Original article

International Journal of Musculoskeletal Pain prevention

Volume 1, Number 2, Spring 2016

Educational Ergonomic Intervention and Work-related Musculoskeletal Disorders among Office Workers in Tehran, Iran

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Background: Musculoskeletal disorders (MSDs) represent one of the most common occupational health education problems in both developed and developing countries. The aim of this study was to assess the effect of an occupational ergonomic training educational program on awareness, attitude and work-related musculoskeletal disorders behavior among Office Workers.

Methods and Materials: Firstly, 200 office workers from 12 health centers were recruited**.** With response rate of 90%, 180 eligible participants, were assigned to receive an 8-week participatory ergonomic occupational training educational program available in Shemiranat, Tehran, Iran. A self-controlled longitudinal study with pre/post design was used to evaluate the effects of the intervention among office workers in 2015-2016. Post-test was then administered to the participants to identify changes at 3 months after intervention.

Results: Totally**,** 200 participants with a mean age of 37.48 ± 8.78 years old completed this study**.** The 3-month follow-up rate was 90%. After the intervention, the awareness rate, attitude and MSDs work-related health behaviors were improved. The self-reported prevalence of work-related musculoskeletal disorders for neck, shoulder, upper and lower back pain or discomfort were significantly lower than before intervention ($P < 0.05$).

Conclusions: The MSDs work related behaviors as well as MSDs prevalence can be improved through the health education program. It is recommended that further research with larger sample and longer follow up be conducted to confirm the findings of this study.

Keywords: Health education program, Office workers, Work-related, Musculoskeletal disorders

[DOR: 20.1001.1.24765279.2016.1.2.3.2]

Introduction

Musculoskeletal disorders (MSDs) represent one of the most common occupational health problems in both developed and developing countries. Work-related Musculoskeletal Disorders (WMSDs) among office workers are receiving growing attention (Jay, et al., 2010) With mechanized livings, WMSDs are becoming a major health problem encountered by professionals (Brannmark et al., 2012 & Kim et al., 2012). The prevalence of WMSDs linearly correlates with age and length of working experience (Cardoso et al., 2011).

Musculoskeletal disorders have been associated with individual and biomechanical risk factors in the workplace (Bernard et al., 2007). These disorders develop gradually, show a chronic course and often go untreated. Although many symptoms are associated with work-related musculoskeletal disorders, one of the most notable symptoms is pain. Painful symptoms may worsen gradually and progress to loss of function. Pain and loss of function may persist for years and, in some cases, become intractable (Strazdins et al., 2008).

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The risk of developing MSDs is higher among workers who have a high work strain, longer mouse and keyboard use, perceived high muscle tension, and previous MSDs in the neck and shoulder; these risk factors were reported in several longitudinal studies with a follow-up ranging from 3 months to 5.4 years (Douphrate et al., 2012 & Korkmaz et al., 2011).

There is considerable evidence indicating an increased evidence of MSDs problems among office workers (Coury, Moreira & Dias, 2008). Concerns about the risk of WMSDs have been increasing in world. Health centers office workers in general, relative to other occupational groups, have a high prevalence of WMSDs (Erick & Smith., 2011), with a prevalence of between 44% and 92% & Al-Zuhair, 2013). WMSDs decrease productivity at work due to sick leave, absenteeism and early retirement (Maguire & O'Connell, 2007). Musculoskeletal complaints, especially of the lower back, neck and shoulders, are also common among office workers due to prolonged desk work, prolonged sitting and working on a computer (Chong & Chan, 2010). Health education and ergonomics training is an important means of effective prevention and control of musculoskeletal injury. There is a large published literature, that goes back 50 years or more (Erick & Smith., 2011; Cardoso et al., 2011; Korkmaz Cavlak, & Telci 2011 & Darwish & Al-Zuhair, 2013) on the relationship between office workers and WMSDs.

The World Health Organization (WHO) has defined a work related-disorder as one that consequences from a number of factors, and where the work environment and the implementation of the work contribute significantly, but in varying dignity, to the causation of the disease (Darwish & Al-Zuhair, 2013).

This study aimed to explore the efficacy of an interventional program to reduce WMSDs pain among office workers.

