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Theory-Based Education and Postural Ergonomic Behaviours of Computer Operators: A Randomized Controlled Trial From Iran

Bilgisayar Kullanıcılarının Postüral Ergonomik Davranışları ve Teoriye Dayalı Eğitimi: İran'dan Bir Randomize Kontrollü Çalışma

Sedigheh Sadat TAVAFİAN, Isa 1- Mohammadi ZEİDİ*, Ali Reza HEİDARNİA

Department of Health Education, Faculty of Medical Sciences, Tarbiat Modares University, Tehran, Iran

**Department of Public Health, Faculty of Health, Qazvin University of Medical Sciences, Qazvin, Iran*

Summary

Objective: This study evaluated the effects of a designed stage-matched educational program based on stage of change model on knowledge, attitude, intention and behaviours of Iranian computer users.

Materials and Methods: Of four computer stations affiliated to Qazvin University of Medical Sciences, two sites were randomly selected as intervention and control ones, each 75 eligible computer users were randomly selected and if satisfied, they were entered into the study. The participants working in intervention site received the stage-matched intervention. Questionnaires of stages of change, ergo-knowledge/attitude, intent towards ergonomic and postural behaviour, Rapid Upper Limp Assessment (RULA), Visual Analogue Scale (VAS), and the Nordic questionnaire were completed at baseline and 3-month follow up. Data were entered to SPSS and analyzed through descriptive and analytical statistics.

Results: A total of 150 participants with a mean age of 31.6 years (SD=7.0) took part in the study of which 67% (n=101) were female. The intervention group, compared to control group, showed significant improvements in stages of change ($p<0.001$), ergo-knowledge ($p<0.001$), attitude ($p< 0.05$), intent ($p<0.001$), and perceived behaviours control ($p<0.001$).

Conclusion: This study revealed beneficial impact of the educational program in occupational setting. This designed stage-matched educational program could be practiced by computer workstations. *Turk J Phys Med Rehab 2012;58:312-8.*

Key Words: Stage-matched intervention; ergonomic/postural behaviours; musculoskeletal disorders; pain; computer user; theory of planned behaviours; transtheoretical model

Özet

Amaç: Bu çalışma, evre eşlemeli projelendirilmiş bir eğitim programının İran'daki bilgisayar kullanıcılarının bilgi, tutum, niyet ve davranışları üzerindeki etkilerini değerlendirmiştir.

Gereç ve Yöntem: Kazvin Tıbbi Bilimler Üniversitesi'ne bağlı dört bilgisayar istasyonundan ikisi çalışmaya dahil edilmiştir. Bu iki istasyondaki görevlilerden çalışma kriterlerine uyan 75'er bilgisayar kullanıcısı çalışma ve kontrol denekleri olarak randomize edilmiştir. Çalışma grubundaki deneklere evre eşlemeli girişim programı uygulanmıştır. Başlangıçta ve 3 aylık takipte değişim evreleri, ergonomi bilgisi/davranışı, ergonomiye ve postural davranışa yönelim anketleri, Hızlı Üst Uzuv Değerlendirmesi (RULA), Vizüel Analog Skala (VAS) ve Nordic anketi kullanılmıştır. Tanımlayıcı ve analitik istatistikte SPSS'den yararlanılmıştır.

Bulgular: Yaş ortalaması 31,6 yıl (SD=7,0) olan 150 katılımcı çalışmaya alındı. Bunların %67'si (n=101) kadındı. Bu çalışma iş ortamında eğitim programının faydalı etkisini göstermektedir, değişim evreleri (p=0,001), ergonomi bilgisi (p=0,001), davranış (p=0,05), niyet (p=0,001) ve algılanan davranış kontrolünde (p=0,001) kontrol grubuna kıyasla önemli gelişmeler gösterdi.

