CLINICAL SCIENCE

STRETCHING AND JOINT MOBILIZATION EXERCISES REDUCE CALL-CENTER OPERATORS' MUSCULOSKELETAL DISCOMFORT AND FATIGUE

Denise Helena de Castro Lacaze, Isabel de C. N. Sacco, Lys Esther Rocha, Carlos Alberto de Bragança Pereira, Raquel Aparecida Casarotto

doi: 10.1590/S1807-59322010000700003

Lacaze DHC, Sacco ICN, Rocha LE, Bragança Pereira CA, Casarotto RA. Stretching and joint mobilization exercises reduce call-center operators' musculoskeletal discomfort and fatigue. Clinics. 2010;65(7):657-62.

AIM: We sought to evaluate musculoskeletal discomfort and mental and physical fatigue in the call-center workers of an airline company before and after a supervised exercise program compared with rest breaks during the work shift.
INTRODUCTION: This was a longitudinal pilot study conducted in a flight-booking call-center for an airline in São Paulo, Brazil. Occupational health activities are recommended to decrease the negative effects of the call-center working conditions. In practice, exercise programs are commonly recommended for computer workers, but their effects have not been studied in call-center operators.
METHODS: Sixty-four call-center operators participated in this study. Thirty-two subjects were placed into the experimental group and attended a 10-min daily exercise session for 2 months. Conversely, 32 participants were placed into the control group and took a 10-min daily rest break during the same period. Each subject was evaluated once a week by means of the Corlett-Bishop body map with a visual analog discomfort scale and the Chalder fatigue questionnaire.
RESULTS: Musculoskeletal discomfort decreased in both groups, but the reduction was only statistically significant for the spine and buttocks (p=0.04) and the sum of the segments (p=0.01) in the experimental group. In addition, the experimental group showed significant differences in the level of mental fatigue, especially in questions related to memory Rienzo, #181ff and tiredness (p=0.001).
CONCLUSIONS: Our preliminary results demonstrate that appropriately designed and supervised exercise programs may be more efficient than rest breaks in decreasing discomfort and fatigue levels in call-center operators.

KEYWORDS: Exercise therapy. Occupational disorders. Computer terminal. Computer users. Work rest.

INTRODUCTION

For several decades, the use of computers has become increasingly common, particularly among office workers,[2] and musculoskeletal complaints are widespread among computer users. The most frequent symptoms occur throughout the neck-shoulder region.[1] In 2008, the number of telemarketing or call-center operators was approximately 345,220 in the USA.[3] In Brazil, 60,000 new jobs were created in 2006, leading to a total of 675,000 operators.[4] Tasks performed by call-center operators are characterized not only by physical stress due to prolonged time in a seated position and repetitive movements (e.g., typing) but also by mental stress related to meeting deadlines and achieving productivity goals. These factors lead to musculoskeletal discomfort,[5] and the most commonly affected body segments are the neck, shoulders, back and eyes. The prevalence and severity of symptoms is strongly correlated with the amount of time at work,[6] and a low frequency of rest breaks[7] is a significant risk factor for musculoskeletal symptoms and injuries.

Recently, research has demonstrated the effect of exercising on worker's symptoms. A 10-week aerobic training program significantly reduced neck pain among employees of an insurance company.[8] Light resistance training at the worksite reduced the intensity of neck symptoms among office workers,[9] and stretching exercises reduced musculoskeletal

Department of Speech, Occupational Therapy and Physical Therapy, Faculdade de Medicina, Universidade de São Paulo - São Paulo/SP, Brazil.
Email: denise.lacaze@terra.com.br
Tel: 55 11 3091-8426
Received for publication on February 19, 2010
First review completed on March 01, 2010
Accepted for publication on April 05, 2010

discomfort in data entry operators.[10] Isometric shoulder strength training decreased perceived exertion and improved arm motion in female industrial workers.[11] Similarly, isometric strength training and dynamic endurance training decreased pain and disability among female office workers with chronic neck pain.[12] Range of motion, stretching and eye-relaxation exercises performed by directory assistance operators reduced whole body discomfort and postural adjustment (in-chair movements).[11] Interestingly, a study comparing stretching exercises for tight regions and full range of cervical motion[12] showed that being supervised by a physical therapist is important because participants feel motivated to exercise.

