasks. As a result, work activities such as repetition were related to MSDs (Bernard, 1997). In conclusion, MSDs arise from the frequency of injuries to soft tissues and arise from the incompatibility between a task's physical requirements and the human body's physical capacity (Bernard, 1997).

Previous studies reported that approximately 62,000 to 100,000 firefighters are injured annually in the United States of America (USA), and most of the injuries happen during fire ground operations (Haynes & Molis, 2017). Several factors lead to these injuries, like ageing problems, muscular strength, fatigue, and external factors like unergonomic equipment and environmental factors (Kong et al., 2013). Physical fitness is also a factor that would save them from injury because the equipment worn by them during fire operations is relatively heavy (Colburn et al., 2017; Kong et al., 2012; Park et al., 2011). Whilst in Malaysia, the accident rate of firefighters who work for 24 hours shifts is higher than those who work 12-hour shifts (Osman et al., 2012). This is due to the full attention to reflection, cognition, and instant reaction toward emergency calls. Also, these firefighters are working in a high-risk environment with potential hazards of ergonomics risk factors like awkward postures, overweighted breathing self-contained breathing apparatus (SCBA), and more (Gentzler & Stader, 2010; Hansen et al., 2012).

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Nonetheless, most past research has been conducted on firefighters and engrossed in psychological well-being, which is the source of occupational stressors (SOOS) (Malek et al., 2009; Malek et al., 2010). On the other hand, musculoskeletal disorders and psychological health disorders were affected by the physical workload of firefighters (Malek et al., 2010), environmental hazards, and human factors (Lusa et al., 2010). Other than the problem affecting the musculoskeletal system, and psychological health, there is also some synergy effect from the work experience of firefighters where they are required to face some physical workload (Malek et al., 2010), which exposes them to environmental hazards and human factors (Lusa et al., 2010). According to past research, some hazards will cause musculoskeletal disorders and psychological health problems among firefighters, like the psychological demands toward the firefighters promoted to unergonomic working postures in firefighters (Roja et al., 2009).

Soteriades et al. (2019) investigated the relationship between occupational stress and musculoskeletal symptoms in Cyprus Fire Service and found that 11% of the firefighters were facing moderate to extremely severe stress, and 40% of the firefighters facing musculoskeletal disorders, back pain was the highest. Based on the multivariable-adjusted logistic regression models, work-related stress directly affects the musculoskeletal symptoms in firefighters by 50% after regulating age, smoking, and obesity problems. Furthermore, Katsavouni et al. (2014) studied the correlation between work-related physical risk factors and lower back pain and examined the contribution of exercise among 3,451 Greece firefighters. The result showed that 30% of respondents are facing lower back pain. It was proven by this study that there was a significant relationship between job position, work time, weightlifting, exercise, age, smoking, gender, and lower back pain. The result also has proven that lower back pain is more severe in rescuers than in drivers, and officers, in women, those who work more than 5 years, those who exercised with an average time of 1 to 5 hours a week, and those who usually lift more than 25 kg.

However, since most of the studies were conducted among firefighters in developed countries, it is argued that the predictors associated with MSDs among local firefighters in Malaysia would be similar to those of their counterparts in developed countries. Given the problem, the purpose of this study is to examine the relationship between risk factors (demography, task characteristics, physical demands, work-life balance, workstyle, and psychosocial factors) in affecting musculoskeletal disorders among firefighters in Kota Kinabalu, Sabah, one of the states in Malaysia.

RESEARCH METHOD

Sampling Method

A cross-sectional study was used to gather the data from a firefighter in 4 different fire stations (Kota Kinabalu, Lintas, Tuaran, and Penampang) registered under zone Kota Kinabalu, Sabah. A simple random sampling method was applied in choosing the respondents. 130 questionnaires were valid and used for the final analysis.

Research Questions

1. Is there a relationship between gender and ageing with the prevalence of musculoskeletal disorders (MSDs) among firefighters in Kota Kinabalu, Sabah?
2. Is there a relationship between risk factors (Physical demand, Psychosocial Factors, Work-life balance, Mental Health, Workstyle, Task Characteristics) with MSD among firefighters in Kota Kinabalu, Sabah?

Respondents

There were 250 sets of questionnaires distributed to the respondents, but there were only 130 of them valid for the final analysis. Among these respondents, there were 90.8% of them are

male and 9.2% are female. They were mostly aged between 31 and 40 (58.5%). The respondent's background is shown in Table 1.

