International Journal of Psychosocial Rehabilitation, Vol. 23, Issue 02, 2019
ISSN: 1475-7192

A Study on Contributing Factors to Body Regions' Discomfort among Public Sector's Employees

Irma Wani Othman, Herlina Jupiter and Norazah Mohd Suki

Abstract--- *Assessing the current ergonomic practices information that will influence employees' body regions is the purpose of this study. A survey questionnaire was distributed to staff in public sectors in the Peninsular Malaysia. The Statistical Package for Social Science (SPSS) version 21.0 was used for data analysis. Correlations and regression analysis was used to analyze the data. The results showed significant relationship between work station, job control, job demand, physical environment, break time, social support and body regions' discomfort. Besides that, multiple regression analysis showed that only 18.8 percent of the variance in the body regions' discomfort has been significantly explained by two variables (human factors and work environment). Thus, another 81.2 percent of variance explained by other variables like physiological, behavioral and motivational variables that are important in explaining the body regions' discomfort that have not been considered in this study. It is suggested for future study to survey these variables in other industries. It is very essential to build perception on the importance of ergonomics amongst the workforce in Malaysia as such for this could lead into a higher organizational productivity and efficiency.*

Keywords--- *Human Factors, Work Environment, Body Regions' Discomfort*

I. INTRODUCTION

In Malaysia, Chandrasakaran, Chee, Rampal and Tan (2003) in their study on the Prevalence of MSD: The problems and risk factors among529 women workers in semiconductor found that83.4percenthad musculoskeletal disorders (MSD) symptoms with three most common MSD problems that were back pain(57.8%), lower leg (48.4%), and shoulder (44.8%). Three significant associations were found. First was on standing too long with upper and lower leg pain. The second was on prolonged sitting with neck and shoulder pain. Lastly on extensive bending with shoulder, arm, back and upper leg pain. Thus, the research indicated an obvious correlation among work-related musculoskeletal pain and the lengthy hours that are spent in the specific postures and movements.

Study by Mazlan, Win Kye, and Rampal (2000)among batik workers in Kelantan, Malaysia found that60.2 percent of employees faced musculoskeletal symptoms at work. The most common pain was shoulders (41.0%), lower back (34.4%), and ankle(34.4%). Thus, in preventing these musculoskeletal symptoms, it is crucial in recovering both ergonomic and psychosocial environments in organizations.

Furthermore, in fulfilling the employer's responsibilities by ensuring the employees to have a safe workplace, industries, including public sectors, should comply with the Occupational Safety and Health Act 1994. The third objective of the said act mentioned: "to promote the work environment for employees that conform to the

Irma Wani Othman, Herlina Jupiter and Norazah Mohd Suki, Dr. of Public Health, School of Business Management, Universiti Utara Malaysia 06010 Sintok, Kedah Darul Aman, Malaysia. Email: norazimah@uum.edu.my

Received: 06 Feb 2019 | Revised: 07 Mar 2019 | Accepted: 30 Mar 2019

requirements of their physiological and psychological" is a special focus on the ability of ergonomic in improving the safety and health of employees. Even though the employers are bind by this regulation, the statistics report by Social Security Organization (SOCSO) shown that in2007, there were 921 cases of exposure and contact with extreme temperatures, 3,380 cases of over-exertion or strenuous movement, 13 cases of disease caused by vibration, and 26 cases of musculoskeletal disorders (MSD). While in 2016, the cases of over-exertion or strenuous movement have increased to 7,047, cases of exposure and contact with extreme temperatures were 436, 89cases of disease caused by vibration and 1,006 cases of musculoskeletal disorders (MSD). Most of the cases showed an increasing trend (refer Table 1).

Table 1: SOCSO Statistics From 2007 – 2017

Type of Case	Year									
	2007	2009	2010	2011	2012	2013	2014	2015	2016	2017
Exposure and contact with extreme temperatures	921	646	655	539	433	429	377	387	431	451
Over-exertion or strenuous movement	3,380	2,715	3,518	3,519	4,943	5,609	5,202	5,462	7,047	7,192
Disease caused by vibration	13	33	34	65	110	175	156	98	89	-
Musculoskeletal disorders (MSD)	26	161	238	268	447	515	675	708	1,006	1,354

Source: SOCSO (2007 - 2017)

As a result, inclusion of principles of ergonomic in the work tasks design and equipment is essential so as employees are not burdened with excessive bodily stress, strain, and overexertion incorporating vibration, discomforted postures, forceful exertions, recurring motion, in addition to bulky raising (OSHA, 2000). Therefore, identification of ergonomic hazards should be the initial phase in rectifying the hazards and enhancing employees' safety and health protection (OSHA, 2000). Hence, the psychometric analyses of the ergonomics' perception scales should be the focus of many studies. So far, there are few studies that tried to validate the correlation between ergonomic and performance or inspecting the construct, criterion and validating the content scale (Seo et al., 2004 cited in Havold & Nesset, 2008). Hence, to explain the ergonomic concept, it is important to develop an extensive tool and validating the scale comprehensively. Thus, evaluating the determinant of ergonomic element that can influence employees' body discomfort is the purpose of the study.