In addition to exercises, rest breaks have also been advocated to reduce discomfort in data entry workers,[10] airline employees,[12] computer workers[13] and video display terminal operators (data entry and arithmetic tasks).[14] In fact, frequent "micro" breaks reduce discomfort, eyestrain, fatigue and mood disturbances[14,15] and improve keystroke speed and accuracy.[14]

An investigation of working conditions and symptoms among call-center workers and computer users showed that call-center operators report more musculoskeletal symptoms and spend longer and more continuous periods of time in front of a computer with deficiency in the work pace when compared with a reference group.[16] Although various groups of workers were investigated, few studies have included call-center operators. Thus, we present a preliminary study with the objective of assessing the effects of a short-term supervised exercise program (compared with rest breaks) on musculoskeletal discomfort and fatigue levels of call-center operators.

SUBJECTS & METHODS

Our pilot study involved a sample of 64 flight-booking operators from the call-center of one airline. They were split into two groups (experimental and control) of 32 individuals. The anthropometric and demographic characteristics of the experimental group (EG) and the control group (CG) are displayed in Table 1. There were 11 males in the EG and six males in the CG. During a 10-week period, the EG attended a daily 10-min supervised exercise program, while the CG had a 10-min rest break. The call-center was open 24 hours a day, and the morning shift started at 6 a.m. Employees were scheduled to come on duty every half hour. Hence, the allocation process had to account for when they started working. The two groups worked in separate locations to prevent subjects in the different groups from talking to each other about the study. All subjects worked a 6-hour shift and had a regular 25-min break. Length of employment in the company was similar in both groups and could be divided into following three categories: less than 2 months, between 2 and 37 months, and over 37 months.

All subjects fulfilled the inclusion criteria: they were permanent employees of the company and had no musculoskeletal disorders or past history of upper-limb surgery. Subjects were asked about past and present illnesses, and we had access to the medical records of the subjects by means of the company's medical department. The study was approved by the ethics committee for research projects of Hospital das Clínicas from the Medical School of Universidade de São Paulo (SP, Brazil). Subjects signed a written informed consent form before entering the study.

Procedures

Subjects in the EG were submitted to 10 weeks of a daily 10-min exercise program in which they performed 10 different sets of exercises, including stretching (hamstrings, spinal column, forearms, and shoulders), joint mobilization (hands, wrists, shoulders, column, hips, knees and ankles) and relaxation. Exercise sessions took place 4 days a week, and subjects were asked to fill out the questionnaire and the body map once a week. Exercises were designed based on an ergonomic evaluation that focused on the requirements of this specific population. During the exercise session, subjects were instructed to stretch when they felt that their muscles were tense and then to hold the position for 10 s. Sessions were carried out halfway through the work shift. Subjects in the CG were submitted to a daily 10-min rest break and were instructed not to perform any kind of work task or physical activity during this period.

Subjects were allocated to the different groups according to the time they started working. Small groups of subjects started their shift every half hour, from 6 a.m. to 5 p.m., and after that, every hour until 8 p.m. This schedule was taken into account during the selection process.

Subjects in each group were further divided into subgroups of five to eight workers to take part in the exercise intervention or rest break to prevent a negative impact on client attendance. All parties agreed on the length of the exercise session and rest break, as well as on the number of employees in each group, to prevent excessive changes in work flow. The investigator was the only person who followed and recorded the performance in the EG and the CG.

Measurements

The level of musculoskeletal discomfort was measured using a horizontal 10-point visual analog scale (VAS).[11,13,14,17] Musculoskeletal discomfort was considered to be any type of soreness or pain the subjects were feeling during the collection of data, and its location was indicated on the body discomfort map (BDM),[18] which was divided into the following 15 segments: neck (1), left shoulder (2A), right shoulder (2B), left arm (3A), right arm (3B), left forearm (4A), right forearm (4B), upper back (5), middle back (6), lower back (7), buttocks (8), left thigh (9), right thigh (10), left shank and foot (11), and right shank and foot (12). These body segments were clustered into three large areas: S1 (neck and shoulders), S2 (upper and lower limbs) and S3 (spinal column and buttocks).

Mental and physical fatigue was assessed by means of a 15-question validated questionnaire[19] that evaluated tiredness, sleepiness, weakness, concentration difficulty, memory and muscle pain. Answers utilized a four-point scale (1 - better than usual, 2 - not greater than usual, 3 - worse than usual and 4 - much worse than usual), and there was an open question on the reasons for feeling tired. Assessments were carried out once a week, and instructions to complete the questionnaires and scales were given during the baseline assessment.