Table 1. Respondents' Background

Variables	N (%)
Gender	
Male	118 (90.8)
Female	12 (9.2)
Age	
21-30	32 (24.6)
31-40	76 (58.5)
41-50	16 (12.1)
51-60	6 (4.8)

Research Instruments

Scale for Physical Job Experience

A 12-item scale was used to measure the job experience in exposure to job-related physical hazards with the use of a five-point scale point scale (1= never or hardly ever, 2=seldom, 3=sometimes, 4=often, 5= almost all the time) (Macdonald et al., 2007). Items included such questions as "Repeating a common task or action several times within every second or minute". The reliability for this scale was $\alpha = .844$, which shows a highly reliable scale.

Scale for Psychosocial Factors

Work Organization Assessment Questionnaire (WOAQ) The respondents were given the Work Organization Assessment Questionnaire (WOAQ) (Griffiths et al., 2006) used to find out the psychosocial factors in the workplace. This scale comprises 26 items (job control, job satisfaction, perceived stress level, and social support). This is a 5-point scale point scale (from 5=very good, 4=good, 3=not a problem, 2=slight problem, 1=major problem). One of the items was "Reward and recognition". The Cronbach's alpha for this scale was $\alpha = .939$.

Scale for Work-life balance

The work-life balance Scale was applied in this study to test the respondents' work-life balance level. This scale consists of a 22-item 5-point scale (from 1= strongly disagree to 5= strongly agree). One of the examples for this scale was "I spend working time to manage my family members". The Cronbach's alpha for this scale was $\alpha = .892$.

Scale for Mental Health

A mental Health Scale was used to measure the respondents' mental health levels. There were ten

items with a 5-point scale (point scale (0=never or hardly ever, 1=seldom, 2=sometimes, 3=often, 4=almost all the time). One of the items was "Easily feeling board?". The Cronbach's Alpha was $\alpha=.940$.

Scale for Workstyle

The workstyle scale was used to assess the workstyle of the respondents for the past 6-months. The questions of this scale were rated by a 5-point Likert scale from 1 never to 5 very often. One of the items was, "I did not attend work because my colleagues will look down on me.". The Cronbach's alpha was $\alpha=.934$.

Scale for Task Characteristics

Task characteristics of this research were measured by the Experience of Work and Life Circumstances Questionnaire developed by (Van Zyl & Van der Walt, 1991). The original subscale comprised 14 items but was reduced to 10 by expert opinion. These items were rated with a 5-point Likert scale ranging from 1 very low to 5 very high. One of the questions was "Work Shift". The Cronbach's alpha for this scale is $\alpha=.798$

Scale for MSDs

To identify the prevalence of MSDs, the respondents were asked to self-rate the musculoskeletal discomfort experience for the past six months with a yes or no response (Oakman et al., 2014). Next, the respondents who answered "yes" are required to self-rate the frequency and the level of severity of discomfort from 5 areas of the body (neck and shoulder, hand and fingers, arms, middle to lower back, hip, bottom, legs, and feet). The level of frequency of MSDs was recorded on a scale from 0=never to 4=almost always, and the severity of MSDs from 1= from mild to 3=severe. For the study, the scale of Cronbach's alpha was $\alpha=.878$

Data Analysis

All the data will be gathered and analysed quantitatively. Reliability and validity will be carried out to test the validation of the scale used. The relationship of demographic, task characteristics, physical demand, workload, workstyle, and psychosocial factors with Musculoskeletal Disorder (MSD) will be using Pearson Correlation and regression test.

FINDINGS AND DISCUSSION

Respondents' Background and Prevalence of MSDs

Table 2 shows the results of the Person's Correlation between Respondents' Background and the Prevalence of MSD. The results proved that gender and age show no relationship with the prevalence of MSDs among the respondents. This is because the score of correlation between gender and age with the prevalence of MSDs are ($r=0.50$, $p>0.05$) and ($r=.084$, $p>0.05$), respectively. There is a positive relationship between respondents' backgrounds and the prevalence of MSDs.