Methods and Material

This study was a before-after interventional study among office workers which conducted from Dec, 2015 to Mar, 2016. Ethical approval to conduct the study was obtained from the Ethics Committee of Shahid Beheshti University of Medical Sciences. Cluster sampling was used to select participants randomly. To do this, in first stage, from 24 health centers located in north of Tehran, 12 health centers were selected randomly. Then. From the selected centers, all health care workers who were eligible and were satisfied to be studied, were recruited to be entered into the study. Figure 1 shows the flow chart of the participant selection. The inclusion criteria in this study were as working with computer for at least 3 hours per day and being satisfied to enter into the study. However, the workers who had any previous history of illness and/or injuries contributed to MSDs were excluded of the study.

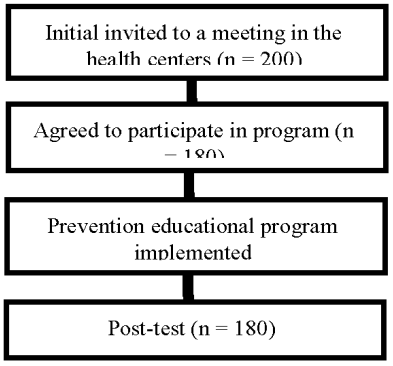

Figure 1 Flow chart of the study participants.

The study' procedures and aims were explained for the potential participants and then the informed consent forms were being signed by them.

To collect data, a questionnaire based on job characteristics of health care office workers was designed. This self-administered questionnaire was constructed and modified from related literature investigating WMSDs among office workers. Furthermore, demographic questionnaire included items like age, gender, education status, years of employment experience were applied for the study. These two questionnaires were collected at initial of the study. In addition to these data, two other questionnaires based on main variables such as knowledge, attitudes, and behaviors regarding ergonomic posture as well as WMSDs pain measurement were completed at two time points of baseline and 3- month follow up. Data were collected from Dec 2015 to Mar 2016 based on information in a survey packet. The survey packets was given to each of the 180 randomly selected office workers which included an information letter, study questionnaires, and pre-paid return envelope. Information regarding completing the questionnaires was also provided in the information letter.

In present study, the body posture and workstation layout were assessed by the modified version of the ergonomic questionnaire (Lewis et al. 2001; Baron et al. 1996). This section was referenced to the Nordic Musculoskeletal Questionnaire (NMQ) (Kuorinka et al., 1987).

[DOR: 20.1001.1.24765279.2016.1.2.3.2]

The term "musculoskeletal disorders" here refers to work-related musculoskeletal disorders that lasted more than a day which affected daily activities, and happened during work hours. Therefore our WMSDs questionnaire covered felt pain in nine body regions, including neck, shoulder, upper back, elbow, hand/wrist, low back, hip/thigh, knee, and ankle/foot.

Moreover the effects of intervention on WMSD-related knowledge, attitudes and behaviors regarding WMSDs as well as prevalence rate of WMSDs were assessed by the researcher-made questionnaire. Content validity index and inter-rater agreement were examined in previous research (Yue et al., 2010).

Thirty office workers from another health care were surveyed to ensure the face validity of the questionnaire in the baseline assessment phase. Moreover, this group completed the questionnaire again after 2 weeks. The validity of questionnaire was determinant by content validity and the test–retest reliability of the questionnaire was conducted to demonstrate that the questionnaire was reliable (Kappa 0.83).

The multifaceted intervention comprised of two sections of lecture and posture training that were lasted approximately for 40 minutes in each session for 8 weekly session. Through this theoretical/analytical intervention musculoskeletal disorders risk factors, pathogenesis, high-risk groups, and basic ergonomic principles, as well as doing exercise and ergonomic training, improving body supported by the current literature on work space ergonomics (Taieb-Maimon et al., 2012-Robertson et al., 2013).

The lecture lasted 40 minutes and ergonomics training involved one exercise 8 -weekly session (Szeto et al., 2013). Each health centers was managed by an experienced health educator.

Descriptive statistics were used to identify the frequencies of WMSD. The proportions of office workers who reported WMSDs in any body part were calculated based on the number of WMSD cases and total respondents.

The knowledge, attitude, behaviors as well as WMSD pain of the office workers were analyzed between pre-intervention and 3 months post- Intervention. This study was conducted with the full consent of the participants. The participants were provided with the details of the study procedure. The consent form was signed by all participants.

Results

Totally, 180 office workers participated and completed the study (90% response rate at 3-month follow up). The office workers' mean age was 37.48 ± 8.78 years. The Majority of the participants were married (N = 138, 69%). Table 1 shows the demographic characteristics of the participants (94.7%).