Statistical analyses

Data were analyzed using Excel for Windows. Relative gain was considered in the VAS. Gain observed in the two groups was compared by means of a 2x2 contingency table with the mean differences (MDs) for each group. The chi-squared test was used to analyze if variables were independent. A contingency table was constructed to show the frequencies of subjects "feeling better" and "not feeling better" in both groups. An odds ratio (OR) was calculated to show the amount of improvement in one group compared with the other; the ratio was between the relative frequencies obtained in the EG and CG. The 95% confidence intervals (CIs) for the OR were also evaluated for the body segments and the most relevant questions from the Chalder fatigue questionnaire. Results were confirmed by the chi-squared test for homogeneity in the 2x2 contingency tables. The level of significance was set at 0.05.

RESULTS

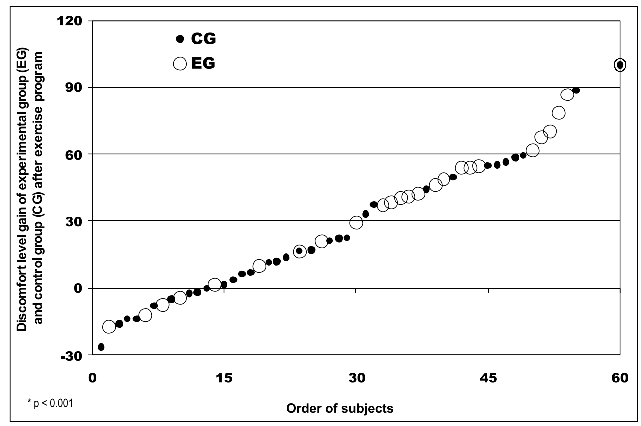
Adherence to the study was 100% with no dropouts. The body mass indices of both groups and demographic data are presented in Table 1.

Figure 1 compares the first and last measurements, showing VAS individual gain. This gain was significantly greater than zero ($p < 0.0001$) in both the EG and the CG. The EG is represented by black circles, and the CG is represented by black dots. Note that the circles are concentrated in the higher ranks. The two groups were significantly different ($p < 0.01$), and the OR for improvement was 6.5 (95% CI [5.4-7.6]).

Table 1 – Mean (standard deviation) of antropometric and demographic characteristics of the experimental group (EG) and the control group (CG).

	EG	CG	*p*
Height (m)	1.68 (0.08)	1.67 (0.09)	0.577¹
Weight (kg)	65 (10)	64.4 (12.7)	0.832¹
Gender	11 (M)	6 (M)	0.157¹
	21 (W)	26 (W)	
BMI (kg/m²)	22.8 (2.4)	22.9 (3.1)	0.913¹
Age (years)	34 (3)	31 (4)	0.644¹

¹ t test; W = woman; M = man



* Median Test for comparison of two independent samples

Figure 1 - Ranked gain in the level of discomfort in the experimental (EG) and control (CG) groups after the exercise program.

Participants in the EG showed a decreased trend toward the frequency of discomfort in body segments S1 and S3 compared to the CG (Table 2). S2 in the CG also showed a significant trend.

The frequency of EG individuals who had few painful body segments increased by the end of the 10 weeks. The OR for improvement in the EG compared with the CG was 2.5 (95% CI [0.9, 7.05] for S1, 2.7 (95% CI [1.0, 7.6]) for S3, and 4.2 (95% CI [1.2, 13.7]) for both of these segments.

Comparing the EG and the CG revealed a trend toward significance for S1 ($p = 0.07$), S3 ($p = 0.04$), and a strong significant difference for the sum of the segments ($p = 0.009$). No significant difference was observed for S2 ($p = 0.31$) (Table 2).

Fatigue levels were "not greater than usual" (between 30 and 60%) for most individuals, as shown in the answers to the Chalder fatigue questionnaire. The questions that most distinguished the groups related to concentration difficulty, making mistakes when speaking, memory problems and feeling tired. In terms of the frequency of subjects feeling better after the intervention, the two groups showed no significant differences for question 8 (Q8) ($p = 0.18$).

Table 2 – Number of subjects in the experimental group (EG) and the control group (CG) showing improvement in discomfort of neck and shoulders (S1), upper and lower limbs (S2), column and buttocks (S3) and in the sum of the segments (S1 + S2 + S3) after the exercise program.