Table 2. Relationship between respondents' background and prevalence of MSDs

Variables	Gender	Age	Prevalence of MSDs
Gender	-		

Age	-0.44	-	
	(.622)		
Prevalence of MSDs	.050	.084	-
	(.573)	(.342)	

Risk Factors (Job Experience, Psychosocial Factors, Work-life balance, Mental Health, Workstyle, Task Characteristics) and Prevalence of MSDs

Table 3 shows the relationships between risk factors (Job Experience, Psychosocial Factors, Work-life balance, Mental Health, Workstyle, and Task Characteristics) and the Prevalence of MSDs. Among these factors, only psychosocial factors show no significant relationship with the prevalence of MSDs ($r=.061$, $p>0.05$). On the other hand, Job Experience, Work-life balance, Mental Health, Workstyle, and Task Characteristics positively correlated with the prevalence of MSDs. Among these factors, workstyle factors showed the highest correlation value toward the prevalence of MSDs ($r= -.345$, $p<0.05$).

Discussion

The Relationship between Gender and Ageing with MSDs (results in Table 2)

One of the purposes of this research is to determine the prevalence rate of MSD among firefighters in zone Kota Kinabalu. The total prevalence of MSDs was 32.3% for both males and females. Women were usually excluded from studies regarding firefighters because the number of females among firefighters is too low (Ngem et al., 2017). Although our sample included 12 females, only three reported suffering from MSDs; it is essential to include females because firefighting is male-dominated. Using a small sample size will lead to unstable prevalence predictions (Ngem et al., 2017). Although the number of female respondents in this study is low, the researchers still included them to fulfil the minimum requirement for the study's sample size. Moreover, the researchers wish to increase the awareness of the public toward the health issues of female workers. According to Maakip et al. (2020), female workers in Malaysia face a huge number of musculoskeletal disorder problems as they are working full time and participating in numerous household tasks.

Furthermore, Watkins et al. (2019) stated that more than 9-23% of women firefighters suffer from MSDs, including pain in upper and lower limbs and back injuries. The prevalence of MSDs among female firefighters are usually caused by lower muscle strength compared to male because both genders had to carry the same equipment during their missions, for example, personal protective equipment and breathing apparatus, which weighed around 23kg (Roy & Lopez, 2013; Vu et al., 2017; Watkin et al., 2019).

In this study, the research found that ageing problems had become a factor affecting the prevalence of MSDs. Ageing is a controversial factor in affecting the prevalence of MSDs. In this study, the results show that the prevalence rate of MSDs is affected by ageing problems. Ngem et al. (2017) also stated that the average firefighter aged more than 45.4 years old tends to suffer from multi-regional MSD, and firefighters aged 42 years or older have a higher frequency of suffering discomfort in the neck and upper and lower limbs than those who are younger than 42 years old. Therefore, these researchers suggested that the evaluation for the MSDs among firefighters should be done early to find any serious injury in the upper extremity.

Table 3. The relationships between risk factors (Physical Demands, Psychosocial Factors, Work-life balance, Mental Health, Workstyle, Task Characteristics) and Prevalence of MSD.

Variables	Jobs Experience	Psychosocial Factors	Work-life Balance	Mental Health	Workstyle	Task Characteristics	Task Characteristics
Job Experience	-						
Psychosocial Factors	-.063 (.473)	-					
Work-life Balance	.379** (.000)	-.295** (.001)	-				
Mental Health	.288** (0.001)	-.331** (0.001)	.588** (.000)	-			
Workstyle	.404** (.000)	-.348** (.000)	.473** (.000)	.660** (.000)	-		
Task Characteristics	.364** (.000)	-.161 (.067)	-.282** (0.001)	.377** (.000)	.492** (.000)	-	
Prevalence of MSD	-.161 (.067)	.061 (.494)	-.161 (.067)	-.212* (.016)	-.345** (0.000)	-.271** (.002)	-

**Correlation is significant at 0.01 level. Sig. (2-tailed). () =p-value

On the other hand, Cloutier et al. (2000) stated that old firefighter individual tends to experience less work-related injury because these individuals have more experience in avoiding accident than younger ones. Cloutier (1994), Cru and Dejours (1983), to Dejours (1993) supported this statement by stating that older firefighters are highly experienced in the development of strategies for protecting themselves during their tasks.

Risk Factors Affecting MSDs

Task Characteristics and MSDs

Task Characteristics at the workplace are one of the risk factors contributing to musculoskeletal disorder (MSD) among firefighters in Kota Kinabalu. This is in line with Jeon et al. (2013) finding that found work demands and physical environment are some of the risk factors leading to musculoskeletal disorders. Physical demands factors such as firefighters being forced to use some unergonomic position in conducting a rescue mission and the protective gear worn by the firefighters weighted around 24 kg, which increases the intensity and pressure on the musculoskeletal to support the movement and action of the firefighters.

