ORIGINAL ARTICLE

Musculoskeletal Disorders and Its Association With Self-reported Productivity: A Cross-sectional Study Among Public Office-workers in Putrajaya, Malaysia

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ABSTRACT

Introduction: Prevalence of musculoskeletal disorders (MSDs) among office workers found to be high worldwide, leading to considerable economic impacts and health issues. The relationship between MSDs and productivity loss is widely recognized. This study investigates the possible relationships between the self-reported musculoskeletal disorders and productivity in term of absenteeism/presenteeism and self-evaluated productivity levels during presenteeism time among office workers. **Methods:** Cross-sectional study was carried among office workers (n=398) in three public sector organizations in Putrajaya. Socio-demographic and productivity data were determined using self-administered general questionnaire whereas prevalence of MSDs evaluated using Cornell Musculoskeletal Disorders Questionnaire (CMDQ). **Results:** This study found that prevalence of MSDs symptoms among office workers in any body parts is high (83.7%), low-back pain reported the highest (58.5%) whereas thighs pain reported less prevalent MSDs symptoms (25.4%) among participants. Also, the results showed a significant association between prevalence of MSDs and productivity loss in regard with presenteeism ($p<0.01$). In addition, self-evaluated productivity levels of office workers during presenteeism time also found to be significantly associated with MSDs ($p<0.05$). **Conclusions:** These findings suggest that majority of office workers reported MSDs symptoms. Presenteeism was significantly affecting productivity in term of quality and or quantity of work that workers could do. One more concluded point of this study is the need for applying changes that could help in minimizing presenteeism due to MSDs so as to decrease workers productivity loss.

Keywords: Cross-sectional Study, Musculoskeletal disorders, Self Report, Prevalence

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INTRODUCTION

As a result of recent accelerating expansion of information technologies the numbers of office based workers are on rapid growth, yet; around 50% of population across the world are doing some form of office-based jobs according to estimations count (1). Moreover, these numbers are predicted to witness more increasing in the near future (2). MSDs implicate a wide range of inflammatory and degenerative conditions that impacts the muscles, tendons, ligaments, joints, peripheral nerves, and supporting blood vessels and causing a possible consequences of pain and lack of physical comfort.

Through the previous decades, musculoskeletal disorders have moved toward becoming progressively prevalent worldwide, yet became a typical reason for work-related inability among workers resulting in high economic burden (3). It worth specifying that, the financial misfortunes in term of economic loss became greater because of MSDs influence on individuals and societies as well as organizations in both developed and developing countries (4).

Productivity is a measure of the efficiency of an individual, machine, processing plant, and so forth in turning inputs into useful outputs. In term of definition; productivity determined as the time in units (days/hours) required completing certain unit quantity of specific activity (5). Consequently, various researchers concur on using the productivity as a term to depict that concept. Productivity increment is thought to be the outcome of better work environment conditions. Better physical environment of office will support the workers at enhance their working productivity thereafter. However, investigations of numerous workplaces showed that components such as office place environment and poor ergonomics have a significant effect in decreasing

workers' productivity (6).

A vast and growing assortment of published literature has explored the work-related MSDs influence on office workers productivity (7,8). Therefore, there has been a consensus among researchers that MSDs may lead to constrained working capability and hence unwanted time away from work which mean decrease of production and staff absenteeism (9).

There are two ways to assess loss of work productivity (10); as off-work days have been taken (absenteeism) or as self-reported productivity decrease or working execution while doing certain job tasks (presenteeism). However, a number of studies have demonstrated evidences that rather than absenteeism, the presenteeism (working while sick) is the fundamental factor that leads to productivity loss in various works (11,12).

Several studies held in Malaysia uncovered a high prevalence of MSDs with almost all population groups that studies were investigating (13–16). Social Security Organisation (SOCSO Malaysia 2011, 2015) reports are detailing high occurrence rate of MSDs in Malaysia. However, office workers in Malaysia were not an exception, as a published results of recent studies concentrated in office ergonomics have affirmed that MSDs prevalence among office worker in this country is significantly high (19–21).

