

# Predictors of Musculoskeletal Disorders Among Teachers: An Exploratory Investigation in Malaysia

Ng Yi Ming<sup>1</sup>, Peter Voo Su Kiong<sup>1</sup>, & Ismail Maakip<sup>1</sup>

<sup>1</sup> Faculty of Psychology and Education, Universiti Malaysia Sabah, 88400 Kota Kinabalu, Sabah, Malaysia

Correspondence: Ng Yi Ming. E-mail: yimingng31@gmail.com

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## Abstract

### Purpose:

The present study aimed to examine the prevalence and gender differences in MSDs among teachers, as well as the interaction of associated predictor. In addition, another aim of the study was to investigate the contribution of these predictors, which have not been examined thoroughly particularly in Malaysia.

### Methodology:

A cross-sectional study was employed in this study. A questionnaire was used to measure physical factors, psychosocial factors, workload, work-life balance, general well-being, and MSDs levels among primary school teachers (N=460) from 10 primary schools in Kota Kinabalu.

### Findings:

The prevalence of MSD in the past 6 months was 61.7% (95% CI: 57.4% – 65.9%). The present study findings also indicated that there were significant gender differences in MSDs between female and male teachers ( $t = 1.04$ ,  $p < .05$ ). Hierarchical multiple regression was conducted to examine a range of predictors related to MSDs. Physical factors ( $\beta = .17$ ,  $p < 0.05$ ). Multiple regression was used for a variety of predictors that are associated with MSD. Physical factors ( $\beta = .17$ ,  $p < 0.05$ ), psychosocial factors ( $\beta = -.14$ ,  $p < 0.05$ ), and general well-being ( $\beta = .43$ ,  $p < 0.01$ ) are significantly associated with MSD in Malaysian primary school teachers. Overall, model statistic result was  $F(3, 276) = 36.730$ ,  $p = 0.001$ ,  $R^2 = .45$  and adjusted  $R^2 = .435$ . The model explained 44.7% ( $r = 0.67$ ) of the variance in MSD discomfort.

### Conclusion:

The studies concerning MSDs among teachers revealed the need for a significant effort, not only to examine the risk factors but also to develop interventions to minimize MSDs for those in the teaching profession.

**Keywords:** physical factors, psychosocial factors, workload, work-life balance, MSD

## 1. Introduction

Musculoskeletal disorders (MSDs) have been increasing dramatically worldwide (Durmus, 2012; Labour Force Survey, 2016) and one of the occupations that have been shown to suffer from MSDs is the teaching profession (Mohseni-Bandpei, Ehsani, Behtash, & Ghanipour, 2014). Punnett and Wegman (2004) classified MSDs as injury or pain located in any of the physical supporting structures of the body including the joints, muscles, ligaments, and tendons. Previous studies reported that for teachers, the most commonly reported sites of MSDs were neck and shoulder, lower back and the upper limbs (Erick & Smith, 2011; Darwish & Al-Zuhair, 2013; Erick & Smith, 2014; Rottermund, Knapik, Saulicz, Myśliwiec, Saulicz, Rygiel, & Linek, 2015).

With regard to the incidence of MSDs in teachers, many studies have reported a range of 12 to 84% (Korkmaz, Cavlak, & Telci, 2001). Further, predictors associated with MSDs in various occupations suggested that work involving significant exertion, heavy lifting, uncomfortable positions and very repetitive tasks were responsible for MSDs in the working population (Mayer, Kraus, & Ochsmann, 2012). Due to their great variety of activities and tasks, teachers are also susceptible to both physical and emotional factors that contribute to MSDs (Chong & Chan, 2010).

The physical factors that contribute to the development of MSDs among teachers are physical exertion and

remaining in the same and sometimes awkward positions for most of the workday (sitting or standing) repetitive procedures, head down positions, frequent lifting of heavy loads, and many hours working with the hands raised (Cardoso et al., 2009). These physical factors have been strongly associated with both neck and shoulder pain. They also have the biomechanical bases to be possible risk factors for MSDs (Cardoso et al., 2009; Chiu & Lam, 2007). In addition, other factors such as prolonged standing, poor sitting posture and activities such as carrying papers and books back and forth, moving equipment walking around both in and outside of the building might have an impact on the incidence of MSDs (Cardoso et al., 2009).