II. LITERATURE REVIEW

Work related musculoskeletal disorder is the term used to state conditions like cumulative trauma disorder, repetitive strain injury or overuse syndromes. Situations that involve muscles, tendons or nerves are usually evident by pain and discomfort around the body area (Lemaster & Atterbury, 1996). Many research has been conducted on the area of musculoskeletal disorders that include rates, identification of risk factors, clinical diagnosis including issues of returning work in the manufacturing or other industries(Roto & Kivi, 1991). The areas in the related employments, work activities and worksites are normally foreseeable and work tasks affecting risk in ergonomic are generally restricted to one or two body areas.

Even, works in the construction sectors need the usage of multiple body regions, like handling of hand and power equipment, perpetual movement in the awkward positions and recurring, powerful use of the back and upper and lower limbs and all are entirely recognized as risk factors of musculoskeletal disorders (Armstrong, Buckle, & Fine, 1993). According to Tarcan, Varol and Ates (2004) and Wojcikiewicz (2003), blood flow will reduce with static movements and causing muscle fatigue and tension.

Fahrenberg (1995) indicated that musculoskeletal problems can cause tension and will affect health condition such as feeling cold, itchy throat, dry skin, stomachache, and headache. Commonly, low back pain occurred dueto oldness, physical fitness, smokers, body weight excess the back and abdominal muscles strength. Furthermore, anxiety, depression, emotional instability and pain behavior are psychological factors, associated with the occurrence of back pain (Pfleger, 2003).

According to Woolf and Pfleger (2006), there have been evidences on the relationship between obesity and musculoskeletal conditions. Commonly, obesity is related to the disabling range states in adults and some evidences of childhood obesity showed a considerable effect on musculoskeletal problems (Anandacoomarasamy et al., 2008; Shiri et al., 2010; Tsiros et al., 2011). Across countries in the European Union, there is a normal trend of obesity among women which is higher compare to men (OECD, 2010).

As stated by Cook, Burgess-Limerick and Papalia (2004), the use of ergonomic chair will affect the workers' performance in minimizing their fatigue and stress. Poor posture is usually due to the task being performed and from poor ergonomic design of the computer workstation. For example, while typing on the keyboard, the parallel positions of the row and the inward rotation of the forearms and the wrists and a sideways bend is critical. This awkward position, result in the increase of the carpal tunnel which shortly increase the risk of Carpal Tunnel Syndrome (CTS) (Fagarasanu & Kumar, 2003). If the workstation is poorly designed, to see the computer screen the workers may need to tilt their neck. They may need to bend his/her trunk forward when the monitor is far away.

Additionally, positioning keyboard condition too high, too low or too far away, may cause the workers to lift up their shoulders. According to Straker, Pollock and Mangharam (1997), shoulders position at 30 degree flexion as compared to 0 degree shoulder flexion, posture of the workers accounted greater discomfort and fatigue. Besides that, Blatter and Bongers (2002) found that prolonged static posture have the strongest influence on MSD incidence.

The design of workstation on the ergonomic perspective can effectively minimize stress and improve productivity in the contact between the various components (Dempsey, McGorry, & O'Brien, 2004). Workstation that arenot ergonomically designs may expose workers to excessive physical tension, strain, and overexertion, including vibration, uncomfortable postures, powerful energy, recurring movement and lifting heavy objects (Leaman, 1995).

DeCroon, Sluiter, Kuijer, and Frings-Dresen (2005) found that the workstation design, directly or indirectly affect the psychological and physiological reactions for example crowding tension, induced exhaustion in occupation, decrease in job satisfaction and blood pressure level increase. Besides that, for reactions in the long term it comprises the reduced in performance and also the negative health outcomes for examples chronic exhaustion, burnout and musculoskeletal disorder (DeLange et al., 2002; Sluiter et al., 2003). Poorly designed workstation will rise distress to the workers because of their awareness that they are unprotected to health risks (Timoteo-Afnidad, 2010).

The definition of psychological work factors are the facets of the occupational environment for instance occupational roles and occupational pressure that will give about to the occurrence of stress toward the workers (Lim & Carayon 1993; ILO 1996). Lim and Carayon (1993) examined the connection between psychological work factors such as work pressure and job controls and found out that these factors were essential forecasters of superior and thoracic limbs musculoskeletal discomfort particularly neck regions and shoulder areas.

In addition, several evidences showed the consequence of job strain (job control as well as job demand) on health. Cote et al. (2009) suggested that, it increase the risk and incidence of the neck pain when job demand and job control are high. Niemi, Levoska, Rekola and Keinanen- Kiukaanniemi (1997) supported this finding. They pointed out a positive association between job control together with the neck and shoulder symptoms. Job strain among workers is usually due to the task to be accomplished and the amount is frequently beyond their control.

Besides, there are studies that examined actual workloads and narrated the association between tasks and work related musculoskeletal disorders. The diversity of contributing factors to musculoskeletal discomfort have been revealed by studies. This include, increased in job demand and extra hours putting the work on the computer (Bernard et al., 1994; Faucett & Rempel, 1994). Even, Polanyi et al. (1997) indicated that workers who are facing a regular deadline and demand of high psychological have low in skill discretion and also in social backing and they need to spend extra time keyboarding and were more likely to account moderate to MSD symptoms severely.