Linking that with employees productivity in form of presenteeism/absenteeism; findings from Malaysia's Healthiest Workplace survey done by AIA-Vitality (2017) revealed an average of 67 days are lost because of absenteeism and presenteeism per worker every year in Malaysia, with average annual cost per organization evaluated to be around RM 2.7 million. Results demonstrated that out of the 67 days lost, 58.8 days (87.7%) were because of presenteeism while the remaining 8.2 days (12.3%) were imputed to actual absence from work. This very recent report concluded that 64% out of employees surveyed in the study (n= 5,369) were physically inactive doing some form of sedentary work which clearly linked with MSDs symptoms. So far, however, there has been little discussion about possible relationship between MSDs and productivity among office-workers in Malaysia.

The aims of this study were: 1) to determine the prevalence of self-reported musculoskeletal disorder among public office-workers in Putrajaya and; 2) to evaluate the relationship between musculoskeletal symptoms and productivity levels reflected in form of presenteeism/absenteeism and, 3) to evaluate the relationship between musculoskeletal symptoms and self-reported productivity level during presenteeism time.

MATERIALS AND METHODS

Study population and instruments

A cross sectional study carried out in three public sector organizations in the Federal Territory of Putrajaya, Malaysia. Organizations where study took place were selected according to study area and study approval obtained. Name list of office-workers has been gotten from each organization where study took place. Simple random sampling method (random draw using excel INDEX function) was implemented to choose study participants. Afterwards; inclusive criteria were implemented to select study participants out of office-workers name lists obtained earlier. Selected participants were of Malaysian national, age between 19 to 60 years old. To increase the likelihood of finding a true association between exposure/intervention and outcomes; the study participants were with at least one year been working in office and performing office-based work that involve using of computer equal to or more than four hours every working day.

For calculating the adequate sample size in cross-sectional study, the following formula (23) was used:

$$n = \frac{Z^2 (P) (1-P)}{d^2}$$

Where
n = sample size needed for the study
Z = statistic corresponding to confidence interval – 95%
= 1.96
P = prevalence of MSDs in previous study = 72% (24)
= 0.72
d = desired precision – set as 0.05

$$n = \frac{1.96^2 (0.72) (1 - 0.72)}{0.05^2}$$

$$n = \frac{3.8416 (0.72) (1 - 0.72)}{0.0025}$$

n = 309.79 = 310

To avert sample size attrition due to possible non-response or invalid data; more 20% increasing of sample size has been carried out.

$$N1 = \frac{N}{1-q}$$

Where

N1 = total number of participants to be recruited to insure final sample size (N) is achieved
N = number of subjects are required in the end of the study with all the data being complete for analysis
= 310
q = proportion of attrition- set to be 20% anticipating participants turnover, non-responding or missing data
= 0.20

$$N1 = \frac{310}{1-(0.20)}$$

$N1 = 387.5$

Total participants needed for the study = 388

Prior to conduct this study, the ethical approval was obtained from Ethical Committee of Universiti Putra Malaysia (JKEUPM) Ref. No. JKEUPM-2018-298.

Before distribution the questionnaire to all study participants, test-retest of internal consistency has been conducted on 32 respondents (not included in the final analysis), the results achieved Cronbach's alpha value of (0.87) demonstrated good reliability.

Along with consent form, self-administered questionnaire was distributed to participants who met study inclusion criteria, and be collected after a few days. Subjects were excluded if they had any known musculoskeletal system problem (fracture, tumors, systemic disease) that led to a disability and or histories of medical surgery operation. Awareness of all participants about anonymousness and information secrecy was confirmed.

Questionnaire

Questionnaire was previously structured, pretested and validated, composed of four sections; the self-administrated questionnaire intended to collect data on individual socio-demographic data, employment history, and productivity information in form of presenteeism/absenteeism. In addition to that, data on musculoskeletal disorders prevalence were determined.

Individual socio-demographic data

Implicate gender, age, body mass index (BMI) education, manual lifting tasks and frequency, smoking, hobbies involve physical activity, and physical activities time per week (in minutes) classified according to World Health Organization (25).

Employment history

Include years spent in current office job, daily hours of computer usage in office, and self-reported break/rest intervals during working day.