Psychosocial factors may also affect the presence of MSDs (Tsuboi et al., 2002; Chiu & Lam, 2007; Erick & Smith, 2013; Erick & Smith, 2014; Mohseni-Bandpei et al., 2014; Yue, Liu, Li, & Wang, 2014; Maakip et al., 2015; Zamri, Moy, & Hoe, 2017; Jaafar & Rahman, 2017; Maakip et al., 2017). Predictors such as high job demands, low supervisory support, poor interpersonal relationships and leadership, low co-worker support, lack of job control, little autonomy for use of skill, and lack of job satisfaction were positively related to MSDs among teachers, office workers, school personnel, and miners. These findings were also supported by da Costa and Vieira (2010) as well as van Rijn, Huisstede, Koes, and Burdorf (2010). A cross-sectional study of teachers in Taiwan found that insecurity was also more likely to contribute to less job control, increased job demands, lack of workplace social support and poor job satisfaction, which in turn adds to job strain, and thus the likelihood of becoming ill (Cheng, Chen, Chen, & Chiang, 2005).

Previous studies also reported that chronic pain can have an impact of general well-being (e.g. mental health) and frequently co-occurs such as anxiety/depression: individuals who suffered from pain are at increased risk for depression, and individuals who suffer from pain are at an increased risk for depression and vice versa (Gureje, Simon, & Von Korff, 2001). It is commonly believed that teachers are more likely to experience mental health problems such as anxiety, depression, somatization disorders, and burnout than those in other professions (Kinman, Wray, & Strange, 2011; Ganster, & Rosen, 2013; Ahola, Hakanen, Perhoniemi, & Mutanen, 2014); Thus, due to increased job demands and work stress, teachers are at more risk of mental health issues than people from most other occupations (Melchior, Caspi, Milne, Danese, Poulton, & Moffitt, 2007; Franco, Manas, Cangas, Moreno, Gallego, 2010; Elder, Nidich, Moriarty, & Nidich, 2014; Kidger et al., 2016). Studies indicated that psychological complaints like depression and anxiety can lead to MSDs (Bair, Wu, Damush, Sutherland, & Kroenke, 2008; Blozik, Laptinskaya, Herrmann-Lingen, Schaefer, Kochen, & Himmel, 2009). Nevertheless, Smedley and colleagues (2003) showed that nurses who reported having depression or stress at the baseline were more likely to report neck/shoulder pain later. Smedley and colleagues (2003) also found a relationship between pre-existing anxiety or depression and the later appearance of MSDs in a sample of female health care workers. Further, the stress caused by anxiety or depression can result in greater muscle tension and pain change blood flow and oxygen supply, and even cause a spike in the sensitivity to the pain of muscles, especially in long-duration muscle pain situations (Linton, 2000; Larsson, Sogaard, & Rosendal, 2007).

Besides, other predictors such as workload also have been implicated in the development of MSDs among a working population (Bongers, Ijmker, van den Heuvel, & Blatter, 2006; Durmus & Ilhanli, 2012). With regard to those in the teaching profession, a heavy workload is related to neck pain among teachers (Chiu et al., 2006). Thus, being a teacher is not an easy task. Kinnunen and Mauno (1998) indicated that women in the teaching profession suffered from the stress that related to heavy workload and time constraints which in turn led to work-family conflict. The negative outcome of this imbalance in work-family conflict is that most of the women quarreled with their husbands due to both their work schedule and unfinished work that originated from stresses, which turn contributed to work-family conflict between them (Kinnunen, & Mauno, 1998). However, Hännig, Gutzwiler, & Bauer (2009), and Hammig et al (2011) stated that for men, the strongest predictors of work-family conflict were frequent overtime, an unpredictable work schedule, and having a management-level job. Whilst for women, the strongest predictors of work-family conflict were the number of tasks, the heaviness of the workload, an unpredictable work schedule and a high-level job (Hännig, Gutzwiler, & Bauer, 2009). Concerning MSDs, studies also have linked between work-family conflict and MSDs (Hammig, Knecht, Laubli, & Bauer, 2011; Jensen & Rundmo, 2015; Kim & Cho, 2017; Weale, Wells, & Oakman, 2017).

However, the relationship between physical factors, psychosocial factors, workload, work-life balance, general well-being and MSDs among teachers has not been properly examined in Malaysia. Also, a recent systematic review suggested that research on MSDs among teachers is still lacking particularly in developing countries such as Malaysia (Erick & Smith, 2011). This is evident as only four studies on MSDs among school teachers in Malaysia were found in the literature and those studies accessed low back pain (LBP) and only one study accessed musculoskeletal pain among those in the teaching profession (e.g. Samad, Abdullah, Moin, Tamrin, & Hashim, 2010; Anuar, Rasdi, Saliluddin, & Abidin, 2016; Balakrishnan, Chellapan, & Thenmozhi, 2016; Zamri,

Moy, & Hoe, 2017). The lack of studies in Malaysia on MSDs among teachers signifies the lack of awareness about the impact and effect of this occupational health problem among teachers even by responsible parties such as the Teachers Union and the government (Zamri, Moy, & Hoe, 2017). As a result, the impact and effect of MSDs among those in the teaching profession are unknown.