Additionally, Theroell et al. (1991) found that high mental requests and low decision latitude were related with the self-reported muscle tension and the musculoskeletal symptoms. In their cross sectional study among the homecare, they found symptoms around the region of the neck, the shoulders including low back specially for the employees involved with a great workload. The combination of great mental demands and low decision leeway, work pressure, was shown to be an important factor, not only for cardiovascular diseases but also for the negative health outcomes (Karasek et al., 1990). Job demands in the nursing sectorsspecially are probably a mix between physically demanding in the job tasks and also in the mental demands (Malin, Monica, & Hagberg, 1997).

Research by Wickens, Lee, Liu along with Becker (2004) indicated that the occurring of injuries at workplace are due to the tools used by employees in performing their work. Besides the work environment been made more comfortable, pain could be minimized, when lesser alterations of the equipment are commenced namely table, chair, machine and others (Wojcikiewicz, 2003). As an illustration, the chair that are been used by employees in performing their task to fulfill three principal functions which are increasing individual efficiency, besides the fatigue is minimize at the workplace and also in suiting the posture of the body (Wojcikiewicz, 2003).

Furthermore, there are report of workers, resulting productivity been affected due to their discomfort and stress at work. For instance, being overly hot, cold, and draughty or been harassed vialacking in their privacy, affecting their ability in performing their work properly (Leaman, 1995). Such situations give rise to hazards in the workplace, deprived employees' health, incapacities together with the decreasing of the employees' productivity including the quality of the products.

Furthermore, air quality is one essential factor determining organizational comfort levels. Indoor air quality was stated, directly influencing on the worker health problems, besides leading the workplace to be uncomfortable. (Czubaj, 2002; Shiaw-FenFerng, 2002; Wilson, 2001). Making indoor air in good quality will improve quality of the production besides helping in minimizing the outcomes of work stress (Martin, 1999). Ellis (2002) stated that research on ergonomic has shown the nature of warmness and coldness and intense temperature in the workplace can have a negative effect with work performance. Besides that, some researchers have related the quality of the air can cause influence on the worker fatigue and moods.

Without good rest after working long hours, the workers stress level will increase, contributing toward industrial accidents. Iacovides, Fountoulakis, and Kaprinis (2003) indicated, causing the work stress outcomes are due to long working hours. Moreover, in the long duration, it will affect the employees' health besides causing accidents, in the short duration. (Savery& Luks, 2000).In line with Blatter and Bongers (2002) cross-sectional study, they found that individuals who worked using computer in a day for more than 6 hours was related with upper extremities MSD in all body regions for both gender.

Likewise, typing often requires nonstop, relatively forceful and fast striking of the keys, static loading in the static way including placing the arms, hands and wrist in the awkward position, revealing toward an increased risk of overdoing arm by the operator computer(Carter & Banister, 1994). Also similar study by Ijmker et al. (2007) stated there was a strong usage in the duration of the computer mouse usage, linking reliably toward the occurrence of hand-arm symptoms than the length ofthe entire computer and usage of the keyboard.

As per Woods (2005), general social support, comprises supervisor and colleagues support, recognition of colleagues, administration obligation toward health and safety in addition to the management backing for safety and health to raise health problems were found to have relationship with communication at work. Bongers et al. (2006) shown connection to work related neck including also the upper limb musculoskeletal symptoms are due to job demand, work control in addition to societal support. Moreover, the author concluded that there seem to exist the more pertinent factor of social support among the mixed occupational populations rather than in theoffice setting.

The study on work demand, job control and social support by Hartvisgsen et al.(2004) on psychosocial concerning lower back pain reported that there has no connection between psychosocial factors and lower back pain. In contrast, Hoogendoorn et al. (2000) concluded that low work place social support will influence risk factor for back pain. Probably, the strongest claim that low in the social support in the work place is linked to back pain (Linton, 2001).

There have been publication on the risk factors associated in consideration of work like static loads, recurring movements, high force effort, unfavorable work postures, high work pace, stress, high requests, deficient social support and deficient in controlling (Kuorinka & Forcire, 1995; Winkel & Westgaard, 1992).

III. METHODOLOGY

Targeting population of the study was employees in public sectors in the Peninsular of Malaysia. The sampling design was convenience sampling. The samples of this study were employees in the public sector stratified by occupational group: management and non-management staff. The employees were chosen as they are exposed to psychosocial workplace conditions and job stress as risk factors for musculoskeletal symptoms. Self-administered questionnaires were used as its data collection. Survey questionnaire was distributed to the chosen respondents. The survey consists of two sections: demographic and respective variables including body discomfort, human factors (health and body posture) and work environment which include job control, job demand, tools, work station, physical environment, break time and social support. Body discomfort was measured using Nordic questionnaire investigate about symptoms at different regions (neck, shoulders, lower back, and elbows/wrists/hands); "During the past two (2) year I had pain or complaints in one or more of the following body regions: neck, shoulders, lower back, and elbows/wrists/hands." The five response options were "never", to "several times a day". The data analysis used was Statistical Package for Social Science (SPSS) version 21.0.Correlations and regression analysis was used to analyze the data.