Productivity information

Productivity characterized in this investigation was evaluated utilizing distinctive markers, first marker was sick-leave reported for absence during last month of work as well as frequency of off-work days. Second marker was attendance to work during last month despite suffering MSDs pain in any part of the body (presenteeism) and frequency of presenteeism days. As third and last marker was self-reported productivity in form of quality or amount of work during presenteeism days (26); participants were asked to determine how often the MSDs pain limits the quality or amount of work they could do, thereafter a cut-off point was assigned to determine normal productivity and productivity loss (27).

Prevalence of MSDs

In this study, Cornell Musculoskeletal Discomfort Questionnaire (CMDQ) was used to determine prevalence of musculoskeletal disorders among participants (28). CMDQ considered suitable for the studies that intend to evaluate work execution results as well as the degree of musculoskeletal disorders among workers (29).

Statistical analysis

Collected data were entered and analyzed utilizing Statistical Package for the Social Sciences (SPSS) software Version 22. Descriptive statistics were used to display the socio-demographic, employment information and absenteeism/presenteeism data in frequencies, percentages and means. In addition, the prevalence of MSDs for past seven days among respondents was also held a descriptive analysis for all 11 body parts included in Cornell musculoskeletal disorders questionnaire. Chi-square test and binary logistic regression were used at significance level of $p<0.05$ to define the MSDs impact on participants productivity in term of absenteeism/ presenteeism and self-evaluated productivity levels among respondents during presenteeism time.

RESULTS

An aggregate of 419 office workers out of 480 determined for this study responded to the survey for a responding rate of 87.2%. Out of these, 21 were excluded in light of the fact that they reported incomplete or missing data, the remained study population was 398 respondents were considered in the study outcome. Table I exhibits the socio-demographic and employment data of the responded participants.

In term of gender, most of study participants were females (69.8%) compared to (30.2%) males. Ranging from 23 to 54 years old, the mean age of study participants was 35.26 (SD ± 7.17). When categorized, the frequency of age was highest (47.2%) in the 30 - 39 years old category. Study participants body mass index (BMI) was determined according to the Malaysian clinical practice guidelines on management of obesity (30), 65.6% of participants were reported (pre-obese and obese) with percentage of 36.2% and 29.4% respectively, while 21.9% of participants reported normal BMI and 6.0% for the overweight and 6.5% reported as underweight.

Same goes to education as greater percentage (64.8%) of participants attended university level education. Majority of participants (84.4%) were nonsmokers. Physical activities time per week (in minutes) conducted by participants was varied from none (40.7%), < 150 min (35.2%), 150-300 min (21.9%) and (2.3%) > 300 min per week.

Table I: Respondents socio-demographic and employment data

Characteristics	Frequency n	Percentage %	Mean	SD
Gender				
Male	120	30.2		
Female	278	69.8		
Age			35.26	7.17
19-29	65	16.3		
30-39	188	47.2		
40-49	127	31.9		
≥ 50	18	4.5		
Body mass index (BMI)				
< 18.5 (underweight)	26	6.5		
18.5-22.9 (normal weight)	87	21.9		
≥23 (over weight)	24	6.0		
23.0-27.5 (pre obese)	144	36.2		
> 27.5 (obese)	117	29.4		
Education				
Primary/Intermediate School	29	7.3		
Secondary school	111	27.9		
University	258	64.8		
Smoking				
Yes	62	15.6		
No	336	84.4		
Hobbies involve physical exercises				
Yes	236	59.3		
No	162	40.7		
Physical activity time / week (in minutes)				
None	162	40.7		
< 150 min	140	35.2		
150-300 min	87	21.9		
> 300 min	9	2.3		
Years in current job			10.51	8.41
1-≤10	221	55.5		
11-≤20	108	27.1		
21-≤30	56	14.1		
>30	13	3.3		
Computer hours per day			8.40	0.698
4-≤8	244	61.3		
> 8	154	38.7		
Break (Rest) time				
Yes	383	96.2		
No	15	3.8		

N = 398 participants

The mean working years of participants was 10.51 (SD ± 8.41), ranging from 1 to 35 years. Frequency of working years when categorized was highest (55.5%) in the 1-≤10 years category, followed by 11-≤20 years (27.1%), 21-≤30 years (14.1%) and >30 years (3.3%). The mean computer usage hours per day of the study participants was 8.40 (SD ± 0.698), when scaled into 2 classes (4 - ≤8, and > 8 hours per day) the frequency of the scale 4 - ≤8 hours per day was 61.3%, and > 8 hours per day was 38.7%. Majority of participants (96.2%) used to take break time during working day.