Further, not only it is important to investigate the prevalence and the contribution of predictors associated with MSDs but also the interaction of these predictors which has not been examined thoroughly particularly in Malaysia. To date, only a handful of studies have examined the interactive nature of the relationship of various predictors associated with MSDs (Samad et al., 2010; Mohseni-Bandpei et al., 2014; Erick & Smith, 2014; Balakrishnan, Chellappan & Thenmozhi, 2016; Maakip et al., 2017). Although a previous study which conducted by Ng, Peter Voo, and Maakip (2019) found that although the relationship between psychosocial factors and MSDs was partially modified by depression the authors did not explore other underlying risk factors such as physical factors, workload, work-life balance and general well being that may contribute to MSDs. Given this, it is essential to focus on the examination of the risk factors of MSDs in the working population such as school teachers.

## 2. Research Objective

This study had three objectives: the first was to ascertain the incidence of MSDs among primary school teachers in Kota Kinabalu. Secondly, the study aimed to explore the gender differences in MSDs among primary school teachers in Kota Kinabalu. And third, the study aimed to examine the relationship among physical factors, psychosocial factors, workload, work-life balance, general well-being, and MSDs among primary school teachers in Kota Kinabalu. Finally, the last objective of the study was to determine the contribution of various predictors' namely physical factors, psychosocial factors, workload, work-life balance, general well-being to MSDs among primary school teachers in Kota Kinabalu.

## 3. Methods

### 3.1 Sampling Procedures

A cross-sectional survey used to gather information from primary school teachers in 10 primary schools in Kota Kinabalu. A cluster sampling technique was used with probability proportional to size (PPS) surveying a cluster size of 60 teachers from 10 primary schools. The results were that 460 primary school teachers agreed to participate in the study. The survey was conducted between September and November of 2018.

### 3.2 Respondents

There were 367 respondents (n = 460), comprised of 44 (9.6%) of whom were males and 416 (90.4%) were females. The largest number of respondents were middle-aged group (age group of 31–40 (46.3%)).

The respondents' background is displayed in Table 1.

Table 1. Respondents background

Variables	N (%)
<b>Gender</b>	
Male	44(9.6%)
Female	416(90.4%)
<b>Age</b>	
19-20	1 (0.2%)
21-30	28 (6.1%)
31-40	213 (46.3%)
41-50	150 (32.6%)
51 and above	68 (14.8%)

### 3.3 Instrumentation

#### 3.3.1 Instrumentation of Physical Factors

A validated 12-item measure of physical demands was employed to assess participants' exposure to workplace physical hazards using a five-point scale (1= never or hardly ever, 2=seldom, 3=sometimes, 4=often, 5= almost all the time) (Macdonald, Evans and Armstrong, 2007). Items included such questions as "Thinking of your job here, how often do you do very repetitive work-repeating the same actions every few seconds or minutes?"

Based on a previous study (Maakip et al., 2015), the Cronbach's alpha for this scale was 0.80. In the present study, the reliability of physical hazards was  $\alpha = .87$ .

### 3.3.2 Instrumentation of Psychosocial Factors

The respondents were given the Work Organization Assessment Questionnaire (WOAQ) (Griffiths et al., 2006) to assess workplace psychosocial hazards. The validated scale included 26 items for job control, job satisfaction, perceived stress level and social support respectively. The questionnaire was a self-reported questionnaire using a five-point scale (from 5=very good, 4=good, 3=not a problem, 2=slight problem, 1=major problem). A sample item was, "How well do you work with your co-workers (as a team)?" The Cronbach's alpha for WOAQ was 0.93 (Maakip, Keegel, & Oakman, 2017). In the present study, the reliability of this instrument was  $\alpha = .96$  which was very reliable.

### 3.3.3 Instrumentation of Workload

Four validated items on workload were used in the present study that had a five-point response scale (1=never or hardly ever, 2=seldom, 3=sometimes, 4=often, 5=almost all the time) to assess participants' workload (Macdonald et al., 2007). An example of an item to measure workload was "Thinking of your job here, how often do you find that your work is unevenly spread, so it can pile-up?" The reliability of the workload scale was 0.89 (Maakip et al., 2017). In the present study, the reliability of the workload was  $\alpha = .88$ .

### 3.3.4 Instrumentation of Work-Life Balance

Work-life balance was assessed using the Malay Version of a work-family conflict questionnaire that was validated by Sanaz, Syaquirah, and Khadijah (2013). This validated of 22-items had a five-point scale that ranged from 1 (strongly disagree) to 5 (strongly agree). Examples of sample items included "I have to change plans with family members because of the demands of my job", "I would put in a longer workday if I had fewer family demands". The Cronbach's alpha internal consistency ranged from 0.76 to 0.89 which shows adequate evidence of the reliability of the Malay version of the work-family conflict questionnaire (Sanaz, Syaquirah, & Khadijah, 2013). In the present study, the reliability of work-life balance was  $\alpha = .94$  which was very high.

