

THE EFFECT OF ERGONOMICS AND PSYCHOSOCIAL RISK FACTORS ON
MUSCULOSKELETAL COMPLAINTS AND PSYCHOLOGICAL HEALTH AMONG FIRE
FIGHETRS

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AMONG FIRE FIGHTERS

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To my parent, siblings and friends

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May our heart written on HIS bless. Amin.

ABSTRACT

Fire fighters were exposed to ergonomics risk factors and psychosocial risk factors when acting as rescuers to victims of natural disasters, fires and accidents. These events would eventually lead to health-related problems such as musculoskeletal complaints and psychological health. Hence, the purpose of this research is to study the effect of ergonomics risk factors and psychosocial risk factors on the musculoskeletal complaints and psychological health among fire fighters. The total respondents participated in this study were 184. A self-administered questionnaire was used for data collection. The questionnaire consists of ergonomics risk factors which assessed by Dutch Musculoskeletal Questionnaire (DMQ) and psychosocial risk factors was employed the Job Content Questionnaire (JCQ). Meanwhile, musculoskeletal complaints were evaluated by adapted Standardized Nordic Questionnaire (SNQ) and psychological health was measured by General Health Questionnaire (GHQ-12). The results from multiple logistic regression indicated that not enough room at above to perform work properly significantly affect the development of neck complaints. Meanwhile, lifting a load that is hard to hold and slip or fall during work significantly affects the development of shoulder and back complaints. Other risk factor such as difficulty in exerting enough force because of uncomfortable postures was found to be significantly affecting the development of back complaints. As for the psychosocial risk factors, the psychological demand showed significant effect on lower limb. Findings from this study suggested for future research should consider for bigger respondent. As for the organization, the Fire Department should be more aware of the importance of physical fitness and being mentally strong to deal with any stressful condition that may occur during firefighting and rescue.

ABSTRAK

Pegawai bomba adalah secara semulajadi terdedah kepada faktor-faktor risiko ergonomik dan faktor-faktor risiko psikososial terutamanya apabila mereka berfungsi sebagai penyelamat kepada mangsa-mangsa bencana alam, kebakaran dan kemalangan. Situasi-situasi yang mereka hadapi ini akhirnya akan membawa kepada masalah kesihatan seperti sakit otot tulang dan kesihatan psikologi. Oleh itu, tujuan kajian ini adalah untuk mengkaji kesan daripada faktor-faktor risiko ergonomik dan psikososial terhadap sakit otot tulang dan kesihatan psikologi di kalangan pegawai bomba. Jumlah responden yang telah mengambil bahagian dalam kajian ini ialah 184. *Self-administered* soal selidik telah digunakan untuk mengumpul data. Soal selidik yang terdiri daripada faktor-faktor risiko ergonomik dinilai dengan *Dutch Muskuloskeletal Questionnaire (DMQ)* dan faktor-faktor risiko psikososial telah menggunakan *Job Content Questionnaire (JCQ)*. Sementara itu, sakit otot tulang telah dinilai dengan menggunakan *Standard Nordic Questionnaire (SNQ)* yang telah diubahsuai dan kesihatan psikologi pula diukur oleh *General Health Questionnaire (GHQ-12)*. Keputusan daripada regresi logistik daripada kajian ini menunjukkan bahawa ruang yang sempit di bahagian atas untuk melakukan kerja dengan betul mempunyai kesan yang signifikan kepada berlakunya sakit otot di bahagian leher. Sementara itu, faktor mengangkat beban yang sukar untuk dipegang dan tergelincir atau jatuh semasa bekerja adalah signifikan dalam memberi kesan kepada berlakunya sakit otot di bahagian bahu dan belakang. Faktor risiko lain seperti sukar untuk menggunakan sepenuh tenaga disebabkan kedudukan badan yang tidak selesa juga memberi kesan yang signifikan kepada sakit otot dibahagian belakang. Selain daripada itu, faktor-faktor risiko psikososial iaitu permintaan psikologi menunjukkan kesan yang signifikan pada anggota badan dibahagian bawah iaitu antara punggung sehingga tapak kaki. Penemuan-penemuan daripada kajian ini mencadangkan supaya kajian yang akan datang seharusnya mengambil kira jumlah responden yang lebih besar. Bagi organisasi Jabatan Bomba, mereka perlu menitikberatkan kepentingan kecergasan fizikal dan mental dikalangan pegawai bomba dalam menangani sebarang tekanan yang mungkin berlaku semasa kerja-kerja menyelamatkan dan memadam kebakaran.