		EG	CG	*p*
S1	Better	16	9	0.07[1]
	Not better	16	23	
S2	Better	14	18	0.31[1]
	Not better	18	14	
S3	Better	19	11	0.04[1]
	Not better	13	21	
Sum	Better	14	5	0.01[1]
	Not better	18	27	

[1]chi square test; EG = Experimental group; CG = Control group

Table 3 – Number of subjects in the experimental (EG) and the control groups (CG) who felt better after the exercise program as shown by questions (Q) 8, 9, 11 and 14

		EG	CG	*p*
Q8	Better	13	8	0.18
	Not better	19	24	
Q9	Better	11	5	0.08
	Not better	21	27	
Q11	Better	11	3	0.01
	Not better	21	29	
Q14	Better	13	2	0.001
	Not better	19	30	

[1] chi square test; EG = Experimental group; CG = Control group

However, a trend toward significant differences for question 9 (Q9) (p = 0.08), significant differences for question 11 (Q11) (p = 0.02) and strongly significant differences for question 14 (Q14) (p = 0.001) demonstrate the superiority of the exercise program compared to the control rest program (Table 3). The ORs (EG compared to CG) illustrate the above results as follows: for Q8, OR = 2.05 and 95% CI [1.00-3.09]; for Q9, OR = 2.8 and 95% CI [1.65-4.00]; for Q11, OR = 5.0 and 95% CI [3.69-6.42]; and for Q14, OR = 10.2 and 95% CI [8.70-11.83].

DISCUSSION

The objective of this pilot study was to determine the effects of a short-term supervised exercise program on the call-center operators of an airline company. To assess these beneficial effects, we compared an exercise program carried out during a work break with a rest break and measured musculoskeletal discomfort and mental and physical fatigue. Our findings showed that the level of discomfort and number of body segments with discomfort decreased, and the percentage of painful segments was reduced in the EG compared to the CG. In addition, the exercise program relieved fatigue in the EG.

The level of discomfort over time, measured by the VAS, decreased in both groups, but the reduction was greater in the EG. These findings are in agreement with previous studies involving computer workers and dental floss assemblers, which reported a reduced frequency of painful segments after stretching and joint mobilization exercises.[8, 11, 17] Fenety and Walker[11] demonstrated that exercises did not eliminate discomfort but minimized its rate of development, mainly during the second hour of continuous work. It is likely that after 3 h of work, discomfort was greater in our subjects. This fact partially explains the decreasing level of discomfort after exercising observed in our study. Additionally, changing postures during the exercises sessions (from sitting to standing) and moving after long periods of restricted posture may be related to the reduction in the level of discomfort that we observed in the study.

Silverstein and Armstrong[17] found no significant differences in musculoskeletal symptoms between individuals who did or did not participate in an exercise program. The program was performed in the plant and under the supervision of a physical therapist and physical therapy assistants who demonstrated the exercises. Compliance and effective/correct performance of the exercises could not be assessed. Despite the fact that there was no improvement in the level of discomfort, these authors reported that 67% of subjects felt good after exercising, and this finding is in agreement with our results.

Computer users who reported complaints showed that discomfort affected the neck and shoulders, scapular area, shoulder/upper arm, upper and lower back.[2, 13, 20] These areas are also the most prevalently affected regions among call-center workers.[16] These findings are similar to the significant results obtained for S3 and for the sum of the segments in the present study.

Intergroup analysis showed more subjects feeling better in relation to S1, S3 and the sum of the segments. In segments that support muscle tension as a consequence of immobility (neck and column), improvement was more noticeable and is shown by means of the greater number of subjects feeling better in the EG. Surprisingly, upper limbs (S2) showed better results in the CG than in the EG. However, compared to the CG, fewer subjects in the EG reported forearm discomfort at week 10 than at week 1.

This may be due to the fact that telemarketing operators may stop typing for a few seconds or minutes while reading information on the screen or talking to a client. These short rest breaks are likely enough to avoid excessive muscle tension and prevent upper-limb discomfort.

Galinsky et al.[10] demonstrated that 5-min supplementary breaks led to the best results compared with exercise breaks. Subjects stretched during only 25% of their regular 15-min breaks and 39% of the supplementary breaks. Restricted time for exercising and low compliance of subjects may be responsible for the inefficacy of the exercise program. Conversely, participants complied closely with the assigned rest break schedule and showed an evident tendency to take one extra brief break per day when they were assigned to the conventional schedule. This may explain the positive results of rest breaks compared with exercising. There are differences between the study of Galinsky et al. and the present one in terms of the length of the exercise sessions and the rest breaks, as well as the rate of compliance (close to 100% in our case). These are likely the main reasons why exercises had a positive effect on discomfort in this study.