### 3.3.5 Instrumentation of General Well-Being

Participants' general well-being and mental health were measured with 10 validated items measure from the General Well-Being Questionnaire (GWBQ) (Cox, Thirlaway, Gotts, & Cox, 1983). An example of items used to measure general well-being included, "Thinking of how things are at work, how often have you been easily bored" This scale was measured using a five-point scale (0=never or hardly ever, 1=seldom, 2=sometimes, 3=often, 4=almost all the time). The Cronbach's alpha was 0.92 as reported by Maakip et al., (2015). The Cronbach's alpha for the general well-being instrument in the present study was 0.88.

### 3.3.6 Instrumentation of MSDs

To measure the incidence of MSDs, participants were asked if they had experienced discomfort toward the end of their workday in the past six months, with a yes or no response (Oakman et al., 2014).

For the self-reported MSDs (Macdonald et al., 2007) participants who responded 'yes' were asked to report how often and how severe the discomfort was for five areas of the body: 1) neck and shoulder, 2) hand and fingers, 3) arms, 4) middle to lower back, and 5) hips, bottom, legs and feet. They reported the frequency of musculoskeletal discomfort was recorded on a scale of 0-4 (0=never, 1=occasionally, 2=sometimes, 3=often, 4=almost always), and the severity of musculoskeletal discomfort from 1-3 (1=mild, 2=moderate, 3= severe discomfort). Scores for musculoskeletal discomfort were computed for each body region by multiplying frequency and severity and then adding the totals to come out with a total score out of a maximum of 60. Based on previous studies (e.g. Maakip et al., 2015), Cronbach's alpha was 0.92. In the present study, the reliability of the workload was  $\alpha = .87$ .

## 3.4 Data Collection

Before data collection began, the researchers applied for permission from the Ministry of Education and approval from the Department of Education of the state as well. Then, the researchers made a phone call to each school and requested permission from the school principal. If the school agreed to proceed, only then the appointment date and time were set for conducting the study. During the data collection, researchers first distributed a packet consisting of a) information sheet, b) informed consent and c) questionnaire. The respondents were then briefed regarding the study and assured their participation in the study was voluntary. Then, respondents gave their consent to participate and completed the self-administered questionnaire. Ethical approval was given by the Human Ethics Committee, Universiti Malaysia Sabah (UMS).

### 3.5 Data Analysis

The Statistical Package for Social Science (SPSS) version 23 was used to code and analyze the data. First, the data were screened by Exploratory Data Analysis (EDA) to assist in detecting errors, identifying outliers, and checking assumptions on the normality of a distribution. The statistics used in EDA included skewness, kurtosis, boxplot, Q-Q plot, and homogeneity of variance. The descriptive statistics reveal the basic distributional characteristics of all the study variables. The descriptive and inferential statistics were determined as outlined earlier for the study objectives. The magnitude and strength of the relationship between physical factors, psychosocial factors, workload, work-life balance, general well-being, and MSDs were described using the Pearson Product-Moment Correlation analysis. An independent sample T-test was used for the gender differences in MSDs among primary school teachers. The hierarchical multiple regression was conducted to examine a range of predictors related to MSDs.

### 4. Results

The study hypothesized that female teachers in Kota Kinabalu would have a higher incidence of MSDs than male teachers would. In response to the question asking participants if they had experienced discomfort toward the end of the workday; a 6-month point incidence of MSDs was 61.7% (95% CI: 57.4% – 66.3%) with 63.7% of female and 43.2% of male teachers reporting discomfort during the prior six months. Hence the data supported the first ( $H_1$ ) hypothesis of the study.

Table 2. The prevalence rate of musculoskeletal discomfort for Malaysian sample

	Male N (%)	Female N (%)	Total N (%)	Gender differences
Prevalence of musculoskeletal discomfort (last 6 month)				
Yes	19 (43.2%)	265 (63.7%)	284 (61.7%)	p=0.008*a
No	25 (56.8%)	151(36.3%)	176 (38.3%)	

Note: \*  $\chi^2$  (Chi-square)

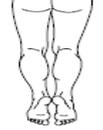
The frequency of MSDs by body regions was shown in Table 3 with participants reporting the most MSDs discomfort was at their neck/shoulder (56.5%), followed by hips, bottom, legs and feet (lower extremity) (48.9%), middle to lower back (48.4%), arms (40.7%) and finally, at their hands/fingers (36.5%).