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LIST OF ABBREVIATIONS

EMS	emergency medical service
MSDs	musculoskeletal disorders
SOOS	sources of occupational stressors
JCQ	Job Content Questionnaire
GHQ-12	12-items General Health Questionnaire
JBPM	Jabatan Bomba dan Penyelamat Malaysia
PPDA	Unit of Air, Water Rescuer Team
K-9	Unit of Detector
RIM	Unit of Rapid Intervention Motorcycle
EMRS	Emergency Medical Rescue Service
HAZMAT	Hazardous Material Team
ER	Ergonomics risk
MSCs	Musculoskeletal complaints
VDT	visual display terminal
DASS-21	Depression Anxiety Stress Scale
JDCS	Job Demand-Control-Support
DMQ	Dutch Musculoskeletal Questionnaire
BMI	Body Mass Index
SOCISO	Social Security Organization

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CHAPTER 1

INTRODUCTION

1.1 Introduction

High risk jobs often associated with health-related problems in the workplace because they are exposed to the environmental hazards (Lavender et al. 2000). According to Baker (2013) each population of job has various potential hazards. For example, agriculture and manufacturing are vulnerable to the ergonomics risk factors, biological, chemical and psychosocial risk factors. In addition, the public service sector such as health care workers, ambulance personnel, emergency medical services and fire fighters are also may acquire similar exposure (Baker 2013). These factors will be the contributors to the workers' health such as musculoskeletal complaints, psychological health, injuries and accidents at the workplace (Niu 2010).

According to the data released by the European Occupational Diseases Statistics in 2005, musculoskeletal complaints covered about 38.1% of the total European occupational disease (Neurologic diseases, respiratory diseases, diseases of sensory organs, skin diseases, cancers and infections) (Schneider and Irastorza 2010). Meanwhile, psychological health has slightly overtaken musculoskeletal problem and

lower back pain in ten European countries. Due to this problem, it causes long-term absence in the most multinational companies (MERCER 2010).

Generally, ergonomics risk factors can be categorized as a repeated exposure to unnatural postures and unnatural environment, wrong design of work station, tools and task (Raemy 2008). Ergonomics has been applied in many workplaces. However, for certain types of job with high risk, the ergonomics risk factors may occur to occupation at a specific task that requires extended reaches or overhead (Lavender et al. 2000), articular postures, effort, repetitive work, working in a steady static postures and vibrations (Lanfranchi and Duveau 2008). Similarly to surgeons who are required to execute fine repetitive movements, sitting and standing while performing their work tasks (Ruitenburt et al. 2012). These posture stress and biomechanical loads with repetitive exposure will eventually lead to musculoskeletal complaints, low back pain, psychological distress and other health related outcomes (Hansen et al. 2012; Tamrin et al. 2007).

Meanwhile, another potential hazard that often occurs at the workplace among workers is the psychosocial risk factors. According to Moon and Sauter (1996) the psychosocial risk factors are also known as non-biomechanical that comprised of anything from personality to job organization. Jobs with high risk evidently face psychosocial risk factors such as psychological demands (Pencis et al. 2009) job satisfaction (Malek et al. 2010), work cohesion (Landen and Wang 2010), social support (Beaton et al. 1997) and job control (Aasa et al. 2005).