IV. FINDINGS

4.1 Correlation

The hypothesis for this analysis was:

H_1: There is a positive relationship between the independent variables(IVs) (health, body posture, workstation, job control, job demand, tools, physical environment, break time and social support) and the dependent variable(DV) (body regions' discomfort).

A Bivariate Pearson's product-moment correlation coefficient was analyzed in assessing the relationship between the IVs (health, body posture, workstation, job control, job demand, tools, physical environment, break time and social support) and DVs (body regions' discomfort). From Table 2, there was a positive correlation between work station and body regions' discomfort, where $r = 0.310$, $p < 0.05$. Hence, hypothesis wasaccepted. In general, there was a low positive correlation between work station together with the body regions' discomfort (31.0%). Meaning that increasing in work station design were correlated with increase in body regions' discomfort.

Received: 06 Feb 2019 | Revised: 07 Mar 2019 | Accepted: 30 Mar 2019

For job control, it seems that there was a positive connection between job control and body regions' discomfort, where r= 0.195, p< 0.05. There was a low positive link between job control and body regions' discomfort (19.5%). Thus, hypothesis was accepted.

For job demand, there was a positive relationship between job demand and body regions' discomfort, where r= 0.156, p< 0.05. There was a low positive relationship between job demand and body regions' discomfort (15.6%). Thus, hypothesis was accepted.

There was a positive correlation between physical environment and body regions' discomfort, where r= 0.243, p< 0.05. There was a low positive relationship between physical environment and body regions' discomfort (24.3%). Thus, hypothesis was accepted. It means that increases in physical environment were linked with increase in body regions' discomfort.

For break time, it was seen that there was a positive correlation between break time and body regions' discomfort, where r= 0.204, p< 0.05. There was a low positive correlation between break time and body regions' discomfort (20.4%). Thus, hypothesis was accepted.

There was a positive relationship between social support and body regions' discomfort, where r= 0.310, p< 0.05. There was a low positive connection between social support and body regions' discomfort (31.0%). Thus, hypothesis was accepted. It means that increases in social support were associated with increase in body regions' discomfort.

As for health, there was a negative relationship with body regions' discomfort while for body posture and tools, there were insignificant relationships with body regions' discomfort. Thus, the hypotheses were rejected.

Table 2: Correlations

Variables	Body regions' discomfort
Health	-0.052 (0.468)
Body posture	0.121 (0.103)
Work station	0.310 ** (0.000)
Job control	0.195 ** (0.008)
Job demand	0.156 ** (0.035)
Tools	0.073 (0.327)
Physical environment	0.243** (0.001)
Break time	0.204** (0.006)
Social support	0.310** (0.000)

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

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

Received: 06 Feb 2019 | Revised: 07 Mar 2019 | Accepted: 30 Mar 2019

4.2 Regressions

The hypothesis for this analysis was:

H_2: Health, body posture, workstation, job control, job demand, tools, physical environment, break time and social support will influence body regions' discomfort.

Multiple regression analysis was utilized to evaluate the effect of independent variables (health, body posture, workstation, job control, job demand, tools, physical environment, break time and social support) on dependent variable (body regions' discomfort). As depicted in Table 3, the regression results shown the R square value of 0.188. This designates that 18.8% of the variances that clarified the DV (body regions' discomfort) was accounted for by the IVs (health, body posture, workstation, job control, job demand, tools, physical environment, break time and social support) where the F value = 4.484 at $p< 0.05$. Thus, hypothesis was accepted. Further, health ($\beta = -2.083$, $p < 0.05$), work station ($\beta = 2.182$, $p < 0.05$), and social support ($\beta =2.291$, $p < 0.05$) were significant predictors of body regions' discomfort.

Table 3: Regressions Analysis

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	.008	.862		.010	.992
health	-.397	.191	-.158	-2.083	.039
body_posture	.150	.106	.109	1.413	.159
work_station	.397	.182	.191	2.182	.030
job_control	.169	.132	.114	1.281	.202
job_demand	-.126	.174	-.067	-.720	.473
tools	-.097	.176	-.045	-.550	.583
physical_environment	.192	.188	.087	1.018	.310
break_time	.160	.125	.102	1.280	.202
social_support	.422	.184	.184	2.291	.023

a. Dependent Variable: body regions' discomfort_frequency

r square = 0.188, F = 4.484, p = 0.000

V. DISCUSSION AND CONCLUSION

Result of the correlation analysis demonstrates that there has no significant correlation between health and body regions' discomfort. This result is contrary to several studies. According to Fahrenberg (1995), these musculoskeletal problems can cause tension and will affect health condition such as feel cold, itchy throat, dry skin, stomachache, and headache. It has been demonstrated on studied toward employees subjected toward stressful

psychosocial working condition by Frankenhaeuser and Gardell (1976) that employees, also showing increased autonomic stimulation (e.g. increase heartbeat and blood pressure, increase muscle tension).