Table 3. Frequency of MSDs based on body regions

	Body regions	Frequency (%)
	Neck/shoulder	56.5%
	Hands/fingers	40.7%
	Arms	36.5%
	Middle to lower back	48.4%
	Hips, bottom, legs & feet (lower extremity)	48.9%

Table 4 shows the MSDs based on the severity of discomfort by body region among primary school teachers. The most severe discomfort reported amongst teachers was at the neck/ shoulder (14.6%) but many (14.6%) of participants complained they had a moderate level of MSDs at the neck/ shoulder (37.8%). A mild level of MSDs was reported at hips, bottom, legs & feet (lower extremity) among teachers.

Table 4. MSDs based on the severity of body region among primary school teachers

	Body regions	Mild (%)	Moderate	Severe
	Neck/shoulder	9.6%	37.8%	14.6%
	Middle to lower back	28.9%	27.2%	5.2%
	Hips, bottom, legs & feet (lower extremity)	30.4%	25.0%	6.1%
	Hands/fingers	17.2%	32.8%	11.7%
	Arms	19.3%	31.5%	10.9%

4.1 Relationships Between Physical Factors, Psychosocial Factors, Workload, Work-Life Balance, General Well-Being and MSDs

The study hypothesized that there would be a significant relationship between physical factors, psychosocial factors, workload, work-life balance, general well-being and MSDs among primary school teachers in Kota Kinabalu (H<sub>2</sub>). The predictors most associated with MSDs among school teachers were physical factors ( $r= 0.40, p < .01$ ), psychosocial factors ( $r= - 0.37, p < .01$ ), workload ( $r= 0.40, p < .01$ ), work-life balance ( $r= 0.47, p < .01$ ), and general well-being ( $r= - 0.59, p < .01$ ) (see Table 5). Hence the data supported the second (H<sub>2</sub>) hypothesis of the study.

Table 5. Correlates of physical factors, psychosocial factors, workload, work-life balance, general well-being and MSDs

Variable	Physical factors	Psychosocial factors	Workload	Work-life balance	General well-being
Physical factors					
Psychosocial factors	-0.199**				
Workload	0.429**	-0.365**			
Work life balance	0.466**	-0.353**	0.464**		
General well-being	0.355**	-0.386**	0.452**	0.612**	
MSDs	0.405**	-0.379**	0.408**	0.471**	0.599**

\*\* . Correlation is significant

4.2 Gender Differences in MSDs

The study hypothesized that there would be a significant gender difference between male and female teachers in MSDs (H<sub>3</sub>). Table 6 shows that there was no significant gender difference in MSDs among female and male teachers ( $t = 1.04, p > .05$ ). This study found that the mean for males in MSDs was 25.10 and 21.98 for females suggesting that male teachers experiencing MSDs more than their female counterparts do. Thus, data rejected the third (H<sub>3</sub>) hypothesis of the study.

Table 6. Gender differences in MSDs

Variable	Mean		df	t	p
	Male	Female			
Musculoskeletal Disorders (MSDs)	25.10	21.98	460	1.04	0.291

P>0.05

4.3 Predictors Contribution Towards MSDs

The study hypothesized that there would be significant influences by physical factors on MSDs (H<sub>4</sub>) also a significant influence of psychosocial factors on MSDs (H<sub>5</sub>) and a significant influence of workload (H<sub>6</sub>), work-life balance (H<sub>7</sub>) and general well-being on MSDs among primary school teachers in Kota Kinabalu (H<sub>8</sub>). However, findings showed that only physical factors, psychosocial factors and general well-being contributed towards MSDs among primary school teachers (see Table 7). Therefore, data supported the fourth (H<sub>4</sub>), fifth (H<sub>5</sub>), and eight (H<sub>8</sub>) hypothesis of the study.

A hierarchical multiple regression was conducted to examine all of the predictors related to MSDs. Physical factors ( $\beta = .17, p<0.05$ ), Psychosocial factors ( $\beta = -.14, p<0.05$ ), and general well-being ( $\beta = .43, p<0.01$ ) are significantly associated with MSDs in Malaysian primary school teachers (Table 2). Overall, model statistic are  $F(3, 276) = 36.730, p=0.001, R^2 = .45$  and adjusted  $R^2 = .435$ . The model explained 44.7% ( $r = 0.67$ ) of the variance in MSDs discomfort.

Table 7. Hierarchical multiple regression analysis of MSDs on independent variables

Variables	$\beta$	P-value	$\Delta F$	R/R <sup>2</sup> Adjusted R <sup>2</sup>	R <sup>2</sup> Change
Step 1					
Physical factors	.280	.000*		R = .491	
Workload	.288	.000*	29.154**	R <sup>2</sup> = .241	.241
				Adjusted R <sup>2</sup> = .232	
Step 2					
Physical factors	.167	.002*			
Workload	.063	.254		R = .668	
Psychosocial factors	.136	.008*	36.730**	R <sup>2</sup> = .447	.206
Work-life balance	.063	.303		Adjusted R <sup>2</sup> = .435	
General well-being	.431	.000*			