Table 2 shows the mean score of knowledge, attitudes and behaviors at two time points of pre and post intervention.

Table 1. Demographic characteristic of the participants at initial of the study.

Demographic characteristic		Studied group N = 200		Mean (SD)	SD
		Number	percent		
Age (year)	20-30	52	26	37.48	8.87
	31-40	114	57		
	41-50	34	17		
	50 <	0	0		
Gender	Male	20	10	23.8	3.8
	Female	180	90		
Body mass index (kg/m2) *	Under Wt.	47	23.5		
	Normal	58	29		
	Over Wt.	42	21		
	Obese	53	26.5		
Martial Status	Married	138	69		
	Single	57	28.5		
	Widow	5	2.5		
	No	196	98		
Education	Diploma	23	11.5		
	Upper diploma	65	32.5		
	Bachelor	112	56		
Working e experience	< 5 years	92	46	9.8	2.83
	5-10 years	50	25		
	10-15 years	21	10.5		
	> 15 years	37	18.5		
Sciatica Pain	Yes	4	2		

* BMI

[DOR: 20.1001.1.24765279.2016.1.2.3.2]

Table 2. Comparative pre- and post-intervention results on knowledge/attitudes/ and behavior due to WMSDs* prevention.

Variable	Pre intervention M (SD) **	3 months after intervention M (SD)	95% OR	*P* ***
knowledge	27.57± 9.8	29.62± 0.8	0.78	0 < 0001
Attitudes	27.69± 8.5	28.78± 4.5	0.66	0.005
Behaviors	28.76±0.25	28.96±0.25	0.44	0.033

WMSDs (Work-related Musculoskeletal Disorders)
**M ±SD (Standard Deviation)
*** (P≤0.05)

As Table 2 shows, the WMSD-related knowledge increased significantly at three months post-intervention (P < 0.001). Furthermore, attitudes and behavior mean scores were different promoted after three month post intervention (P = 0.005 and P = 0.033 respectively).

Table 3 shows the self-reported WMSDs frequencies of the participants at two time points of baseline and 3-month follow up. As this Table shows the most frequently felt pains by the participants before intervention were in shoulder and upper back region. Furthermore, this Table shows the rate of felt pain in neck, shoulder, upper and lower back was decreased significantly at three months post-intervention compared to pre-intervention time point (Table 3).

However, this Table indicated that the rate of pain felt in the regions of elbow, wrist/hand, hip/thigh, knee, and ankle/foot was not significantly differed at post-intervention follow up (P > 0.05, Table 3).

Table 3. Comparison of workers' self-reported pain/discomfort at initial and 3-month follow up among studied participants.

WMSDs	Pre-intervention	3 months post-intervention	x2 *P*	
	N (%)	N (%)		
Neck pain	14 (17.03)	9 (14.03)	1.12	0 < 000
Shoulder pain	16 (19.51)	10 (15.62)	1.08	0 < 000
Upper back pain	16 (19.51)	14 (21.87)	1.58	0 < 000
Elbow pain	2 (2.43)	2 (3.12)	1.80	0 < 000
Lower back pain	13 (15.85)	10 (15.620	1.36	0 < 000
Wrist/hand pain	4 (4.87)	3 (4.68)	1.34	0 < 000
Hip/thigh pain	5 (6.07)	5 (7.81)	1.80	0 < 000
Knee pain	9 (10.97)	8 (12.5)	1.59	0 < 000
Ankle/foot pain	3 (3.65)	3 (4.68)	1.80	0 < 000

N (%)–Number (Percent) *P > 0/001

Discussion

This study explored the effects of ergonomic training educational intervention on musculoskeletal pain in different regions of body among office workers. It has been argued that the workplace exercise could reduce musculoskeletal pain, although this beneficial effect depends on the characteristics of the exercise program. Office ergonomics training as the primary prevention program has beneficial effects on lower workstation pain, lower musculoskeletal risk factors, and reducing pain among office workers. Multi component ergonomic intervention alone has been effective in reducing ergonomic risk factors at prevalence of workplace musculoskeletal disorders and also varied across occupational groups and over national boundaries. Previous studies indicated that subjectivity of terms, different assessment tools, organizational differences in work settings, and cultural differences in perception, and reporting of pain and disorders could cause the variation in rates of WMSDs in different evidences (Yue et al., 2010 & Chong & Chan., 2010).

