Effect of educational intervention on practicing correct body posture to decrease musculoskeletal disorders among computer users

Ziba Khalili\textsuperscript{1}, Mohammad Panahi Tosanloo\textsuperscript{2}, Hossein Safari\textsuperscript{2}, Bahman Khosravi\textsuperscript{2}, Seyyed Abolfazl Zakerian\textsuperscript{3}, Nazli Servatian\textsuperscript{4}, Farhad Habibi Nodeh\textsuperscript{2,5}

Abstract:
AIM AND BACKGROUND: Studies show that the risk of musculoskeletal disorders (MSDs) among computer users is more than the other occupations. The present study aimed to determine the effect of educational intervention based on the “stages-of-change” model on practicing the correct posture to reduce MSDs among computer user staff of Tehran University of Medical Sciences (TUMS).

METHODS: This is a quasi-experimental study which was carried out on 176 staff of TUMS. The study population was divided into two case and control groups, each including 88 participants. A self-structured as well as a standard questionnaire was used to collect the data. Data then were analyzed using descriptive and analytical tests.

RESULTS: There was no significant difference between both groups in terms of mean score of stages of change, perceived benefits and barriers, self-efficacy, and processes of change before the intervention. However, the mean score of these variables increased for case group 3 months after the intervention. In addition, case group participants reported lower MSDs in their neck, lower back, elbow, and knee compared to control group.

CONCLUSION: Ergonomic educational intervention based on the “stages-of-change” model has a positive impact on reduction of MSDs. Therefore, these disorders can be decreased through reducing working hours, changing the work conditions in accordance with ergonomic principles, dedicating some time for staff exercise, and holding educational courses for the personnel.

Keywords: Correct posture, educational intervention, musculoskeletal disorders, stages-of-change model

Introduction

The growing advancement of modern technologies in human life has speeded up the processes of doing jobs and has increased the rate of production and productivity. However, it has also imposed some side effects such as inertia, fatigue, neurological-psychological pressures, and increased incidence of musculoskeletal disorders (MSDs) on people.\cite{1} MSDs are the result of workplace risk factors along with doing physical activities at positions which are ergonomically unsuitable.\cite{2} Such disorders are known as one of the most important reasons for work absences and disability in individuals. Moreover, almost one-third of health-care expenditures is the result of such disorders, and it has had an increasing trend since 1980.\cite{3,4} Some of the most important occupational causes of these disorders include doing repetitive physical activities, wrong posture of the body while working as well as the stress due to local contact and standing position of body

How to cite this article: Khalili Z, Tosanloo MP, Safari H, Khosravi B, Zakerian SA, Servatian N, \textit{et al.} Effect of educational intervention on practicing correct body posture to decrease musculoskeletal disorders among computer users. \textit{J Edu Health Promot} 2018;7:166.
which all are created while working with computer. Literature shows that computer users, compared to other occupations, are more likely to experience the risk of MSDs. In addition, computer users are prone to develop the musculoskeletal symptoms with a prevalence of 50%. Considering the various ergonomic exposures, working with computer can cause MSDs in different parts of the body such as the neck, shoulder, elbow, waist, and fingers. According to a study in the US, the frequency of MSDs among computer users was 54%; this was especially seen among women and in their neck and shoulder. Another study in Germany also showed that most of these disorders happen in the neck, shoulder, and elbow, and the symptoms for those who worked more than 6 h with computer were more severe. Furthermore, in a national study by Bastani et al., the prevalence of these disorders among computer laboratory employees of a governmental organization was reported 48.2%; most of these disorders had happened in the neck (53%), waist (48%), and shoulder (12%).