\*p< 0.05; \*\* p<0.01

5. Discussion

The main purpose of this research was to ascertain the 6-month incidence of MSDs among school teachers in Kota Kinabalu. The prevalence of MSDs was 61.7% (95% CI: 57.4% – 65.9%) with females and male teachers reporting discomfort in the prior six months which was similar to previous studies undertaken in Malaysia. For example, the prevalence rate in developing countries such as Malaysia is at a range between 40.4% and 74.5% (Anuar, Rasdi, Sa`liludin, & Abidin, 2016; Balakrishnan, Chellapan, & Thenmozhi, 2016; Zamri, Moy, & Hoe, 2017). Samad, Abdullah, Moin, Tamrin, and Hashim (2010) showed that 40.4% of the total respondents reported having low back pain during their teaching years. In this study, female teachers showed a significantly higher prevalence of low back pain (48.1%) than men (39.6%). While in other types of occupation, Maakip, Keegel, and Oakman, (2017) found 6 months prevalence of MSDs of 92.8% among office workers in Malaysia. These results suggested that MSDs is a significant cause of concern among teachers in Malaysia.

The second aim was to examine the gender differences in MSDs among primary school teachers in Kota Kinabalu. The findings of the present study found no significant gender difference, although male teachers were higher than female teachers. This finding was supported by a few studies that reported no gender differences in the reporting of MSDs (Bernard, 1997; Luime, Koes and Miedem, 2005; Rahman and Atiya, 2009; Mohseni Bandpei, Ehsani, Behtash, & Ghanipour, 2014). However, MSDs among teachers has been positively associated with female sex in several studies (Chong & Chan, 2010; Bařkurt, Bařkurt, & Gelecek, 2011; Korkmaz, Cavlak,

& Telci, 2011; Durmus & Illhanli, 2012; Yue, Liu, & Li, 2012). Cardoso and colleagues (2009) reported that women complained of higher back pain than men did but the differences might be due to the sample size of male vs female teachers, not to the effect of sex on MSDs as education is a professional field that is occupied predominantly by women. This statement was confirmed by Yue, Liu, and Li, 2012; Korkmaz, Cavlak, and Telci, 2011, who found that female sex is not a risk factor for MSDs in teachers. Nevertheless, the role of gender in MSDs development in Malaysia is not well explored.

However, it contradicted findings that reported that the experience of MSDs is higher in women compared to men (Bernard, 1997; Wijnhoven, de Vet, & Picavet, 2006). This has been supported by findings from several studies where female teachers reported neck pain (Chiu & Lam, 2007; Chong & Chan, 2010; Başkurt, Başkurt, & Gelecek, 2011; Korkmaz, Cavlak, & Telci, 2011; Durmus & Illhanli, 2012; Yue, Liu, & Li, 2012) shoulder pain (Edling, & Fjellman-Wiklund, 2009; Chong & Chan, 2010; Korkmaz, Cavlak, & Telci, 2011; Durmus & Illhanli, 2012;) upper limb pain (MacLean, May, Klaber-Moffet, & Sandmark, 2000; Treaster & Burr, 2004; Chiu & Lam, 2007; Cardoso et al., 2009; Chong & Chan, 2010; Sharp & Gardiner, 2010; Paksaichol et al., 2012) back pain (Sandmark, 2000; Chiu & Lam, 2007; Cardoso et al., 2009; Edling & Fjellman-Wiklund, 2009; Chong & Chan, 2010; Başkurt, & Gelecek, 2011; Korkmaz, Cavlak, & Telci, 2011; Durmus & Illhanli, 2012) and lower limb pain (Cardoso et al., 2009; Chong & Chan, 2010; Başkurt, & Gelecek, 2011) more often than their male counterparts.

MSDs prevalence rates have been higher in women compared to men; the possible reason is that males were found to be involved in regular physical exercise more often than females (Durmus & Illhanli, 2012; Beyen, Mengestu, & Zele, 2013). Another possible explanation is that women bear more heavy housework responsibilities than men in daily life; such differences may cause musculoskeletal differences between men and women (Yue, Liu, & Li, 2012). In a Brazilian study, differences in MSDs prevalence were attributed to the female teachers' working conditions. The female teachers were less qualified and had low salaries, greater demands at work, and less autonomy in their work than male teachers did (Cardoso et al., 2009). Another possible explanation is related to differences in pain perception between men and women (Craft, Mogil & Aloisi, 2004), with females more sensitive to pain and more willing to report pain than males (Robinson et al., 2000). This explanation is in line with a study conducted by Chong and Chan (2010), which found that women might be more likely to report pain than men because they have less physical strength, pressure from family and career prospects; or just because men and women have different traditions and thresholds for when and how they report pain (Chong & Chan, 2010).