This research illustrated that there has no significant correlation between body posture and body regions' discomfort. This is contrary to several studies that indicated there was a significant link between body posture and body regions' discomfort. According to Cook et al. (2000) including Fagarasanu besides Kumar (2003) indicated that awkward body posture has been associated with an increase in body regions' discomfort. Straker, Pollock and Mangharam (1997) revealed that when the shoulders were at 30-degree flexion as compared to 0-degree shoulder flexion, posture the workers accounted greater discomfort and fatigue.

Besides that, the result of this study demonstrates that there was a significant correlation between workstation and body regions' discomfort. This is consistent with other findings that revealed work station has strong impact on body regions' discomfort. According to DeCroonet. al. (2005), the design of the workstationmight directly or indirectly result in physiological and psychological reactions for example occupationally induced exhaustion, crowding stress, decrease in job satisfaction also making levels of blood pressure to be increase.

This research demonstrated that job control has a significant correlation between job control and body regions' discomfort. This is consistent with other findings that indicated job control is associated with body regions' discomfort. Cote et al. (2009) suggested that when job demand and job control are high, it can effect on increasing the risk and incidence of neck pain. This finding was also reinforced by Niemi et al. (1997), which shown, there has positive correlation between job control and neck and shoulder symptoms. Job strain among workers is usually due to the task to be accomplished and the amount is frequently beyond their control.

Furthermore, the result of the correlation analysis confirmed the significant positive relationship between job demand and body regions' discomfort. This finding reinforced by Cote et al. (2009) shown that high amount of work demand scan result in the rise of neck pain risk. Findings by Neimi et al. (1997) also shown that there was a positive association between work stress toward the shoulder and neck pain. This means that by increasing in job demand, may cause stress that will lead toward increasing the risk of body regions' discomfort especially the neck including the shoulder pain.

In addition, the result of this study demonstrated there was no significant correlation between tool and body regions' discomfort. This is contrary by previous studies. Tarcan et al. (2004) clarified that if the association does not supply a good working environment for the workers for examples supplying the best-fitting tools and furniture, the risk becoming ill related toward the workplaces will increase. According to Woods et al. (1999), their finding confirmed high levels of musculoskeletal pain and discomfort amongst UK cleaners. The main problem areas were neck, shoulders, elbows, wrists/hands, lower back and knees.

This study revealed that the physical environment is associated with body regions' discomfort. Czubaj (2002), Shiaw-Fen Ferng (2002) and Wilson (2001) supported the finding, indicated that air quality is a very crucial factor in the determining in the levels of the organizational comfort. There is a direct impact on health problems of the indoor air quality that can leads toward the workplace environments to be uncomfortable. The employee productivity will be affected, when they express discomfort and stress such as being overly hot, very cold, extremely

draughty or harassed by means of lack of privacy in the ways that affect their ability to perform their work properly (Leaman, 1995).

A result of the correlation analysis showed that break time is positive significant associated with body regions' discomfort. This is supported by several studies according to Gerr, Marcus and Ensor (2002) and Village, Rempel and Teschke (2005) revealed that rise hours of computer work are associated with an increase in musculoskeletal disorder on all the parts of their body. Moreover, Blatter and Bongers (2002) found that neither men nor women doing their job using computer with extended 6 hours per day was linked with upper extremities in around the body regions. To significantly decreases the risks of musculoskeletal pain and injury and error rates during intensive computer work are significantly declined the employees should be allowed flexible micro breaks in exactly 30 second for every 10 minutes (Henning et al., 1996).

This study result, illustrates that social support is associated with body regions' discomfort. Making its consistent with findings of other research by Bhanderiet al. (2008), who discovered a relationship between upper extremity musculoskeletal disorders and support from colleagues along with from seniors at place of work. Buckle and Woods (2002) in their study discovered the connection between social support and musculoskeletal health. Furthermore, Bongers et al. (1993) deduced that deprivation of social support from work colleagues was positively linked with musculoskeletal disorder. Exist also, strong proof regarding low social support at work place was associated toward the back pain risk (Hoogendoorn et al., 2000). However, this finding was dissimilar with Hartvigsen et al. (2004), who reported negative correlation between social support and low back pain and the consequences of low back pain. Nevertheless, there are discrepancies findings from these recent research of low back pain. There are several findings that support a positive viewpoint of the role of social support in relation to low back pain (Hoogendoorn et al., 2000), whereas other findings by other researchers do support the negative concluded statement given out by Hartvigsen et al. (2004).

Furthermore, the independent variables; human factors (health and body posture) and work environment (work station, job control, work demand, tools, physical environment, rest time and social support) were significantly explained the variance in dependent variable (body regions' discomfort). Multiple regression analysis shown that 18.8 percent of variance in body regions' discomfort accounted for by the independent variables (human factors and work environment). The fact that only 18.8 percent of the variance in the body regions' has been significantly explained by these two variables (human factors and work environment) and they have another 81.2 percent of variance explained other additional variables that are important in explaining the body regions' discomfort that have not been considered in this study.