An interesting finding was the reduction of fatigue observed in the EG. Subjects reported improved concentration and memory, made fewer mistakes when speaking and felt less tired, all of which are related to mental fatigue, which is a subjective evaluation. Despite the subjectivity of this measure, intergroup analysis showed that exercise had a strong effect on fatigue levels. These results corroborate those of Rhenen et al.[21], who found reduced psychological complaints, such as fatigue, in approximately 50% of the employees who participated in a physical activity intervention.

Subjective symptoms, such as job stress, may be responsible for two-thirds of sick leaves. Employees exposed to prolonged job stress are more prone to health complaints such as depression, anxiety and physical symptoms[22]. The literature suggests that psychosocial[23] and psychological [24] factors are related to musculoskeletal disorders and health complaints. Salmon et al.[25] associated physical exercise with better mental health and improvement in these psychological complaints. If psychological complaints can be relieved by exercise programs and these symptoms are related to musculoskeletal disorders, this is a simple way to prevent such problems.

Although the OR for improvement in the EG group ranged from 2.05 to 10.2, the design of this study made it impossible to detect differences between the two groups because of their small size, a factor that was imposed by the company. Positive results in the CG concerning discomfort and fatigue may be related to the intensive support and intervention that is present in a small group of workers. This support may have a positive psychological effect and thereby influence the measures of well-being. However, because both groups received similar support and only the EG exercised, the differences observed between the groups were likely due to the beneficial effects of exercising.

This study has some limitations. The relatively small sample sizes and the variable length of employment (2 to 37 months) may prevent generalization of the results. However, because this is one of the few investigations on call-center operators available in the Brazilian and international literature, our findings provide valuable information in this area of study and may guide future studies. In addition, the variability in the length of employment is inherent to investigations involving call-centers.[26] Another limitation of this study may be the use of subjective scales to assess physical symptoms. However, such scales are universally employed due to the nature of the symptoms measured (e.g., pain and fatigue, which are subjective complains), and they are well-established in the literature. An important point is that the subjective opinion of the researchers did not interfere with the results: subjects filled out the questionnaires on their own, without any interference from the investigators. Auto-assigned tools and all instructions were given during the initial period of data collection.

Given these findings and the limitations of the present trial, further studies are necessary to confirm our results on a large scale and in a more homogeneous population. Future studies should include objective measures of physical performance and/or of effectiveness at work in addition to the subjective scales used here.

The main strength of this study was the finding of significant differences between the two groups even though they were relatively small. We showed that with little managerial effort, the quality of life of the workers may be considerably improved. Call-center workers have not been frequent objects of study. Thus, the results presented here provide a valuable contribution to the literature on this population, which has increased tremendously over the past few years. In addition, because interventions were carried out in the work environment, the protocol may be easily applied to real settings.

CONCLUSION

Our pilot study indicates that periods of exercise during the work shift are more effective than rest breaks for reducing musculoskeletal discomfort and both physical and mental fatigue in call-center workers.

Author Contributions: Lacaze was responsible for applying the exercises program, for the data collection of the study, and writing the paper. Sacco was responsible for revising the paper. Rocha was responsible for the ergonomic assessment of the work environment before starting the exercise program. Pereira was responsible for the statistical analyzes. Casarotto was responsible for the orientation of the study.

REFERENCES

1. Proper K, Staal BJ, Hildebrandt VH, vanderBeek A, vanMechelen W. Effectiveness of physical activity programs at worksites with respect to work-related outcomes. Scand J Work Environ Health. 2002;28:75-84.

2. Blangsted AK, Sogaard K, Hansen EA, Hannerz H, Sjogaard G. One-year randomized controlled trial with different physical-activity programs to reduce musculoskeletal symptoms in the neck and shoulders among office workers. Scand J Work Environ Health. 2008;34:55-65.

3. Statistics BL. Occupational Employment Statistics. Available from: www.bls.gov/oes/2005/may/oes419041.htm#ind: Accessed in (Feb 28):

4. Telesserviços ABd. Associação Brasileira de Telesserviços. Available from: http://www.abt.org.br: Accessed in (Jan 29):

5. Rocha LE, Glina DMR, Marinho MF, Nakasato D. Risk factors for musculoskeletal symptoms among call center operators in São Paulo, Brazil. Industrial Health. 2005;43:637-46.