The third aim examined the relationship between physical factors, psychosocial factors, workload, work-life balance, general well-being and MSDs among primary school teachers in Kota Kinabalu. The findings of this study found that there was a significant relationship between physical factors, psychosocial factors, workload, work-life balance, general well-being and MSDs. Teachers appear to be at an increased risk of developing musculoskeletal symptoms because they are exposed to physical factors that have been associated with the development of MSDs (Baskurt, Baskurt, & Gelecek, 2011). In China, a study found that prolonged sitting in one position without adequate back support has been positively associated with neck/shoulder and lower back pain among teachers. Positions characterized by twisting have also been associated with lower back pain, and prolonged standing has been closely associated with neck/shoulder pain (Yue, Liu, & Li, 2012).

Also, a large and well-accepted body of research literature base supports the relationship between psychosocial factors and the development of work-related MSDs (Tsuboi et al., 2002; Chiu et al., 2006; Chiu & Lam, 2007; Mafarlane et al., 2009; Samad et al., 2010; Mohseni-Bandpei et al., 2014; Maakip et al., 2017). Tsuboi and colleagues (2002) reported that high job demand and physical loads correlated with MSDs in kindergarten personnel. Researchers concluded that low social support and low job satisfaction were related to MSDs even with low physical loads (Tsuboi et al., 2002).

However, there is the inconsistent finding in the review papers which conducted by Hartvigsen, Lings, Leboeuf-Yde, and Bakkateig (2004) stated that after reviewing and critically assessing 40 prospective cohort studies published between 1990 and 2002 in the general population, they found no clear picture of the relationship between work-related psychosocial factors and LBP emerges. The study also found no association between MSDs and perception of workload, organizational factors of work, or support from co-workers. Further, they found insufficient evidence of a positive association between stress at work and MSDs (Hartvigsen et al., 2004).

Furthermore, according to Yahaya, Jamaludin, and Mazeni (2010), the main causes of workplace stress among teachers are their heavy workload. A probable explanation could be that, primary school teachers are expected to

teach eleven subjects, emphasize child-centered teaching methodologies like project methods and breakthrough to Setswana, which require individualized teaching, maintain a continuous assessment record for each child and undertake remedial teaching for slow learners (The National Commission on Education, 1993). However, the contribution of the workload factor in MSDs development among teachers in Malaysia is not well explored.

Work-life balance was an important predictor of musculoskeletal discomfort in Malaysia (Maakip et al., 2015; 2017). Muscle tension is often steadily elevated after work (Baur et al., 2016). The European Foundation for the Improvement of Living and Working Conditions supported this relationship, finding that only 15.6% of workers with low work-family conflict complained about backache, but that this percentage rose by as much as 53.8% in workers who reported high work-life balance (Giaccone, 2007). This occurred faster in women than in men when the work-family conflict was high (Giaccone, 2007; Hännig, Gutzwiler, & Bauer, 2009). The reason could be that working women have to deal with both work and household responsibilities (Giaccone, 2007).

Chronic pain and general well-being (e.g. mental health) such as anxiety/depression frequently co-occur in individuals who suffer from pain, as well as mental health issues such as depression, report greater pain and disability, worse functioning and less effective treatment outcomes for their pain (Bair, Robinson, Katon, & Kroenke, 2003). The study which conducted by Cardoso and colleagues (2009) found that high mental pressure showed a significant relationship with MSDs among school teachers as well as among Japanese nurses (Smith, Mihashi, Adachi, Koga, & Ishitake, 2006). Hence general well-being (e.g. mental health) is related to MSDs.

The fourth aim examined the relationship between physical factors, psychosocial factors, workload, work-life balance, general well-being and MSDs among primary school teachers in Kota Kinabalu. The findings of this study found that only physical factors, psychosocial factors and general well-being have contributed to MSDs among primary school teachers. For the physical factors, the study of Cardoso et al. (2009) showed strong physical exertion and non-ergonomic furniture has also been positively associated with back pain among Brazilian teachers. Parallels can be drawn to the results of a study in Botswana conducted by Erick and Smith (2014) who suggested that teachers whose jobs demanded high physical effort, physical activity, awkward body, and awkward arm placement had a higher prevalence of MSDs. Furthermore, frequent work in an uncomfortable posture has been found to increase the experience of pain in the neck region among office workers in Thailand (Janwantanakul, Pensri, Jiamjarasrangi, & Sinsongsook, 2009). These findings were statistically significant in contributing to the development of MSDs in the teaching profession.

The above findings were consistent with previous studies conducted in Malaysia. The study which conducted by Samad and colleagues (2010) reported that the main task contributing to low back pain in schools was lifting loads mainly workbooks, exam papers and some heavy sports equipment carried by the physical education teachers. Prolonged sitting to grade exams and assignments and prepare lessons was the second factor contributing to low back pain (25.2%), followed by prolonged standing (23.4%). Activities during physical education sessions and climbing up and down the stairs were the fourth contributing factor to low back pain (13.5%). Finally, sitting at a computer was the fifth contributing factor (6.3%).