Moreover, Table II presents the prevalence of self-reported MSDs symptoms in any of the body parts (at least one body part) among study participants during past seven days, over all prevalence reported was 83.7% in any of body parts. The most prevalent MSD among the 11 body parts was reported for lower back (58.5%) followed by shoulder pain (48.5%), neck (43.0%), knee (42.0%), lower leg (38.4%), upper back and upper arm (37.9%) each, wrist (34.9%), hip/buttock (33.9%), forearm (32.7%), and thigh (25.4%) with lowest prevalent MSD among participants.

Table II: Prevalence of musculoskeletal disorders (MSDs) among respondents

Part of the body	MSDs prevalence	
	Frequency n	Percentage %
Neck	171	43.0
Shoulder	193	48.5
Upper back	151	37.9
Upper arm	151	37.9
Lower back	233	58.5
Forearm	130	32.7
Wrist	139	34.9
Hip / Buttock	135	33.9
Thigh	101	25.4
Knee	167	42.0
Lower leg	153	38.4
MSDs in any part of the body	333	83.7

N = 398 participants

On the other hand, productivity loss was determined in two ways:

(1) Productivity in term of absenteeism / presenteeism: Presenteeism found to be more common among respondents compared to absenteeism. Table III shows the frequencies and percentages for both absenteeism and presenteeism among respondents during last month. It also displays the key by which this study assorted normal productivity and productivity loss. Thereafter, the results were tested for relationship with MSDs prevalence reported among study participants. By using chi-square test and logistic regression; the results (Table IV) showed no significant association in term of absenteeism, while presenteeism found to be significantly associated with MSDs prevalence reported ($P < 0.01$).

Table III: Absenteeism and presenteeism among respondents during last month and productivity level determination

Productivity level	Absenteeism		Presenteeism	
	n	%	n	%
YES *(Productivity loss)*	14	3.5	71	17.8
NO *(Normal productivity)*	384	96.5	327	82.2
Total	**398**	**100**	**398**	**100**

Table IV. Association between [absenteeism/presenteeism] and work productivity

	Productivity		X^2	*P* value	OR	95% CI	
	Normal	Loss					
	n (%)	n (%)				Lower	Upper
Absenteeism	320 (80.4)	13 (3.3)	0.897	0.344	0.39	0.05	2.96
	64 (16.1)	1 (0.2)					
Presenteeism	262 (65.8)	71 (17.8)	8.818	0.004**	0.29	0.11	0.76
	61 (15.3)	4 (1.0)					

(2) Self-reported productivity level:
As shown in table V, answers represented None of the time (2.3%) were considered as normal productivity, while answers a little, some, most and all of the time (96.7%) were considered as productivity loss. Utilizing same statistical analysis ran for previous productivity test; significant association ($P < 0.05$) was found between self-reported productivity loss and prevalence of MSDs reported among study participants (table VI). However, this later finding should be interpreted carefully as a very small effect made significant for extremely large sample size.

DISCUSSION

Musculoskeletal Disorders

Known to be mostly a sedentary work; office based work was globally associated with prevalent musculoskeletal symptoms (31). The results of the present study indicate musculoskeletal symptoms among office workers were quite common (83.7%). This found to be supported by results of similar studies held in Malaysia (19–21), reported high prevalence rates of MSDs among office-workers during past six months and past 12 months.

Table V: Self-reported productivity loss during presenteeism

	Frequency	Percentage	Productivity determined	Total %
How often MSDs pain limit your working quality?	n	%	*(normal/loss)*	*(normal/ loss)*
1. None of the time	13	3.3	Normal	3.3% normal
2. A little of the time	54	13.6	Loss	96.7% loss
3. Some of the time	213	53.5	Loss	
4. Most of the time	98	24.6	Loss	
5. All of the time	20	5.0	Loss	
Total	**398**	**100.0**		**100**

In particular, those workers who were more likely to report presenteeism during the last month also reported MSDs pain and were manifested in the presence of musculoskeletal symptoms. This is consistent with the results obtained by several studies in literature which showed that presenteeism is significantly correlated with MSDs prevalence (32).