In a study by Pillastri et al., the results revealed that those who had received information brochure as well as ergonomic interventions were more likely to experience lower pain and had less problems in the waist, neck, and shoulder. In addition, Mohammadi and Mohammadi have also pointed out that educating people on having proper body postures has a significant effect on reduced MSDs. Therefore, those who continuously work with computer should be educated to prevent from these disorders. There are different models for education depending on the goal of education. Transtheoretical Model (TTM) is one of these educational models which was introduced by Prochaska in 1979. Studies carried out using “stages-of-change” model have shown its positive effect on possibility of quitting cigar smoking, reduced alcohol use, doing mammography, and using proper body posture. Nonetheless, this model has rarely been used in occupational health. According to this model, change is not an accident but a process, and people are at different stages of a change process.

This model measures an individual’s readiness to act on a new healthier behavior through various stages of change including precontemplation, contemplation, preparation, action, and maintenance. The model consists of constructs such as ten-stage processes of change, self-efficacy, and decisional balance. Moreover, simultaneous use of all these steps provides a suitable guideline for implementing the interventions.

Considering the high prevalence of MSDs among computer users as well as the importance of prevention from such disorders within workplaces, this study was prospected to determine the effect of implementing an educational intervention based on TTM on practicing proper body postures to reduce these disorders among computer users. The results of this study will be helpful in designing programs for educating people on having proper body postures during the work to prevent from MSDs.

Methods

This is a quasi-experimental study which was carried out on 176 computer user staff at Tehran University of Medical Sciences (TUMS) in 2015. Multistage random sampling was used to choose the samples. Among all of the administrative buildings of TUMS, central administrative building was selected as setting of the study. Then, upper and lower floors were randomly considered as control and case groups, respectively. There was no certain relationship between these two groups. Inclusion criteria were having at least a year work experience and more than 20 h of work per week—a benchmark for long work in occupational health. Moreover, exclusion criteria included having less than a year work experience and <20 h of work per week. In addition, we also excluded those who were suffering from any pain or discomfort due to having former medical disorders or those who had been suffering from MSDs before getting employed in their current organization. Data were collected using two standard questionnaires: nordic standard questionnaire which includes questions related to MSDs in the neck, shoulder, upper waist, wrist, lower waist, elbow, knee, hip, and foot. This questionnaire was developed by Kuorinka et al. at occupational health institute for Scandinavian countries. The second one was a self-structured questionnaire which was developed based on the “stages-of-change” model to improve the right body posture. This questionnaire includes demographic as well as special questions related to constructs of TTM (stages of change, perceived benefits, perceived barriers, self-efficacy, and processes of change). It includes 55 questions of which 12 are for demographic information, 1 related to stages of change, 7 for perceived benefits, 9 for perceived barriers, 6 for self-efficacy, and 20 related to processes of change. Question for “stages of change” was a five-choice question receiving the score 1 (the lowest) to 5 (the highest). Moreover, questions for perceived benefits and barriers were in Likert scale ranging from “completely agree” to “completely disagree”. The least and the most score for perceived benefits ranged from 7 to 35. However, it was 9–45 for perceived barriers. In addition, “self-efficacy” questions were also in Likert scale ranging from “completely unsure” to “completely sure” with the least and the most score of 6–30, respectively. Finally, “processes of change” were measured using five-choice questions with answers ranging from “never” to “always” with the lowest and the highest score of
20–100. The validity of self-constructed questionnaire was approved using a ten-member expert panel and through content analysis, content validity rate, and content validity index. Furthermore, its reliability was tested through doing a study on 20 samples similar to the study samples along with doing test–retest ($r = 0.89$, for all constructs) and Cronbach’s alpha ($r = 0.99$). At the first stage, researchers explained the objective of study as well as the confidentiality of collected data to the participants. Then, the questionnaires were filled out by both case and control groups, and the data gathered at this stage were analyzed. Next, after needs assessment and analysis of the results from stage 1, an educational intervention based on the constructs of TTM was carried out for 70 min through holding short lectures, question and answer meetings, group discussion, individual counseling, and provision of educational videos and pamphlets for case group. The control group did not receive any training. Both groups again completed the questionnaires 3 months after the intervention. Postintervention data were entered into SPSS 16 and were analyzed using descriptive (mean, standard deviation, and percentage) and analytical (independent $t$-test, paired $t$-test, Chi-square, and McNemar’s test) tests.