Psychosocial factors happen to most professions such as office workers, automotive staff, physicians and workers in the agriculture industry (Bongers et al. 2006; Bongers et al. 2002; Bos et al. 2004; Bos et al. 2007; Edimanshah et al. 2007; Hauke et al. 2011; Seyed Abolfazi and Indra Devi 2009). There is an evident that demonstrates the psychosocial risk factors being subjected to have an interaction with physical and psychological work which are associated with musculoskeletal

complaints, psychosocial distress such as anxiety, depression and stress (Malek et al. 2010).

Previous study denoted that the increasing occurrence of musculoskeletal complaints and psychological health have led to early retirement and poor job performance (Hansen et al. 2012). These should be minimized especially for critical occupational services such as emergency medical service (EMS) (Lavender et al. 2000). Thus, the investigation of prevalence and risk factors especially among the fire fighters may lead to better physical and psychological health. For instance, the enhancement of task performance towards each of them as well as the management as a whole may be resulted from such intervention. In order to prescribe an appropriate intervention, the determination of risk factors should be investigated and should be taken as the first step.

Therefore, the interest of this study is to identify the potential work hazards among fire fighters that focusing on the range of ergonomics risk factors as well as psychosocial risk factors.

1.2 Problem Statement

Fire fighters are part of the medical emergency response (Angle 2005). They act as rescuers to victims of natural disasters, fires and accidents (Subramaniam et al. 2010). The responsibilities undertaken in doing rescue work will be able to determine the property loss, public safety and fatalities (Malek et al. 2010). In rescue activities, they are often exposed to the hazards (Beaton and Murphy 1993). According to Angle (2005), a total of 39,390 cases of strain, sprain and muscular pain in United States was reported due to responding to or returning from incidents, fireground, non-fire emergency, training and other on-duty tasks.

In Malaysia, according to Sharifah et al. (2012), the incidents rates of fire fighters that working on 24 hour shift were higher compared to those who work on 12 hour shift. It was due to the requirement to keep prepared to reflect, think and react instantly while having emergency call. Apart from that, as a rescuer, a fire fighter is at risk of the exposure to potential hazards of ergonomics risk factors such as an awkward postures, manual handling and biomechanical loads (Gentzler and Stader 2010; Hansen et al. 2012) as well as the psychosocial risk factors (Malek et al. 2010). This happens because of their nature of work in which will lead to the effect on musculoskeletal complaints and psychological health problems in some extent (Beaton et al. 1997).

According to Huang et al. (2002), the health-related problems at the workplace will be contributed by factors called stressors or exposure such as ergonomics risk factors and psychosocial risk factors. These two factors can trigger an acute response that typically includes a cascade of physiology. When this response occurred persistently, the onset of symptoms may occur which eventually will develop health-related outcome such as musculoskeletal complaints and psychological health.

The problems of ergonomics risk factors of fire fighters have been shown in Gentzler and Stader (2010). They indicated that lower back problem has been the most problematic area especially when the fire fighters are in a high degree of bending their body in the trunk. In other cases, injuries around the neck, back, shoulders, arms, knees and ankles have occurred more often to biomechanically demanding activities such as standing, lifting/carrying, pushing/pulling, kneeling/squatting, stooping, jumping and working in a twisted posture (Bos et al. 2007).

Apart from what is happening to the musculoskeletal system, psychological health is also affected due to the synergy effect when fire fighters experience demanding physical workloads (Malek et al. 2010), expose to the environmental

hazards and human factors (Lusa et al. 2010). In the case of psychosocial factors, previous study demonstrated that this particular potential hazard may cause musculoskeletal complaints and psychological health problem among fire fighters. For example, the psychological demands toward fire fighters have contributed to the compulsive working postures (Pencis et al. 2009). Constant repetition of arm movements, on the other hand, may result in fatigue and changes in the muscle tone. In the same study, it is also revealed that the psychological demand may influence the physical load significantly whereby excessive overload could lead to work-related musculoskeletal complaints under different workload conditions.