Sonuç: Evre eşlemeli projelendirilmiş eğitim programı bilgisayar merkezlerinde uygulanabilir. *Türk Fiz Tıp Rehab Derg 2012;58:312-8.*

Anahtar Kelimeler: Evre eşlemeli girişim; ergonomik/postüral davranış; muskuloskeletal hastalıklar; ağrı; bilgisayar kullanıcısı; planlanmış davranış teorisi; transteoretik model

Address for Correspondence:/Yazışma Adresi: Sedigheh Sadat Tavafian MD, Department of Health Education, Faculty of Medical Sciences, Tarbiat Modares University, Tehran, Iran Phone: 0098 21 82884547 E-mail: tavafian@modares.ac.ir **Received/Geliş Tarihi:** July/Temmuz 2010 **Accepted/Kabul Tarihi:** December/Aralık 2011

Introduction

Computer using has become increasingly common in both workplaces and homes over the past years, worldwide (1). Many evidences indicated that disregarding ergonomics while operating computer may lead to work-related musculoskeletal disorders (MSDs) (1,2-4). A review of the available literature confirms the association between computer using and MSDs (5). It has been argued that up to half of video display terminal (VDT) operators are particularly susceptible to the development of musculoskeletal symptoms (6). Because of widespread use of computer, even relatively small risk of related musculoskeletal symptoms would have important implication to design appropriate interventions (7). Ergonomics training is one of the basic elements of macro-ergonomic approaches that could play a key role in unifying ergonomic goals and practices, providing adequate knowledge about rearrangement of work area and promoting healthy ergonomic habits (7,8-11). Due to very few existing studies regarding the effects of theory-based interventions on safe postural and ergonomic behaviours, doing further research in these regards were recommended in previous evidences (12-15).

Theory of planned behaviour (TPB) is an extension of the theory of reasoned action (TRA) to which the construct of perceived behavioural control was added (15,16). This theory has been applied to many related studies of safety and occupational behaviours such as using helmets (17), complying with correct posture of hand (18) industrial risk perception (19), risky behaviours of motorcyclist (20), chronic back pain (21,22), work-related musculoskeletal disorders (14), safety lifting (15) and sitting postural habits (23).

Transtheoretical Model (TTM) provides the concept of behaviour change through moving from different stages. This approach is often used to tailor interventions to change unhealthy behaviours. The five stages of change have been reliably identified across health behaviours including precontemplation (PC), contemplation (C), preparation (PR), action (A), maintenance (M), however, movement through these stages may not always occur in a linear fashion (24). The stage-matched intervention (SMI) based on TTM is matched to the individual's stage of readiness for target behaviour and uses different strategies and techniques to bring about behaviour change (25).

Although TPB and TTM propose different determinants of behaviour, they include conceptually similar variables such as decisional balance of TTM (26). The construct of pros and cons of TTM mirrors construct behavioural beliefs of TPB (27). Thus, it is documented that TPB constructs could be used instead of TTM (28). In this study, we aimed to examine the effects of a stage-matched educational program on improving stages of change and main constructs of TPB as well as increasing adopting the behaviour of upright body posture among computer operators.

Materials and Methods

This trial study was implemented in two computer workstations of Qazvin University of Medical Sciences (QUMS), Qazvin, Iran. Eligible subjects were recruited in April 2009. Data were collected at the time of randomization (baseline) and 3 months after intervention. All adult individuals aged ≥18 years who were working with computer predominantly in a sitting position over 20 hours per week and were in inactive stages of TTM such as precontemplation, contemplation and preparation were candidates for inclusion in the study. Computer operators were not admitted to the study if suffering from upper extremity musculoskeletal symptoms, neck/shoulder or hand/arm pain with an intensity score 6 or greater according to visual analogue scale, and finally unwillingness to be studied. Of four computer stations affiliated to the university, two sites were randomly selected as intervention and control sites, of each one 75 eligible computer users were randomly selected as intervention group who received stage-matched educational intervention and 75 computer users were selected as control group who did not receive the program. The ethics committee of Qazvin University of Medical sciences approved the study in accordance with the Helsinki Declaration of 1975, revised 2002.