6. Matias A, Salvendy G, Kucsek T. Predictive models of carpal tunnel syndrome causation among VDT operators. Ergonomics. 1998;41:213-26.

7. Ferreira-Junior M, Conceição GMS, Saldiva PHN. Work organization is significantly associated with upper extremity musculoskeletal disorders among employees engaged in interactive computer telephone tasks of an international bank subsidiary in São Paulo. Am J Ind Med. 1997;31:468-73.

8. Groenningsaetter H, Hytten K, Skauli G, Christensen CC, Ursin H. Improved health and coping with by physical exercise or cognitive behavioral stress management training in a work environment. Psychol Health. 1992;7:147-63.

9. Sjogren T, Nissinen KJ, Järvenpaa SK, Ojanen MT, Vanharanta H, Malkia EA. Effects of a workplace physical exercise intervention on the intensity of headache and neck and shoulder symptoms and upper extremity muscular strength of office workers: A cluster randomization controlled cross-over trial. Pain. 2005;116:119-28.

10. Galinsky TL, Swanson NG, Sauter SL, Dunkin R, Hurrell JJ, Schleifer LM. Supplementary breaks and stretching exercises for data entry operators: A follow-up field study. Am J of Indust Medicine. 2007;50:519-27.

11. Fenety A, Walker LM. Short-term effects of workstation exercises on musculoskeletal discomfort and postural changes in seated video display unit workers. Phys Ther. 2002;82:578-89.

12. Tsauo JY, Lee HY, Hsu JH, Chen CY, Chen CJ. Physical Exercise and Health Complaints among Sedentary Workers. J Rehab Medicine. 2004;36:253-7.

13. vanderHeuvel SG, Looze MP, Hildebrandt VH, Thé KH. Effects of software program stimulating regular breaks and exercises on work-related neck and upper-limb disorders. Scand J Work Environ Health. 2003;29:106-16.

14. Balci R, Aghazadeh F. Effect of rest-schedules and type of task on the discomfort and performance of VDT users. Ergonomics. 2003;46:455-65.

15. Galinsky TL, Swanson NG, Sauter SL, Hurrell JJ, Schleifer LM. A field study of supplementary rest breaks for data-entry operators. Ergonomics. 2002;434:622-38.

16. Norman K, Nilsson T, Hagberg M, Tornqvist E, Toomingas A. Working conditions and health among female and male employees at a call center in Sweden. Am J Ind Med. 2004;46:55-62.

17. Silverstein BA, Armstrong TJ. Can in-plant exercise control musculoskeletal symptoms? J Occup Med. 1988;30:922-7.

18. Corlett EN, Bishop RP. A technique for measuring postural discomfort. Ergonomics. 1976;19:175-82.

19. Chalder T, Berelowitz G, Pawlikowska T, Watts L, Wessely S, Wright D, et al. Development of a fatigue scale. J Psychos Res. 1993;37:147-53.

20. Ylinen J, Takala EP, Nykänen M, Häkkinen A, Mälkiä E, Pohjolainen T. Active neck muscle training in the treatment of chronic neck pain in women:a randomized control trial. JAMA. 2003;19:2509-16.

21. Rhenen WV, Roland W, Klink JJLvd, Blonk B, Frank J, Dijk Hv, et al. The effect of a cognitive and a physical stress-reducing programme on psychological complaints. Int Arch Occup Environ Health. 2005;78:139-48.

22. Houtman I, Bongers P, Smulders P, Kompier M. Psychosocial stressors at work and musculoskeletal problems. Scand J Work Environ Health. 1994;20:139-45.

23. Hales TR, Sauter SL, Peterson MR, Fine LJ, Putz-Anderson V, Schleifer LR, et al. Musculoskeletal disorders among visual display terminal users in a telecommunications company. Ergonomics. 1994;37:1603-21.

24. Fenety A, Putnam C, Loppie C. Advances in Occupational Ergonomics and Safety: IOS Press; 1999.

25. Salmon P. Effects of physical exercise on anxiety, depression, and sensitivity to stress: a unifying theory. Clin Psychol Rev. 2001;21:33-61.

26. vanderKlink JJ, Blonk R, Schene A, vanDijk F. The benefits of interventions for work-related stress. Am J Public Health. 2001;91:270-6.