Other than psychological demand, the psychosocial risk factors that frequently occurred along with fire fighters includes social support (Beaton et al. 1997), job control (Lourel et al. 2008), and job insecurity (Beaton and Murphy 1993). For example, in the study upon social support and job control, co-worker and supervisor support remained important especially during emergency rescue (Subramaniam et al. 2010). Meanwhile, job insecurity issue was raised due to its relation in terms of the career longevity. It has been stated by Beaton and Murphy (1993), that the average career of professional fire fighters' career are less than four years. Overall, these psychosocial risk factors discovered inclusive in the sources of occupational stress particularly for the job of fire fighters. Additionally, two researchers found that these sources of stress contribute to health related outcome (Beaton et al. 1996; Malek et al. 2010).

Based on the discussion above, study on the effect of ergonomics risk factors on musculoskeletal complaints is clearly discoursed among fire fighters. However, studies on the similar risk factors and psychosocial risk factors on psychological health are still uncommon as it is discussed extensively towards other occupations (Bongers et al. 2006; Bongers et al. 2002; Hauke et al. 2011; Kausto et al. 2010; Lanfranchi and Duveau 2008).

In Malaysia, there were two studies conducted on the effect of psychosocial risk factors and musculoskeletal complaints as well as the prevalence of MSDs in several occupations such as officers and commercial vehicles drivers (Seyed Abolfazi and Indra Devi 2009; Tamrin et al. 2007). However, most of the studies on fire fighters were focused more on their psychological well-being that is being affected by the sources of occupational stressors (SOOS) (Malek et al. 2009; Malek et al. 2010). It is also revealed that fire fighters in Malaysia have similar norm data ranking of sources of occupational stressors (SOOS) with US sample where the 'Job skill concerns' component was the top and the lowest component was 'Discrimination' (Malek et al. 2010). All the components have being evaluated as part of psychosocial risk factors specifically towards fire fighters and paramedics.

Given the importance of the issues, the researcher intended to study the effect of ergonomics and psychosocial risk factors on the musculoskeletal complaints and psychological health among fire fighters in Malaysia.

1.3 Purpose of the Study

The purpose of this study is to study the association of ergonomics risk factors and psychosocial risk factors on the musculoskeletal complaints and psychological health among fire fighters.

1.4 Research Objective

1. To identify the level of exposure of ergonomic and psychosocial risk factors among fire fighters.
2. To identify the prevalence of musculoskeletal complaints and psychological health among fire fighters.
3. To identify the effect of ergonomics risk factors on musculoskeletal complaints among fire fighters.
4. To identify the effect of psychosocial risk factors on musculoskeletal complaints among fire fighters.
5. To identify the effect of ergonomics risk factors on psychological health among fire fighters.
6. To identify the effect of psychosocial risk factors on psychological health among fire fighters.

1.5 Hypothesis of the Study

H1: There is no significant effect of ergonomics risk factors on musculoskeletal complaints among fire fighters

H2: There is no significant effect of psychological demand on musculoskeletal complaints among fire fighters

H3: There is no significant effect of job control on musculoskeletal complaints among fire fighters

H4: There is no significant effect of social support on musculoskeletal complaints among fire fighters

H5: There is no significant effect of job insecurity on musculoskeletal complaints among fire fighters

H6: There is no significant effect of ergonomics risk factors on psychological health among fire fighters

H7: There is no significant effect of psychological demand on psychological health among fire fighters

H8: There is no significant effect of job control on psychological health among fire fighters

H9: There is no significant effect of social support on psychological health among fire fighters

H10: There is no significant effect of job insecurity on psychological health among fire fighters

1.6 Significance of the Study

Previous studies have revealed that ergonomics risk factors and psychosocial risk factors have contributed to the occurrence of health problems towards employees, including the fire fighters. The health problems often involved musculoskeletal complaints and mental health.