As a conclusion, the range in terms of age, longitudinal studies with larger samples would assist in establishing a causal correlation between various risk factors and musculoskeletal disorders. Many studies shown that correlation between psychosocial work performer, work stress and musculoskeletal discomfort could not be effectively done by cross sectional method. (Bongers et al., 1993; Sauters & Swanson, 1996); thus the relationship among these factors should be studied over a period of time. Future research can further study on the effect of musculoskeletal problems differences between male and female. Furthermore, future study can be made on the differences between industries.

Received: 06 Feb 2019 | Revised: 07 Mar 2019 | Accepted: 30 Mar 2019

It is very crucial to build perception on the importance of ergonomics among the Malaysian workforce. In this way, this will improve the employee health and their performance, leading toward the higher organizational productivity and efficiency.

ACKNOWLEDGEMENT

The author wish to thank The Ministry of Education, Malaysia for providing financial assistance under Fundamental Research Grant Scheme (FRGS) to carry out this study and the Research and Innovation Management Centre (RIMC) with S/O Code 12001, Universiti Utara Malaysia for providing the research assistance.

REFERENCES

[1] Anandacoomarasamy, A., Caterson, I., Sambrook, P., Fransen, M., et al. (2008).The impact of obesity on the musculoskeletal system. *International Journal of Obesity, 32*(2),211-222.

[2] Armstrong, T.J., Buckle, P., & Fine, L.J. (1993). A conceptual model of work-related neck and upper limb musculoskeletal disorders. *Journal of Work Environmental Health,19,* 73-84.

[3] Bernard, H. U., Chan, S. Y., Manos, M. M., Ong, C. K., Villa, L. L., Delius, H., Peyton, C. L., Bauer, H. M.,& Wheeler, C. M. (1994). Identification and assessment of known and novel human papillomaviruses by polymerase chain reaction amplification, restriction fragment length polymorphisms, nucleotide sequence, and phylogenetic algorithms. *The Journal of Infectious Diseases, 170,* 1077-1085.

[4] Bhanderi, D., Choudhary, S.K., Parmar, L., & Doshi, V. (2008). A study of occurrence of musculoskeletal discomfort in computer operators. *Indian Journal Community Medication, 33*(1), 65-66.

[5] Blatter, B.M., & Bongers, P.M. (2002). Duration of computer use and mouse in relation to musculoskeletal disorders of neck or upper limb. *International Journal of Industrial Ergonomics, 30,* 295-306.

[6] Bongers, P.M., Ijmker S., & van den H.S. (2006). Epidemiology of work related neck and upper limb problems: psychosocial and personal risk factors (part I) and effective interventions from a bio behavioral perspective (part II). *Journal of Occupational Rehabilitation, 16,* 279–302.

[7] Bongers, P.M., Winter, C.R., & Kompier, M.A. (1993). Psychosocial factors at work and musculoskeletal disease. *Journal of Work Environment Health, 19,* 297-312.

[8] Buckle, P., & Woods, V. (2002). *Work, inequality and musculoskeletal health*. Health and Safety Executive (HSE), London. Contract research report 421.

[9] Carter, J.B., & Banister, E.W. (1994). Musculoskeletal problems in VDT work: A review. *Ergonomics, 37,* 1623–1648.

[10] Chandrasakaran, A., Chee,H.L., Rampal, K.G., & Tan, G.L.E. (2003). The prevalence of musculoskeletal problems and risk factors among women assembly workers in the semiconductor industry. *Medical Journal of Malaysia, 58* (5), 657-666.

[11] Cook, C., Burgess-Limerick, R.,& Chang, S. (2000). The prevalence of neck and upper extremity musculoskeletal symptoms in computer mouse users. *International Journal of Industrial Ergonomics, 26,* 347-356.

[12] Cook, C., Burgess-Limerick, R.,& Papalia, S. (2004). The effect of wrist rests and forearm support during keyboard and mouse use. *International Journal of Industrial Ergonomics, 33,* 463-472.

[13] Cote, P., van Der Velde, G., Caroll, L., Hogg Johnson, S., Holm, L., & Hurwitz, E. (2009). The burden and determinants of neck pain in workers: Results of the bone and joint decade 2000- 2010 task force on neck pain and its association disorders. *Journal of Manipulative and Psychological Therapeutics, 32* (2), 70- 86.

[14] Czubaj, C.A. (2002). School indoor air quality. *Journal of Instructional Psychology, 29*(4), 317-321.

[15] DeCroon, E.M., Sluiter, J.K., Kuijer, P.P.F.M.,& Frings-Dresen, M.H.W. (2005). The effect of office concepts on worker health and performance: A systematic review of the literature. *Ergonomics, 48* (2), 119-134.

[16] DeLange, A.H., Taris, T.W., Kompier, M.A.J., Houtman, I.L.D.,& Bongers, P.M. (2002). Effects of stable and changing demand-control histories on worker health. *Scandinavian Journal of Work Environment and Health, 28,* 94-108.

[17] Dempsey, P.G., McGorry, R.W., & O'Brien, N.V. (2004). The effects of work height, work piece orientation, gender and screwdriver type on productivity and wrist deviation. *International Journal of Industrial Ergonomics, 33,* 339-346.