In regard with 11 body parts the study assessed for MSDs incidence; the leading percentage was reported for lower back pain (58.5%n=233), these results are in the lines with earlier literature reported rates of lower back pain to be dominating other body parts MSDs symptoms (33,34). However, the high incidence of MSDs among both genders and despite age groups or geographical regions; made the lower back pain counted for one-third of overall global disability emerging from occupational risk factors (35). Furthermore, in Malaysia (36), a research study consistently reported the same outcome among office workers.

However, that was contradicted with few local studies held among other occupational populations (27) which clearly strengthen the hypothesis that linking high incidence of MSDs with office workers.

Individual factors

The study outcome in regard with socio-demographic factors (gender, age, body mass index BMI, education, smoking habit, and physical exercise per week) showed no significant association between these factors and MSDs reported in the study (data not shown). Even though these results were contradicted with studies linked MSDs with socio-demographic data (38,39) but that relevance deemed to be lesser in Malaysia (20,40). However, these results were limitly discussed to highlight the uniqueness of results obtained by several studies held in Malaysia.

Productivity

Musculoskeletal disorders can influence productivity in work-places by boosting off-work days (absenteeism). Moreover, MSDs can affect performance of the workers who are presenting at work despite pain. In this study, data analysis for MSDs prevalence showed no significant relationship with absenteeism. As a potential clarification; lack of significane in regard with relationship of productivity with reported MSDs

Table VI: Association between Self-reported productivity levels during presenteeism with MSDs prevalence

		Productivity		X^2	*P* value	OR	95% CI	
		Normal	Loss					
		n (%)	n (%)				Lower	Upper
Self-reported productivity during presenteeism	Yes MSD	8 (2.0)	325 (81.7)	4.817	.028*	0.95	0.88	1.017
	No MSD	5 (1.2)	60 (15.1)					

*Significant at $p < 0.05$

prevalence during last 7days was inferable due to variance in data collection duration. Although the data collected for presenteeism/absenteeism were representing last month, the investigation utilizing 7 days of MSDs prevalence might not have been symmetrically consistent with productivity measured.

It is noteworthy that the study showed a relatively low reported absenteeism due to MSDs episodes among participants (3.5% n=14) which was quite common result when considering the counter work-style that employees may develop to avoid not meeting the working demands despite feeling MSDs pains (41), and the nature of office-based work that requires less manual handling.

In the other hand, consistent with findings by other studies (26,42), we found that presenteeism was higher among study respondents (17.8% n=71) the thing which make it among leading causes of productivity loss compared to absenteeism. Same goes to self-reported productivity level; the present findings also stated high rates of agreement among participants (97.7%) on their estimates to loosing normal efficiency when working during presenteeism period of time.

These findings indicate that the effect of presenteeism among office workers is noteworthy-full, both in productivity loss level and in connection to MSDs prevalence. As it were, presenteeism is an issue meriting consideration, despite various countries economic status and cultures (26,43). In addition, with global burden of musculoskeletal sicknesses has been appeared to increase significantly (44), the scale of issue is probably going to increment.

Limitations

In spite of the fact that this study has attained its aims, there were some inescapable limitations and shortcomings. First, because of self-reported nature of study data, it is well known that self-reported data can contain several potential sources of bias (e.g. social desirability and recall bias) that cannot readily be avoided even by well-structured questionnaires and data collection tools. Nonetheless, our study aim was basically concentrating on gathering information which by definition is viewpoints that no one but individual can report (45).

One more limitation connected with self-reported studies, confidentiality concerns and the requirement for anonymity can prompt a considerable number of missing information. In our study, few workers did not report some of their individual socio-demographic and occupational characteristics. This points-out an individual choice of disregarding some socio-demographic and occupational data to avert being identified (38). However, the examination of elements affecting missing information is past the extent of the present study and it could be better researched later on.

CONCLUSION

This study found that prevalence of self-reported musculoskeletal disorders is common among office workers with a high rate of lower back pain. It was also shown that presenteeism affects self-reported productivity in term of quality and or quantity of work that workers could do. One more point recommended to be considered is applying some changes in work environment especially on employer/employee's cooperation so as to reduce presenteeism in order of preventing MSDs and minifying productivity loss.

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