Studies of MSDs among school teachers have generally shown that psychosocial risk factors such as greater workload/demands, perceived stress in high level, low support from co-workers, low job control, low job satisfaction and monotonous work appear to be associated with MSDs among teachers (Erick & Smith, 2011; Erick & Smith, 2013). High job demand and physical loads correlated with MSDs in kindergarten personnel (Tsuboi & colleagues, 2002). Another study which conducted by Samad and colleagues (2010) in Malaysia found that poor mental health status has been significantly associated with lower back pain among Malay primary school teachers, while another study which conducted in the Philippine by Atlas, Bondoc, Garrovillas, Lo, Recinto, and Yu (2007) showed that stress significantly increased the risk of back pain among Filipino teachers by approximately fourfold.

Nevertheless, the studies conducted by Chiu and Lam (2007) as well as Chiu and colleagues (2006) found positive relationships between high workload, low support from colleagues, high levels of stress, high anxiety, low levels of job satisfaction with upper limb pain and neck pain among a group of Chinese secondary schools teachers in Hong Kong. Among Ethiopian teachers, stress was found to be a risk factor for lower back pain (Beyen, Mengestu, & Zele, 2013). This may be because teachers work in stressful conditions with large classes, lack of sufficient resources and minimal rewards for their work. It has been reported that the greater the psychological demands needed for a certain task, the greater the likelihood to develop MSDs regardless of the anatomical area (Beyen, Mengestu, & Zele, 2013).

Furthermore, psychosocial factors that include psychological risk factor refers to individual's perception of the job characteristics as a factor that can promote positive feedback (motivation and satisfaction) and stress (Samad

et al., 2010). High mental pressure creates a significant psychosocial risk factor for MSDs among school teachers (Tsuboi et al., 2002; Chiu & Lam, 2007) as well as among Japanese nurses (Smith et al., 2006). Other occupations also showed a high incidence of low back pain also showed the relationship with psychosocial factors (Harreby et al., 1996; Tamrin et al., 2007; Scffham et al., 2009).

## 6. Strengths and Limitations

The present study is one of only a few studies that explored the prevalence and predictors associated with MSDs among those in the teaching profession, particularly in Kota Kinabalu, Sabah, Malaysia. However, the present study has limitations, one of which is that all variables were assessed using self-report measures which means that a general negativistic view of the work situation and health status (negative affectivity) might have contributed to the results. Furthermore, because the reports were only from the teachers' perspectives, they might not offer accurate measures of the construct. Another limitation was the design of the study, which employed a cross-sectional approach that may not provide a good basis for establishing causality.

## 7. Conclusions

The results showed the prevalence of MSDs to be 61.7% (95% CI: 57.4% – 66.3%) with 63.7% of females and 43.2% of male teachers reporting discomfort in the preceding six months. This was similar to previous studies conducted in Malaysia. In line with the literature review, the findings of the present study support the hypotheses that physical factors, psychosocial factors, and general well-being are significant predictors of MSDs among teachers.

This study found that males reported more MSDs were higher compared to females although there were no significant sex differences in MSDs among teachers. Inconsistencies still exist with some studies finding due to the role of gender in MSDs development in Malaysia is not well explored. Nevertheless, the present study also showed that only physical factors, psychosocial factors and general well-being have contributed towards MSDs among primary school teachers.

The recommendations for future studies are based on the contributions and limitations identified in this study. First and foremost is the need for longitudinal studies to develop firm conclusions about the causal relationships between predictors and MSDs. The development of MSDs among school teachers in Malaysia was associated with multiple factors namely physical factors, psychosocial factors, and general well-being which were also similar to those in developed countries. However, the relative contributions were different. Given this, an understanding of this relationship is valuable and will assist those teachers in planning, designing, and implementing preventive intervention programs to reduce the risk of MSDs. This study also raises awareness for teachers and other parties involved in policy setting such as the Malaysian Ministry of Education regarding the issues of MSDs at the workplace. The findings also suggest the need for specific culturally sensitive interventions to minimize MSDs at the workplace

## Declaration

### List of Abbreviations

AMOS	Analysis Moment Structures
EDA	Exploratory Data Analysis
EFA	Exploratory Factor Analysis
MSDs	Musculoskeletal Disorders
SEM	Structural Equation Modelling
SPSS	Statistical Package For Social Science

### Ethics approval and consent to participate

We were grateful for the ethics approval from the committee members of University Malaysia Sabah and the ethics approval number is NN-2018-001. We have attached the consent form to participate in the appendix as below.

### Availability of data and material

All data generated or analysed during this study are included in this published article

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