Intervention

This educational program involved eight 2-hour sessions followed by continued encouragement and motivation - through phone interview and e-mail contact - to maintain improved behaviours. The SMI was designed based on TPB constructs and results from a pilot study. An expert group consisted of two physiotherapists, two ergonomists; two occupational health specialists, who were knowledgeable about MSDs prevention, and two health education specialists, who were knowledgeable about the TTM, confirmed the validity of the educational program package that was as follows.

Stage-matched Ergonomic Counseling (SMEC)

The SMEC consisted of counseling strategies that were individually tailored by constructs of TPB and computer ergonomic guideline. A health education specialist introduced SMEC program to each participant during an initial counseling session. In this initial session, the stage of participants was determined through algorithm in figure 1. Then, corresponding to the participant's current stage of change, the stage-based SMEC program was introduced to the participant as following:

1- PC session that was considered for those who had no intention to change behaviour in the foreseeable future or who deny the need for change. In this 2-hour session, musculoskeletal disorders, ergonomic issues and their benefits/barriers were reviewed by the physiotherapist and health occupation specialist.

2- C session that was considered for those who had intention to change within the next 6 months. In this 2-hour session, dramatic relief, reevaluation of workstation, self-reevaluation, self efficacy and attitude of the participants were evaluated and promoted by the physiotherapist and health occupation specialist.

3- PR session that was considered for those who had a serious intention to change in the next 30 days. In this 2-hour session, the focus of program was on promoting positive attitude, self-liberation and applying reward/reinforcement and also perceived behaviour control strategies.

4- A session was considered for individuals who showed initiation of overt behavioural change. In this 2-hour session, the focus of program provided by the health education specialist was on participants' support and encouragement to continue the behaviour, establishing his/her confidence toward the benefits of the behaviour and reinforcing participants' coping strategies and self-efficacy.

5- M session was considered for whom sustained behavioural change for 6 months or more. In this 2-hour session, the focus of the program was on self-liberation, reinforcement management, stimulus control, establishing positive subjective norms, counter-conditioning, and perceived behaviour control that was provided by the health education specialist.

Counseling was provided once a week by an ergonomic specialist. Problems and concerns in performing SMI were discussed in later sessions or through contacts with the counselor.

Ergonomic Behaviour Training

To practice ergonomic healthy behaviours with participants, two 2-hour practical sessions were conducted by the ergonomist and physiotherapist. The goals of the first session were: (1) to apply office ergonomic principles, (2) to perform self evaluation of workstation, (3) to adjust workspaces, and (4) to utilize the various workspaces designed to support both individual and group working which were practiced by the participants. In addition, some of ergonomic behaviours such as adjusting the chair back support horizontally and vertically, adjusting the chair height, using a cushion and a foot rest, setting the chair closer to the desk, setting the keyboard close to the desk edge, avoiding leaning the wrists on the desk, setting the screen angle and taking breaks were practiced with the participants in ergonomic behaviour training session by ergonomists.

The second session was also a practical 2-hour session in which the physiotherapist practiced healthy body posture with participants while working with computer and doing stretching exercises. All participants were provided with a package of training materials included a facilitator's handbook and a handout regarding computer ergonomic guidelines (''Ergo-Guidelines'') accompanied by appropriate recommendations. All participants were informed about their pre-and post-intervention tests results through e-mail.

Table 1. Demographic characteristics at baseline.

	Intervention group (n=75) M* (SD) **	Intervention group (n=75) N* (%)	Control group (n= 75) M (SD)	Control group (n= 75) N (%)	p value
Gender					
Female		54 (72.0%)		47 (62.7%)	0.29
Male		21(28%)		28 (37.3%)	
Operating computer (years)	11.52 (7.13)		11.1 (7.3)		0.75
BMI	23.53 (3.8)		23.64 (3.6)		0.86
Age (years)	31.73 (7.33)		31.71 (7.01)		0.98
Stages of change	2.36 (0.71)		2.73 (0.69)		0.96
attitude	17.92 (6.5)		18.9 (6.1)		0.34
Subjective norms	13.7 (5.9)		13.3 (5.7)		0.71
Perceived behaviour control	9.1 (2.9)		8.7 (3.03)		0.41
intention	10.5 (4.53)		9.52 (3.96)		0.16
Ergo-knowledge	8.09 (2.61)		7.95 (2.46)		0.72
RULA	5.32 (1.06)		5.6 (1.04)		0.11
VAS	47.79 (36.63)		44.12 (33.6)		0.52