### Results

One hundred and seventy-six computer user staff of the central administrative building of TUMS participated in the present study. Of which 109 (61.9%) were female and the rest were male. Moreover, with regard to their marital status, 133 (75%) were married and the remaining were single. Considering their education, 54 (30.7%) had diploma, 24 (13.6%) with upper diploma, and the rest had bachelor or higher degrees. In addition, the mean and standard deviation of age, work experience, and working hours for case and control groups were 39.54 ± 8.81, 14.87 ± 7.62, and 8.29 ± 1.7 and 35.09 ± 7.43, 12.29 ± 7.78, and 8.1 ± 52.8, respectively. There seen no significant difference between both groups with regard to gender, age, education, work experience, and working hours.

As indicated in Table 1, the results of independent $t$-test showed that before the intervention, there was no significant difference between case and control groups in mean score of stages of change, perceived benefits, perceived barriers, self-efficacy, and processes of change. However, there seen a major difference between both groups after the intervention ($P < 0.001$).

Furthermore, there was no significant difference between case and control groups with regard to the mean score of stages of change ($P = 0.652$); however, the mean score of case group increased after the intervention ($P < 0.001$). Moreover, the results of paired $t$-test revealed that the intervention had statistically significant effect on case group ($P < 0.001$), but the mean score for control group had stayed almost the same as preintervention ($P = 0.366$) [Table 1].

There was no major difference between both groups concerning the mean score of perceived benefits before the intervention ($P = 0.918$); however, the results of independent $t$-test showed that the mean score of case group increased after the intervention and there seen a significant difference between both groups in this regard ($P < 0.001$). According to paired $t$-test, case group showed dramatic changes for this item ($P < 0.001$), whereas this was not significant for control group ($P = 0.713$) [Table 1].

Considering the perceived barriers, self-efficacy, and processes of change, there was also no significant difference between both groups with regard to these items before the intervention; however, the intervention

### Table 1: Mean and standard deviation of case and control group’s variables before and after the educational intervention

| Variable         | Time period | Case group (88 people) | Control group (88 people) | Significance level |
|------------------|-------------|------------------------|---------------------------|-------------------|
| Stage of change  | Preintervention | 2.28±0.99             | 2.35±1                    | 0.652             |
|                  | Postintervention | 3.81±0.71             | 2.30±0.97                 | $P < 0.001$       |
|                  | $P$          |                        |                           |                   |
| Perceived benefits | Preintervention | 20.67±6.41            | 20.8±5.6.80               | 0.918             |
|                  | Postintervention | 27.0±5.81             | 20.56±5.54                | $P < 0.001$       |
|                  | $P$          |                        |                           |                   |
| Perceived barriers | Preintervention | 24.35±40.35           | 23.5±90.46                | 0.541             |
|                  | Postintervention | 34.6±51.76            | 24.09±5.46                | $P < 0.001$       |
|                  | $P$          |                        |                           |                   |
| Self-efficacy    | Preintervention | 14.54±0.29            | 14.4±31.20                | 0.777             |
|                  | Postintervention | 22.4±48.64            | 14.4±48.22                | $P < 0.001$       |
|                  | $P$          |                        |                           |                   |
| Processes of change | Preintervention | 48.9±23.32           | 49.6±86.99                | 0.193             |
|                  | Postintervention | 71.17±88.18           | 50.7±61.06                | $P < 0.001$       |
|                  | $P$          |                        |                           |                   |
had a major influence on case group, but the mean score of control group was not affected [Table 1].

As shown in Table 2, there seen no significant difference between case and control groups concerning the frequency of MSDs; however, the frequency of pain in the neck, waist, knee, and elbow reduced after the intervention. Moreover, the results of Chi-square test showed a significant difference between case and control groups with regard to the frequency of pain in above-mentioned parts of the body after the intervention. In addition, case group reported lesser pain compared to preintervention period. Furthermore, McNemar’s test revealed that although there was a significant difference between frequency of pain in the neck, waist, lower back, knee, and foot before and after the intervention for case group, control group experienced no change after the intervention.