Thus, the significance of this study is it will provides information to the Fire and Rescue Department of Malaysia about the ergonomics risk factors and psychosocial risk factors and its role in the development of musculoskeletal complaints and psychological health. Understanding the causes of these problems by identifying factors in relation to it will produce an implementation of intervention to minimize the risk factors.

For example, the ergonomics risk factors and psychosocial risk factors that produce high risk musculoskeletal complaints can prescribe to physical training, strengthening, flexibility and range of motion and stretching as well as in terms of addressing and maybe altering the biomechanical ergonomic work demands

Other than that, this study could provide knowledge to the Fire and Rescue Department of Malaysia of the importance to have an organization with a working environment that is conducive in terms of the psychology, organizational support and systems and methods of working. This study will also provide knowledge to the fire department or future researcher on the importance of recovery management after returning from rescue operation and work shift.

Furthermore, the results from this study will provide better evaluation of on the effects of physical demands and psychosocial work factors on psychological health and physical health faced by fire fighters. The evaluation and implementation of further preventive measures and advice based on the results of this study may be effective in reducing the possible risks.

1.7 Limitation of study

This study has several limitations. First, this study is a cross-sectional design in which data was collected at one point within the period of study. Consequently, this may not be able to capture the developmental issues on causal connection between the variables of interest.

Secondly, this research will be conducted on fire fighters in the Fire and Rescue Department of Malaysia. Thus, the results from data collection could not be used by other respondents or groups of respondents.

1.8 Definition of Terms

1.8.1 Conceptual and Operational Definition

1.8.1.1 Fire fighters

Fire fighters can be defined as the persons who respond to fire alarms, medical emergency and other calls to protect both life and property that participate in fire prevention, training and station and equipment maintenance activities (Fire 2012). According to Angle (2005), fire fighters is a personnel that provide a full range of fire protection services including advanced life support at a first responder level.

In this research, fire fighters are referring to those who involved in reaction to emergency response that functioning in the department of rescue and firefighting operation in Johor Bahru.

1.8.1.2 Ergonomics risk factors

Ergonomics risk factors can be defined as the nature of biomechanical risk factors of workers that include the excess force, efforts, repetitive work, heavy load and awkward posture (Hansen et al. 2012; Kirkhorn et al. 2010). Other than that, ergonomics risk factors also can be referred as ergonomics stressors that involve hazards related to work-tasks and workstation (Moon and Sauter 1996).

In this research, ergonomics risk factors is defined as a musculoskeletal workload and the association of potential hazardous in the working fire fighters

condition that exposed to the risks such as lift heavy load, lift in awkward posture, not enough room around and above to perform work, perform short, but maximum force-exertion, lift a load that hard to hold, make sudden and unexpected movements, difficulty to exert force because uncomfortable postures, too few facilities to lean on, and slip or fall during work (Hildebrandt et al. 2001).

1.8.1.3 Psychosocial risk factors

The definition of psychosocial risk factor can be characterized as for the most part on the psychological and social structure of the work situation (Karasek et al. 1985). According to Moon and Sauter (1996), they defined psychosocial risk factors as any factor or condition whether individual or work-related that contributes to the stress process. Other study refers psychosocial risk factors to the organizational dimensions underlying work such as management methods, production methods and any form of contribution between the individual and organization (Lanfranchi and Duveau 2008).

In this particular research, the focal point of psychosocial risk factors have four dimensions as extracted from the Job Content Questionnaire (JCQ) developed by Karasek et al (1985). It will be represented by four variables that include social support, job control, psychological demands and job insecurity.

1.8.1.4 Social Support

The conceptual definition of social support is defined as networks related to both the number of a person's social contacts and their quality including emotional support and confiding support (Hemingway and Marmot 1999). Meanwhile, according to Lanfranchi and Duveau (2008), defined social support as the help and recognition of colleagues and hierarchical superiors. Another study defined social

support as a recognition and respect, co-worker support, social relation, relationship at work, external support and supervisory support (Hartvigsen et al. 2004).