M; Means, SD; Standard Deviation, N; Number of participant, BMI; Body Mass Index, RULA; Rapid Upper Limp Assessment, VAS; Visual Analog Scale

Table 2. Comparison of two groups in terms of different variables at follow-up time point.

	Intervention group (n=75) Mean (SD)	Control group (n= 75) Mean (SD)	P value
Stage of change (score)	3.49±1.05	2.41±1.03	0.000
attitude	21.61±4.73	19.2±5.8	0.001
Perceived behaviour control	15.58±3.23	9.01±3.01	0.000
Subjective norms	14.53±3.7	13.14±4.81	0.251
intention	12.01±2.78	10.08±3.71	0.001
Ergo-knowledge	14.07±1.89	8.13±2.43	0.000
RULA score	4.7±0.8	5.5±0.9	0.001
VAS	5.33±3.43	4.53±4.20	0.000

M; means, SD; standard deviation, N; number of participant, VAS; visual analog scale, RULA; rapid upper limp assessment

** P values compares two groups at post test follow up.

*** There were no statistically significant differences between two groups at baseline (all p values >0.05)

Table 3. Distribution of participants between different stages of change at initial and follow up times.

*Stage of change	Intervention group (n=75) N (%) ***baseline	Intervention group (n=75) N (%) posttest	Control group (n= 75) N (%) baseline	Control group (n= 75) N (%) posttest	**P value
PC	10 (13.3)	3 (4.0)	9 (12.0)	15 (20.0)	0.005
C	28 (37.3)	11 (14.7)	29 (38.7)	26 (34.7)	0.000
P	37 (49.3)	19 (25.3)	37 (49.3)	25 (33.3)	0.001
A	0	30 (40.0)	0	6 (8.0)	0.000
M	0	12 (16.0)	0	3(4.0)	0.000

* Stage of change: PC: Pre Contemplation, C: Contemplation, P: Preparation, A: Action, M: maintenance

Outcome Variable

Primary outcomes were improvement of main constructs of TPB such as perceived behavioural control, subjective norms attitude, intent and scores of RULA. Secondary outcome was rate of musculoskeletal symptoms and severity of pain.

Measures

Demographic and personal health history questionnaire

At the time of enrolment, the participants were asked to complete a questionnaire regarding work-related demographic characteristics including gender, age, body mass index (BMI), duration of working experience with computer and history of past MSDs.

Staging algorithm for maintaining an upright body posture

The subjects were staged by the algorithm shown in Table 1. To ensure that all subjects had a comparable concept of an 'ergonomic behaviour', a short and easy-to-understand definition was presented before the staging questions. The subjects were categorized into the five stages of change (Figure 1). Although the staging algorithm was comparatively short, its usefulness and validity had been confirmed across a variety of other behaviours (27,29). Nevertheless, the questionnaire was initially piloted with a small number of computer operators who did not participate in the main sample of survey. The questionnaire was refined in the light of their responses regarding issues of presentation and clarity. An ethical procedure was employed to inform respondents that the purpose of the survey was to explore beliefs and practices towards work-related MSDs prevention.

Attitude

Seven most salient beliefs regarding doing ergonomic behaviours to prevent MSDs were identified in this instrument. The behavioural beliefs were preceded by the statement "MSDs preventing during daily job tasks, does/would help me..." with responses on a 5-point Likert scale with 1 (strongly agree) and 5 (strongly disagree). Internal consistency of this measurement was good (α= 0.83).

Subjective Norms

This measurement was consisted of five items. For example, "Most people who are important to me would strongly encourage/discourage me to observe ergonomic behaviours in daily job task" was a kind of typical item for this construct. Items were measured on a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Internal consistency was good (α=0.89).