**Discussion**

Education through “stages-of-change” model improves the stage of change and enhances the perceptions of benefits, barriers as well as self-efficacy, and processes of change regarding practicing correct posture and its effect on reduction of MSDs.

According to the results of our study, both groups reported having pain in the neck, shoulder, waist, back, and knees before the educational intervention. However, postintervention results showed that case group participants reported a decreased pain in the neck, waist, knee, and elbow, but there was no change in the pain of shoulder and hip. Although education has a positive effect on practicing correct body posture, reducing MSDs require personal and ergonomic protection equipment. Such equipment was not provided for the study population over the study period. On the other hand, analysis of the posteducation results showed a positive change in stages of change, improved perceived benefits and barriers, self-efficacy, and processes of changes regarding practicing correct body posture. These results magnify the significant effect of education on reduced MSDs.

Results of a study by Moazzami and Soltanian on practicing correct posture among nurses showed that education changes the mean score of self-efficacy, processes of change, and reduces the related barriers.\[16\] Furthermore, Solhi et al. reported that educating pregnant women had a positive impact on the mean score of their perceived benefits.\[17\] In addition, according to

| Type of MSDs | Time period | Case group (88 people) | Control group (88 people) | Significance level |
|-------------|-------------|------------------------|---------------------------|-------------------|
| Neck        | Preintervention | 39                     | 41                        | 0.762             |
|             | Postintervention | 22                     | 45                        | \(P<0.001\)       |
|             |              | \(P<0.001\)            | 0.152                     |                   |
| Shoulder    | Preintervention | 30                     | 35                        | 0.435             |
|             | Postintervention | 27                     | 33                        | 0.34              |
|             |              | \(P=0.25\)             | 0.5                       |                   |
| Waist       | Preintervention | 36                     | 37                        | 0.878             |
|             | Postintervention | 19                     | 39                        | 0.001             |
|             |              | \(P<0.001\)            | 0.774                     |                   |
| Back        | Preintervention | 31                     | 24                        | 0.255             |
|             | Postintervention | 25                     | 26                        | 0.868             |
|             |              | \(P=0.031\)            | 0.652                     |                   |
| Knee        | Preintervention | 24                     | 28                        | 0.509             |
|             | Postintervention | 19                     | 38                        | 0.002             |
|             |              | \(P=0.006\)            | 0.062                     |                   |
| Foot and hand wrist | Preintervention | 19                     | 21                        | 0.719             |
|             | Postintervention | 14                     | 19                        | 0.344             |
|             |              | \(P=0.062\)            | 0.5                       |                   |
| Feet        | Preintervention | 17                     | 15                        | 0.696             |
|             | Postintervention | 12                     | 18                        | 0.299             |
|             |              | \(P=0.006\)            | 0.062                     |                   |
| Hip         | Preintervention | 9                      | 16                        | 0.131             |
|             | Postintervention | 12                     | 16                        | 0.410             |
|             |              | \(P=0.25\)             | 0.19                      |                   |
| Elbow       | Preintervention | 9                      | 10                        | 0.808             |
|             | Postintervention | 6                      | 15                        | 0.034             |
|             |              | \(P=0.25\)             | 0.062                     |                   |

MSDs=Musculoskeletal disorders
Moreover, Munchaona pointed out that intervention reduced the musculoskeletal pain among experimental group compared to control group. According to Robertson et al., educating employees about ergonomic issues improve their knowledge and skills on considering correct posture, and they are more likely to act on changing their wrong body postures. Literature has shown that holding educational sessions about correct body postures play a crucial role in decreasing the MSDs, especially in feet.

According to Mohammadi Zeidi et al., educational intervention had a significant effect on case group regarding the stages of change, attitude, perceived behavioral control, and ergonomic knowledge. It reduced the percentage of MSDs from 40% to 33% for experimental group. However, it decreased the incidence of these disorders from 40.11% to 40% in control group. As it is obvious, education plays an important role in decreasing MSDs; therefore, it is essential to educate those who use computers through holding in-service training.