WMSDs have become a large concern in occupational health and are expected to increase in both prevalence and severity because of the changing nature of work and the aging of the workforces (Leyshon et al., 2010). However research is lacking on corresponding intervention among office workers in Tehran, Iran. Compared with the developed countries, Tehran's office workers comprise a high proportional relevant occupational group because of the large population living in Tehran. Thus, in this study based on risk factors, we designed and performed intervention consisting of occupational health education and ergonomics training. Before the intervention, the knowledge and attitudes of office workers regarding musculoskeletal disease was unclear and not scientific. Although most office workers in our study realized that the WMSDs could be prevented, but they were unclear about prevention techniques. After the intervention, the level of knowledge and attitudes about the disorders as well as their prevention behaviors were greatly improved. Furthermore, the present study showed there were significant reduction of pain in regions of neck, shoulder, upper and lower back after

[DOR: 20.1001.1.24765279.2016.1.2.3.2]

intervention. This improvement indicated that multidisciplinary intervention that was applied for the participants in present study could improve knowledge, attitudes and ergonomic training of the participants that in turn led to reduced pain in these regions of participants' bodies.

Ergonomics training intervention in this study made office workers paid special attention to maintaining optimal posture while working at a desk for a period of three months so that after intervention, behavior and attitude toward prevention and control of musculoskeletal injury were improved.

Moreover, educational lectures on occupational health enabled office workers to adjust their own work schedule for doing stretching exercises, which might reduce psychological tension on participants, and subsequently had the greatest impact on improving WMSDs.

Our study verified that WMSDs rates over three months following intervention declined felt pain in neck, shoulder, lower back and waist where the previous researches showed most office workers mainly suffer from pain and discomfort of WMSDs (Yue et al., 2010). However, Yu and co-workers showed that there were significant reductions in WMSDs of the lower extremities, wrist and fingers in manufacturing workers after training intervention (Yu et al., 2012). This inconsistency with our study may be due to differences between jobs' characteristics.

However, with the development of WMSD-related studies, new methods to evaluate the WSMDs are required (Kuijer et al., 2012; Chiasson et al., 2012). Furthermore, doing higher quality studies with increased number of observations over time, or extending the length of follow up, are needed to support evidence-based ergonomic interventions in practice (Yu et al., 2012; Hoe et al., 2012; Van Niekerk et al., 2012; Black, et al., 2012).

This would indicate that long-term specialized training for WMSD-related prevention should be considered and supported in future. WMSDs are chronic cumulative occupational injuries among office workers and this high risk group needs long-term cumulative formation and reinforcement of proper habits to change their behavior forever.

Although there are strength points for this study, some limitations should be mentioned. Firstly, the design of the present study could be improved. Our study was pre/post designed without a control group so that contamination could not be adequately examined. Despite this, as there have been potential applications of this intervention model for office workers in other countries, the intervention should be modified to be implemented among Iranian office workers suffering from WMSDs. Being self-report data collection is the other limitation of this study that should be considered in future studies.

Despite these limitations our study showed that the participants who complied with the training educational management experienced significantly less pain after the intervention that are in the line of other studies' results.

Conclusion

The findings of this study showed the ergonomic education/training intervention could improve knowledge/attitudes/preventive behaviors regarding WMSDs that consequently led to reduced musculoskeletal pain among office workers living in Tehran, Iran.

Conflict of Interest

There is no conflict of interest for this article.

Acknowledgement

The authors would like to thank research deputy of Shahid Beheshti University of Medical Sciences for its financial support of this study.

Author contribution

FP: Study implementation, Data collection and analysis, writing the first draft of Paper.

JN and FP and RP: Study design and data analysis, editing and confirming the final draft of the paper.

HR and RP: Study design, confirming the final draft of the paper.

Funding/Support

No Declared.

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[DOR: 20.1001.1.24765279.2016.1.2.3.2]

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[DOR: 20.1001.1.24765279.2016.1.2.3.2]

How to cite this article: Pourhaji, F., Naserinia, S. J., Pourhaji, F., Pourhaji, R., Ranjbar, H.,Delshad MH. An assessment of a health Educational Intervention based on the ergonomic training for the prevention of work-related Musculoskeletal Disorders among Office Workers: The Behavioral intentions affecting in Risk management IJMPP. 2016; 1 (2): 61-67.