Perceived Behavioural Control

This measurement consisted of six items. For example, "It is entirely up to me, whether or not to prevent MSDs by applying ergonomic behaviours" was a kind of typical item for this construct. Items were measured on a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Internal consistency was acceptable (α=0.72).

Nordic Musculoskeletal Questionnaire (NMQ)

To analyze musculoskeletal symptoms, the standard Nordic Musculoskeletal Questionnaire (NMQ) was used (30). The questionnaire has been widely used and tested for reliability and validity (31,32). At the time of enrolment, the participants were instructed how to use this instrument.

Visual Analogue Scale (VAS)

Visual analogue scales (VAS) are widely used in human clinical and psychological research to assess subjective states. They consist of 10 cm lines, the ends of which are marked with semantic opposites-for example, alert-drowsy. Subjects are asked to indicate their response by marking a position on the line between two extremes. VAS is as a method for assessing chronic/acute pain (33). Validity and reliability of the scale was confirmed by several researchers (34-36).

Rapid Upper Limp Assessment (RULA)

The posture analysis was performed using the Rapid Upper Limb Assessment (RULA) (37). RULA is a validated tool originally developed to assess posture in ergonomic investigations in workplaces where work-related upper limb disorders are reported. To measure this variable, each computer user was photographed while performing daily tasks by two trained ergonomists who were unaware of group assignment. Posture of the computer users was assessed and good inter reliability results were obtained (ἀ Cronbach=0.79, 0.81, 0.76, 0.83, 0.78, 0.79 for arm, trunk, wrist, neck, leg and muscle analysis, respectively). The mean score of the two observations was used for analysis

Ergonomics Knowledge Test

The ergonomics knowledge tests consisted of 14 questions assessing knowledge regarding seven areas of office ergonomics: (1) work-related risk factors (3 items), (2) physical ergonomic

Table 4. Distribution of different musculoskeletal problems between two groups at baseline and post intervention.

Musculoskeletal problems	Intervention group N (%)		Control group N (%)			
	Baseline	Posttest	baseline	Posttest	Z	P
Hand/ wrist	39 (52.0%)	30 (40.0%)	35 (46.7%)	34 (45.3%)	-1.96	0.05
Shoulder	39 (52.0%)	36 (48.0%)	41 (54.7%)	39 (52.0%)	-1.09	0.28
Arm	28 (37.3%)	31 (41.3%)	25 (33.3%)	28 (37.3%)	-1.73	0.08
Neck	35 (46.7 %)	21 (28.0%)	37 (49.3%)	38 (50.7%)	-2.84	0.005
Upper back	36 (48.0%)	37 (49.3%)	40 (53.3%)	41 (54.7%)	-0.58	0.56
Lower back	28 (37.3%)	17 (22.7%)	31 (41.3%)	30 (40.0%)	-2.12	0.03
Leg	20 (26.7%)	19 (25.3%)	16 (21.3%)	18 (24.0%)	-0.30	0.76
Elbow	16 (21.3%)	21 (28.0%)	21 (28.0%)	24 (32.0%)	-2.83	0.025

features (1 item), (3) body posture (4 items), (4) workstation layout and configuration (3 items), (6) rest breaks (1 item), and (7) ergonomics practices and resources (2 items). Content and face validity of ergo-knowledge quiz was approved by an expert panel of 2 ergonomists

Statistical Analysis

The SPSS statistical software package was used to analyze the data. T-test was used to compare the two groups in terms of mean (SD) scores of the questionnaires. However, for comparing each group at two points of time (baseline and post intervention follow-up), paired t-test was applied. Chi-square test was used to compare distribution of participants in different stages of change and also distribution of musculoskeletal problems between the two groups at baseline and post intervention.