Results of the present study showed that the mean score of stages of change for experimental group employees increased dramatically after the intervention, whereas it did not have any impact on control group. Keller et al., argues that individuals pass various stages to accept a behavior, so educational approaches should identify any possible barrier or use proper interventions to guide them into next stage. These results are also in consistent with the results of a study by Mohammadi Zeidi.

A behavior happens when we give more importance to its perceived benefits than its perceived barriers. Results of the present study indicated that the mean score of perceived benefits for case group increased after educational intervention; however, there seen no change in control group regarding this variable. This was also pointed out by Solhi et al. In addition, Moeini et al. reported that educational intervention increased the decisional balance.

According to the findings of the present study, there was a significant difference between both groups concerning the mean score of perceived barriers. In other words, educational intervention reduced the perceived barriers for case group. These results are also in consistent with the findings of Moaazami’s study. Moreover, although there was an increase in the mean score of self-efficacy variable for case group after the intervention, there was no significant change in control group. Abareshi also mentioned this in another study.

Processes of changing the activities are strategies which help the individual move forward in the stages of change. Findings of the present study indicated that the educational intervention raised the mean score of processes of change for case group but did not have any effect on control group. These findings have also been pointed out by Moazami and Soltanian.

Furthermore, the intervention reduced the frequency of MSDs in the neck, elbow, waist, feet, and knee for case group. In other words, educating participants on practicing correct body posture through “stages-of-change” model had decreased MSDs. This was also observed by Munchaona. In addition, Wu et al. also reported a reduction in the prevalence of MSDs after the intervention, especially in feet. In another study, results showed that the total incidence of MSDs for case group had reduced from 40% to 35.33%; however, this was not really significant for control group. Moreover, Choubine et al. also stated a significant decrease in the prevalence of waist and lower back pain for case group after the intervention.

Conclusion

Considering the findings, emphasizing the educational intervention, to maximize the benefit of its impact in proper posture, simultaneously use of other interventions such as equipping personnel offices to auxiliary equipment (including chairs and desks with regard to ergonomic principles and using suitable footrest stands), decreasing the working hours, dedicating some time for staff exercise, and holding educational courses for personnel is necessary. These actions can lead to reduced MSDs.

Acknowledgment

This study was the result of a master thesis in health education and promotion at TUMS. We would like to thank all who sincerely helped us through doing this project.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