[18] Ellis, J.E. (2002). Dimensions of desertification in the dry lands of Northern China. In J.F.Reynolds & D.M.S.Smith (Eds.), *Global desertification: Do humans cause deserts?* (pp. 167-180). Berlin: Dahlem University Press.

[19] Fagarasanu M., & Kumar, S. (2003). Work-related carpal tunnel syndrome: Current concepts. *Journal of Musculoskeletal Research, 7*(2), 87-96.

[20] Fahrenberg, J. (1995). Somatic complaints in the German population. *Journal of Psychosomatic Research, 39*(7), 809-817.

[21] Faucett J., & Rempel, D. (1994). VDT-related musculoskeletal symptoms: Interactions between work posture and psychosocial work factors. *American Journal of Industrial Medicine, 26,*597–612.

[22] Frankenhaeuser, M., & Gardell, B. (1976). Under load and overload in working life: Outline of multidisciplinary approach. *Journal of Human Stress, 2,* 35- 46.

[23] Gerr, F., Marcus, M., & Ensor, C. (2002). A prospective study of computer users: I. Study design and incidence of musculoskeletal symptoms and disorders. *American Journal of Industrial Medicine,* 4221–4235.

[24] Hartvigsen, J., Lings, S., Leboeuf-Yde, C., & Bakketeig, L. (2004). Psychosocial factors at work in relation to low back pain and consequences of low back pain: A systematic, critical review of prospective cohort studies. *Occupational Environment Medicine, 61.*

[25] Havold, J.I., & Nesset, E. (2008). From safety culture to safety orientation: Validation and simplification of a safety orientation scale using a sample of seafarers working for Norwegian ship owners. *Safety Science,* 1 – 22.

[26] Henning, R.A., Callaghan, E.A., Ortgea, A.M., Kissel, G.V., Guttman, J.I. & Braun, H.A. (1996). Continuous feedback to promote self-management of rest breaks during computer use. *International Journal of Industrial Ergonomics, 18,*71-82.

[27] Hoogendoorn, W.E., van Poppel M.N.M., Bongers, P.M., Koes, B. W., & Bouter, L. M. (2000). Systematic review of psychosocial factors at work and private life as risk factors for back pain. *Spine, 25,* 2114–2125.

[28] Iacovides, A., Fountoulakis, K.N., & Kaprinis, G. (2003). The relationship between job stress, burnout and clinical depression. *Journal of Affective Disorders, 75,* 209-221.

[29] Ijmker, S., Huysmans, M.A., Blatter, B.M., van der Beek, A.J., van Mechelen, W., & Bongers, P.M. (2007). Should office workers spend fewer hours at their computer? A systematic review of the literature. *Occupational and Environmental Medicine, 64(*4), 211-22.

[30] International Labour Organization. (1996). *Ergonomics: Your health and safety at work.* Geneva: Bureau for workers' activities, ILO.

[31] Karasek, R., Brisson, C., Kawakami, N., Houtman, I., Bongers, P., & Amick, B. (1990). The Job content questionnaire (JCQ): An instrument for internationally comparative assessments of psychosocial job characteristics. *Journal of Occupational Health Psychology, 3,* 322–355.

[32] Konz, S.A., & Rys, M.J. (2003). An ergonomics approach to standing aids. *Occupational Ergonomic, 3,*165-172.

[33] Kuorinka, I., & Forcire, L. (1995). *Work related musculoskeletal disorders (WMSD).* A reference book for prevention. London: Taylor & Francis.

[34] Leaman, A. (1995). Dissatisfaction and office productivity. *Facilities, 13*(2), 13-19.

[35] Lemaster, G.K., & Atterbury, M.R. (1996). The design and evaluation of a musculoskeletal and work history questionnaire in occupation. In A. Bhattacharaya& J.D. McGlothin (Eds.). *Occupational ergonomics: Theory and application* (pp. 431-462). New York: Marcel Dekker.

[36] Lim, S.Y., & Carayon, P. (1993). An integrated approach to cumulative trauma disorders in computerized office: the role of psychosocial work factors, psychological stress and ergonomic risk factors. In M.J. Smith & G. Salvendy (Eds.). *Human–computer interaction: Applications and cases* (pp. 880-885). Amsterdam, the Netherlands: Elsevier.

[37] Linton, S. J. (2001). Occupational psychological factors increase the risk for back pain: A systematic review. *Journal of Occupational Rehabilitation, 11*(1), 53-66.

[38] Malin, J., Monica,& Hagberg (1997). Musculoskeletal symptoms and job strain among nursing personnel: A study over a three year period. *Occupational and Environmental Medicine, 54*(9), 681-685.

[39] Martin, J. (1999). Addressing IAQ concerns in medical facilities. *Engineered Systems, 16*(6), 53-57.

[40] Mazlan, M., Win Kye, & Rampal, K.G. (2000). Work-related musculoskeletal symptoms among batik workers in Kelantan. *Malaysian Journal of Medical Sciences, 7* (2), 13-17.

[41] Niemi, S.M., Levoska, S., Rekola, K.E., & Keinanen-Kiukaanniemi, S.M. (1997). Neck and shoulder symptoms of high school students and associated psychosocial factors. *Journal of Adolescent Health, 20*(3), 238-242.