Results

Totally, 150 participants with a mean age of 31.6 years (SD=7.0) took part in the study. Sixty-seven percent of participants (n=101) were female, 51% (n=77) had a university degree and 67.1% (n=102) were married. Table 1 shows some demographic characteristics and outcome variables at baseline. The results showed no statistically significant differences between the two groups in terms of these baseline data (all p values >0.05). The mean scores of all measurements of the two groups at post intervention follow-up are shown in table 2. As this table shows, the results of all measurements in both groups were statistically significant ($p<0.0001$) except for subjective norms ($p=0.25$).

At the beginning of the study, all the participants in the two groups were in pre-action stages (13.3% PC, 37.3% C, and 49.3% PR in intervention group compared to PC 12.0% , C 38.7% and PR 49.3% in control group), whereas after intervention, these proportions changed significantly (all p values <0.01). Table 3 shows the distribution of participants of the two groups in different stages of TTM at two time points of baseline and post intervention. According to this table, the two groups were the same at the beginning of the study in terms of their stage of change (all p values >0.05), but there were significant differences between them in terms of stages including precontemplation ($p=0.01$), contemplation ($p<0.0001$), preparation ($p<0.01$), action ($p<0.0001$), and maintenance ($p<0.0001$).

The distribution of musculoskeletal problems between the two groups are shown in Table 4. As this table indicates, at the beginning of the study, two groups were the same in terms of frequency of musculoskeletal problems in different parts of the body (all p values ≥ 0.05) except for neck pain ($p=0.005$), lower back pain ($p = 0.03$) and pain experienced in the elbow region ($p=0.02$). At the time of follow-up, intervention group suffered less problems in their neck, lower back and elbow compared to control group. These differences between the two groups were statistically different at level of $p<0.05$.

Discussion

This study revealed that the educational program could significantly improve the stage of readiness of computer users in intervention group compared to control group, so that the subjects taking part in this group moved from inactive stages of pre-contemplation, contemplation and preparation to active stages like action and maintenance. In accordance with the results of the present study, all participants were in inactive stages at baseline, but at follow-up period, more than half of the participants moved to active stages in which they showed overt behaviour or maintained it. An interesting finding was that these events happened just in intervention group receiving the SMI educational program whereas there were no significant changes in control group. These results were consisting with those reported in previous studies (38-42). As our study showed more than two third of participants, who underwent the protocol of educational program, progressed in their stages of change from baseline, and it was a strong point of this research when compared with results of previous studies which reported less progress in moving through stages (43-44). Calfas et al. (45) reported in their study that less than one third of studied sample progressed a stage throughout their study, 15% regressed or relapsed and more than half of the participants did not change. This result may be due to the strong effectiveness of multidimensional stage-matched program applied in the current study.

Results from this study indicated that the trained group exhibited a higher level of improved behaviours leading to less

For the prevention of musculoskeletal problems it is important to continuously engage in preventive behaviours, not only in certain situations but also in during activities of daily living and leisure time activities. This means, for example, maintaining an upright body posture while sitting or bending your knees when lifting objects from the floor and doing regular stretching, workstation and computer desk rearrangement, safety lifting, regular breaks, promoting ergonomic circumstances such as lighting, using of document holder & armrest and footrest, chair adjustment and avoiding inordinate force.

1. Are you concerned about developing musculoskeletal problems from your work? Y / N
2. Do you think changes should be made to reduce the risk of musculoskeletal problems from your work in the next 6 months? Y / N
3. Do you think changes should be made in the next month or two? Y / N
4. Have you got any suggestions for changes that would reduce the strain of your work?
5. Has your employer made any changes to reduce the risk of musculoskeletal problems from your work? Y / N
6. Are you doing or have you done anything to reduce the risk? Y / N
7. If yes, please describe what you have done:
8. How long ago did you make these changes? ………………………….. wks / months / yrs

Figure 1. Staging algorithm for maintaining an upright body posture

awkward postures and musculoskeletal loading. The trained participants were more likely to make appropriate behavioural changes to their body posture than the control group. It may be explained that these behavioural changes could be resulted from increased knowledge and improved skills of participants regarding principals of workplace ergonomics. The participants in intervention group were more likely to ergonomically adjust their workstation, chair setup and other ergonomic accessories, thereby, reducing their non-neutral postures and muscular efforts as was indicated by lower RULA scores. These findings were consistent with the previous study (46).