In this research, the social support refers to the social relationship from co-workers' and supervisors' support at the workplace. It will be reflected one of the dimension in the Job Content Questionnaire (JCQ) by Karasek et al. (1985).

1.8.1.5 Job Control

The definition of job control was recognized as decision latitude (Kausto et al. 2010). The decision latitude can be defined as the combination of job decision-making authority and use of skills on the job (Edimanshah et al. 2007). Meanwhile, other study defined job control as a concept of decision-making autonomy and control as well as the possibility of using one's skills and developing new ones in one's job (Lanfranchi and Duveau 2008).

In this research, definition of job control can be divided into two categories: skill discretion and decision authority. In this study, skill discretion will be measured to assess the level of skills and creativity required on the job and the flexibility permitted to the worker in deciding what skills to employ when performing the task. As for the decision authority, it refers to the possibility of workers to make decision about their work (Karasek et al. 1998). It will be assessed by using Job Content Questionnaire (JCQ) (Karasek et al. 1985).

1.8.1.6 Psychological Demands

The psychological can be defined as the connection with the mind or the way that it works while demand can be defined as a strong request or order that must be

obeyed (Miranda 2007). Thus, psychological demand can be understood as how hard workers work mentally (Karasek et al. 1998). Other researchers defined psychological demand as the psychological load that represented by the quantitative and qualitative work demands which involve the level of concentration, management of interruptions and the unexpected (Lanfranchi and Duveau 2008).

In this research, the definition of psychological demand refers to the requirement of the fire fighters' mental capabilities to cope with the job stress. The developed Job Content Questionnaire (JCQ) by Karasek et al. (1985) will be employed to measure psychological demands.

1.8.1.7 Job Insecurity

The definition of job insecurity can be referred as a perceived powerlessness to maintain the desired continuity in a threatened job situation (Greenhalgh and Rosenblatt 1984). On the other hand, Beaton and Murphy (1993) define job insecurity as an apprehension regarding personal safety that concern about personal injuries, exposure to increased personal risk and threats to individual safety. Meanwhile, Karasek et al. (1998), stated that job insecurity as a fear of job insecurity and limited future career development possibilities.

In this research, the definition of job insecurity refers to the threat of steadiness of work, job security and future layoff of employees. It will be evaluated by employing a developed questionnaire of Job Content Questionnaire (JCQ) Karasek et al (1985).

1.8.1.8 Musculoskeletal Complaints

Musculoskeletal complaints can be defined as a situation of being dissatisfied in a group of conditions that involve the muscles, tendon, skeleton, cartilage, ligaments and nerves (Luttmann et al. 2003; Miranda 2007). According to Kirkhorn et al. (2010), they defined musculoskeletal complaints as a non-traumatic disorders of the soft tissues of the musculoskeletal system that can be aggravated by work activities.

In this research, musculoskeletal complaint refers to the symptom of discomfort in body region: upper limb (neck, shoulder, elbows, hands/wrists, upper back and lower back) and lower limb (hips, knees and ankle/feet). It will be determined by using the standardized Nordic questionnaire (Kuorinka et al. 1987).

1.8.1.9 Psychological health

The psychological health can be defined as the connection with the mind or the way it works whereas health can be defined as a good or bad condition of someone's body or mind (Miranda 2007). Alternatively, Manninen et al. (1997) indicated that psychological health represents the normal consequences of stressful life events or illnesses that produce subjective experience. Meanwhile, another study refers psychological health to our cognitive, and/ or emotional well-being that ranging on how we think, feel and behave (Nordqvist 2012).

In this particular research, the definition of psychological health refers to the psychological distress which define as a combination of symptoms that range from depression and general anxiety to personality traits, functional disabilities and behavioural problems (Drapeau et al. 2012). It will be determined by using 12-items General Health Questionnaire (GHQ-12) (Goldberg et al. 1997).

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