[42] Occupational Safety and Health Administration (OSHA) (2000). *Ergonomics: The study of work.*Retrieved from www.osha.gov/Publications/osha3125.pdf

[43] OECD (2010). *Overweight and obesity among adults.* Glance, Europe: OECD Publishing.

[44] Ormond, T. (2004). *The voices and silences of young Maori people: A world of (im)possibility.* Unpublished doctoral thesis, The University of Auckland.

[45] Pfleger, B. (2003). Burden of major musculoskeletal conditions. *Bulletin of the World Health Organization, 81*(9), 646-656.

[46] Polanyi, M., Cole, D.C., Beaton, D.E., Chung, J., Wells, R., Abdolell, M., Beech-Hawley, L., Ferrier, S.E., Mondloch, M. V., Shields, S.A., Smith, J.M., & Shannon, H.S. (1997). Upper limb work-related musculoskeletal disorders among newspaper employees: Cross-sectional survey results. *American Journal of Industrial Medicine, 32,* 620-628.

[47] Roto P., & Kivi, P. (1991). Prevalence of epicondylitis and tenosynovitis among meatcutters. *Journal of Work Environment Health, 17,* 32-37.

[48] Sauter, S., & Swanson, N.G. (1996). *An ecological model of musculoskeletal disorders in office work. Beyond Biomechanics. Psychosocial Aspects of Musculoskeletal Disorders in Office Work.* London: Taylor & Francis.

[49] Savery, L.K., & Luks, J.A. (2000). Long hours at work: Are they dangerous and do people consent on them? *Leadership and Organization Development Journal, 21*(6), 307-310.

[50] Shiaw- Fen Ferng, L.W.L. (2002). Indoor air quality assessment of day-care facilities with carbon dioxide, temperature, and humidity as indicators. *Journal of Environmental Health, 65*(4), 14-18.

[51] ShiriR., SolovievaS., Husgafvel-Pursiainen K., Viikari J., Raitakari OT., & Viikari-Juntura, E. (2010). Incidence of nonspecific and radiating low back pain: Follow up of 24–39-year-old adults of the Young Finns Study. *Arthritis Care Res, 62*(4), 455–9.

[52] Sluiter, J.K., De Croon, E.M., Meijman, T.F. & Frings-Dresen, M.H.W. (2003). Need for recovery from work related fatigue and its role in the development and prediction of subjective health complaints. *Occupational and Environmental Medicine, 60,* 62-70.

[53] Social Security Organization (SOCSO) (2015). Annual reports. Retrieve from http://www.perkeso.gov.my/my/

[54] Straker, L., Pollock, C., & Mangharam, J. (1997). The effect of shoulder posture on performance, discomfort and muscle fatigue whilst working on a visual display unit. *International Journal of Industrial Ergonomics, 20,* 1-10.

[55] Tarcan, E., Varol, E.S., & Ates, M. (2004). A qualitative study of facilities and their environmental performance. *Management of Environmental Quality: An International Journal, 15*(2), 154-173

[56] Theorell, T., Perski, A., Akerstedt, T., Sigala, F., Ahlberghulten, G., Svenson, J., & Eneroth, P. (1991). Changes in job strain in relation to changes in psychological state. *Scandinavian Journal of Work Environment and Health, 14,* 189-196.

[57] Timoteo-Afnidad, C.B. (2010). Workstation and workspace ergonomics in Philippine libraries: An emerging priority. *Journal of Philippine Librarianship, 30*(1), 21-44.

[58] Tsiros, M. D., Coates, A. M., Howe, P. R. C., Grimshaw, P. N., & Buckley, J. D. (2011). Obesity: The new childhood disability? *Obesity Reviews, 12*(1), 26–36.

[59] Village, J., Rempel, D., & Teschke. (2005). Musculoskeletal disorders of the upper extremity associated with computer work: A systematic review. *Occupational Ergonomics, 5*(4), 205-218.

[60] Wickens, C. D., Lee, J. D., Liu, Y., & Becker, S. E. G. (2004). *An introduction to human factors engineering* (2nd ed.). Upper Saddle River, NJ: Pearson/Prentice Hall.

[61] Wilson, S. (2001). Graduating to better IAQ. *Consulting-Specifying Engineer, 29*(6), 24-28.

[62] Winkel, J.,& Westgaard, R. (1992). Occupational and individual risk factors for shoulder-neck complaints: Part II- the scientific basis (Literature Review) for the guide. *International Journal of Industrial Ergonomics, 10*(1-2), 85-104.

[63] Woods, E.R., Dudchenko, P.A., & Eichenbaum, H. (1999). The global record of memory in hippocampal neuronal activity. *Nature, 397,* 613–616.

[64] Woods, V. (2005). Work-related musculoskeletal health and social support. *Occupational Medicine, 55*(3), 177-189.

[65] Woolf, A.D., & Pfleger, B. (2006). Burden of major musculoskeletal conditions. *Bulletin of the World Health Organization, 81*(9), 646–56.

[66] Wojcikiewicz, K. (2003). Seven key factors for ergonomic workstation design. *Manufacturing Engineering, 131*(1), 45.