This study revealed that the participants taking part in educational program were less likely to claim a pain in the three body regions - neck, lower back and elbow -, in comparison with other group who did not receive the program. In consistent with this result, Bohr (8) found that those who received office ergonomics education reported less pain/discomfort following the intervention than those who did not receive education, even though it was unclear to this researcher that whether the differences in reported pain/discomfort were related to better work area configuration or improved worker postures.

However, this study showed that some of musculoskeletal symptoms did not improve among intervention group. In addition, our study showed that the severity of pain that was measured through VAS was increased after educational program among participants in intervention group. These findings could be explained by the possible side effects of a partially implemented intervention. One common problem related to ergonomic intervention is that any change in workplaces usually causes new decisions/behaviours that subsequently result in continued pain in workers. However, the impact of changed ergonomic on musculoskeletal pain needs to be evaluated and assessed in further researches. Another reason for this result may be that participants' being aware and responsible for such a complex process of MSDs might lead to being sensitive to pain, thus, these participants felt pain more than other group who were unknowledgeable to ergonomics. The negative or constant results may be due to the method of self-report on the musculoskeletal problems by participants that is not exactly real report. Therefore, beyond the MSDs self-report results, the study has focused on other outcome variables such as RULA scores, and stage change theory constructs. Furthermore, there are evidences that training, and even use of back belts are not always effective in reducing caregiver injuries (47-49). Given the complexity of MSDs, multifaceted programs are more likely to be effective than any single intervention (50). A systematic review performed by Hignett (51) showed that technique training interventions are not effective in improving work practices or reducing injury rates. Stetler et al. (50) concluded that in order to prevent MSDs and make a proper plan for coping with this problem, multifaceted interventions should include at least two of the following: elimination of risk factors, engineering controls, administrative controls and training/education. Thus, results from SMI in this study are not far from existed evidence and could be predicted. However, these discrepancies in different researches should be addressed in future studies. Although the content of educational program was carefully derived from well recognized ergonomic literature and confirmed by expert panel, it seems that this education could help the participants in intervention group to become aware of the ergonomic problems natured in their job and then to link these problems to MSDs, therefore, this explanation could be another reason for increased VAS scores among intervention group. With this regard, the result of the current study regarding MSDs is similar to previous researches (48-52).

Beyond these justification, it has been argued that despite the psychological benefits of exercise and the necessity of doing it in break time to prevent negative effects of prolonged sitting posture, those may not provide any help if they are applied alone without any efforts for providing computer users with ergonomic equipments and workstation.

Several limitations should be considered while interpreting the study findings. Firstly, is that this study did not investigate potentially confounding factors that may affect MSDs, thus, we cannot report these results precisely. Secondly, the lack of financial and organizational support is another important obstacle for the implementation a preventive program in which we could encourage the participants to continue their changed behaviour through complying with their respected co-workers. Therefore, we could not expect improving subjective norms in intervention group. As we recruited the participants from two computer sites, so cautions, however, should be considered while generalizing the results to other computer users.

A strong point of this study was providing stage-matched educational intervention. White Et al. (53) claimed that in order to address individualized needs in each stage of change, intervention should be tailored and should correspond to subjects' stage of readiness.

Conclusion

Computer users in this study demonstrated a high level of exposure to ergonomic risk factors, particularly the use of non-neutral postures. Stage-matched ergonomic training increased employees' perceived behaviour control, ergo-knowledge and attitude regarding work-related postural behaviours. This study supported that SMI was effective in decreasing exposure to risk factors for musculoskeletal injury. The findings suggest that SMI could be effective on creating ergonomic and postural behaviour change.

This stage-matched educational program based on the theory of planed behaviour should be practiced in computer workstations in Iran, in order to improve correct ergonomic and postural behaviour and to reduce the rate of musculoskeletal disorders and severity of pain among Iranian computer users.

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Conflict of Interest:

Authors reported no conflicts of interest.

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