References

1. Bathaei A, Khalili K. Diseases due to Computer Work, Work and Environment Center. Ministry of Health; 2005. p. 29-36.
2. Bernaards CM, Ariëns GA, Hildebrandt VH. The (cost-) effectiveness of a lifestyle physical activity intervention in addition to a work style intervention on the recovery from neck and upper limb symptoms in computer workers. BMC Musculoskeletal Disorders 2006;7:80.
3. Desai A, Shah S. Screening and early intervention of cumulative trauma. Indian J Occup Ther 2004;36:41-5.
4. Rafieepour A, Rafieepour E, Sadeghian M. Effectiveness of ergonomics training in decreasing the risk of musculoskeletal disorders based on rapid upper limb assessment among computer operators. J Ergon 2015;3:25-32.
5. Zakerian SA, Monazzam MR, Dehghan SF, Mohraz MH, Safari H, Asghari M. Relationship between knowledge of ergonomics and workplace conditions with musculoskeletal disorders among nurses: A questionnaire survey. World Appl Sci J 2013;24:227-33.
6. Safari H, Ebrahimi E. Using modified similarity multiple criteria decision making technique to rank countries in terms of human development index. J Ind Eng Manage 2014;7:254-75.
7. Gerr F, Marcus M, Monteith C. Epidemiology of musculoskeletal disorders among computer users: Lesson learned from the role of posture and keyboard use. J Electromyogr Kinesiol 2004;14:25-31.
8. Gerr F, Marcus M, Ortiz D. Musculoskeletal Disorders among VDT Operators. Bethesda (GA): NIOSH; 2001. p. 82.
9. Voerman GE, Sandsjö L, Vollenbroek-Hutten MM, Larsman P, Kadeffors R, Hermens HJ, et al. Effects of ambulant myofeedback training and ergonomic counselling in female computer workers with work-related neck-shoulder complaints: A randomized controlled trial. J Occup Rehabil 2007;17:137-52.
10. Juul-Kristensen B, Jensen C. Self-reported workplace related ergonomic conditions as prognostic factors for musculoskeletal symptoms: The “BIT” follow up study on office workers. Occu Environ Med 2005;62:188-94.
11. Rempel DM, Krause N, Goldberg R, Benner D, Hudes M, Goldner GU, et al. A randomised controlled trial evaluating the effects of two workstation interventions on upper body pain and incident musculoskeletal disorders among computer operators. Occup Envir Med 2006;63:300-6.
12. Bastani S, Lahni M, editors. Survey of the status of musculoskeletal problems in a computer site’s employees in perspective of ergonomics and determine its risk factors. Articles of Ergonomics Congress in Industry and Production Tehran; 2001.
13. Pillastrini P, Mugnai R, Farneti C, Bertozzi L, Bonfiglioli R, Curti S, et al. Evaluation of two preventive interventions for reducing musculoskeletal complaints in operators of video display terminals. Phys Ther 2007;87:536-44.
14. Mohammadi Zeidi I, Mohammadi Zeidi B. The effect of stage-matched educational intervention on reduction in musculoskeletal disorders among computer users. Journal of babol university of medical sciences (JBUMS). 2012; 14 (1): 42-49.
15. Safari M, Shojaei-Zadeh D, Ghofranipour F, Heydarnia A, Pakpur A. Theories, Models and Methods of Health Education and Health Promotion. Tehran: Asaresobhan; 2009. p. 117-21.
16. Moazimi Z, Soltanian AR. Correct body posture in nurses: An application of motivational interviewing. J Res Health 2013;3:466-73.
17. Solhi M, Ahmadi L, Taghdisi MH, Haghani H. The effect of trans theoretical model (TTM) on exercise behavior in pregnant women referred to dehaghan rural health center. Iran J Med Educ 2012;11:942-50.
18. Moeini B, Rahimi M, Allahverdi Pour H, Moghim Beigi A, Mohammadfam I. Effect of education based on trans-theoretical model of promoting physical activity and increasing physical work capacity. J Mil Med 2010;12:123-30.
19. Munchaona S. Application of Transtheoretical Model on Muscle Pain Prevention of Industrial Sewing Machine Operators (Dissertation). Thailand: Mahidol University; 2003.
20. Robertson M, Amick BC 3rd, DeRango K, Rooney T, Bazzani L, Harrist R, et al. The effects of an office ergonomics training and chair intervention on worker knowledge, behavior and musculoskeletal risk. Appl Ergon 2009;40:124-35.
21. Wu HC, Chen HC, Chen T. Effects of ergonomics-based wafer-handling training on reduction in musculoskeletal disorders among wafer handlers. Int J Ind Ergon 2009;39:127-32.
22. Keller S, Herda C, Ridder K, Basler HD. Readiness to adopt adequate postural habits: An application of the transtheoretical model in the context of back pain prevention. Patient Educ Couns 2001;42:175-84.
23. Abareshi Z, Tahmasian K, Mazaheri MA, Panaghi L. The impact of psychosocial child development training program, done through improvement of mother-child interaction, on parental self-efficacy and relationship between mother and child under three. Journal of Research in Psychological Health. 2009; 3(3): 49-58.
24. Choobineh A, Mokhtarzadeh A, Salehi M, Tabatabaei SH. Ergonomic evaluation of exposure to musculoskeletal disorders risk factors by QEC technique in a rubber factory. Jundishapur Scientific Medical Journal. 2008; 7(1):46-55.