Psychosocial Factors and MSDs

There was an insignificant relationship between the psychosocial factors and the prevalence of MSDs among the firefighters in zone Kota Kinabalu. Hartvigsen et al. (2004) also stated that no significant relationship exists between psychosocial factors and the prevalence of MSDs. On the other hand, Linton (2001) stated that there is a strong relationship between psychosocial work factors and back pain. Next, Oakman et al. (2014) stated that the only focus on psychosocial factors will not completely relate to the prevalence of MSDs. Therefore, psychosocial factors must be associated with other factors, such as stress, to show a complete relationship with the prevalence of MSDs.

Work-life Balance and MSDs

Previous studies proved that work-life balance will affect the prevalence of MSDs (Maakip et al., 2015; 2017). In addition, a study in Korea also arrived at similar findings (Wee, 2015). This stated that work-life imbalance usually causes pain in the lower back and upper and lower limbs. However, the present study found no relationship between work-life balance and the prevalence of MSDs. This is because most of the respondents were men. According to past research, women experience more imbalance between work and life (Duxbury et al., 1994). Most women prioritise balancing their family responsibility with their job demands (Gutek et al., 1991), unlike men, who compromise more easily between work and life than women (Tenbrunsel et al., 1995).

Mental Health and MSDs

The result shows that mental health negatively affects the prevalence of MSDs among the firefighters in zone Kota Kinabalu ($r = -.212, p < 0.05$). This shows that the lower the mental health score, the higher the prevalence of musculoskeletal disorders among firefighters. Past research also proved that mental health affects the prevalence rate of MSDs among firefighters. This is because psychological illness like depression often leads to muscle pain among employees. According to Smedley et al. (2003), occupations such as nurses who face psychological illness tend to have neck and shoulder pain. This is due to the pressure caused by depression that will elevate muscle tension, reduce oxygen and blood flow, causing the individual to feel pain in their muscle. There were several past studies have stated that muscle pain and depression usually happen simultaneously that stated that individuals who suffer from depression have a higher chance of suffering muscle pain at the same time (Gureje et al., 2001).

In addition, Jeon et al. (2013) also stated that work-related stress and the prevalence of MSDs, especially back pain among firefighters in Korea, are interrelated. Jeon et al. (2013) also stated that employees in the fire department tend to have 2.1 times higher levels of depression than workers in the business administration department. They also stated that firefighters with MSDs tend to suffer 1.86 times higher levels of depression than those without MSDs.

Workstyle and MSDs

The workstyle negatively correlated with the prevalence of MSDs among firefighters in Kota Kinabalu. Maakip et al. (2016) also stated that the work style among Malaysian workers is negatively associated with MSDs. The work style of the firefighters was also one of the predictors associated with musculoskeletal problems among firefighters in Kota Kinabalu. One reason contributing to this finding is that firefighters must be extremely fast in their reaction to reduce the casualty during a rescue mission. Apart from rescue missions, the training of the firefighters and the maintenance of their vehicles and gears also required high intensity of muscle strength. Fonseca et al. (2010) suggested that neck, shoulder, or upper and lower back pain is affected by physical demands (carrying heavy things, unergonomic position, and more), dangerous training, and restless working style.

CONCLUSIONS

This research was the first to examine the relationship between risk factors (Physical Demands, Psychosocial Factors, Work-life balance, Mental Health, Workstyle, and Task Characteristics) and the prevalence of MSD. The study's results proved that mental health, workstyles, and task characteristics negatively correlate with the prevalence of MSDs. While the ageing problem and gender positively correlated with the prevalence of MSDs. The results proved that male firefighters tend to suffer more from MSDs than female firefighters. In addition, there is no significant relationship between psychosocial factors and work-life balance toward the prevalence of MSDs. Psychosocial factors will only affect the prevalence of MSDs when the presence of other factors, such as work-related stress. Work-life balance shows no relationship with MSDs because firefighter is a dominant male occupation, as males tend to compromise more toward their careers.

LIMITATION & FURTHER RESEARCH

The study provides a turning point for future research, particularly in Sabah, to be conducted in relation to this occupational group (i.e., firefighters) in examining other risk factors associated with MSD. Furthermore, a qualitative and/or mixed-method study should be undertaken to investigate the risk factors associated with MSD and understand the strategies used in minimizing MSD at the workplace among firefighters. Nevertheless, this preliminary study in Kota Kinabalu, Sabah, could assist the relevant authorities in highlighting the risk factors associated with MSD that need to be taken into consideration when developing any intervention to minimize health and psychological-related issues at the workplace.

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