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Medical Journal of the Islamic Republic of Iran (MJIRI)
Iran University of Medical Sciences

The role of ergonomic training interventions on decreasing neck and shoulders pain among workers of an Iranian automobile factory: a randomized trial study

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Received: 25 January 2014 Accepted: 10 September 2014 Published: 10 March 2015

Abstract

Background: Ergonomic training had been implemented for prevention or reduction of neck and shoulder complaints among workers. The purpose of the present study was to assess the role of ergonomic training intervention on decreasing the prevalence of neck and shoulder complaints among workers of an automobile factory.

Methods: Within the present randomized clinical trial, the role of three ergonomic training methods on the prevalence of neck and shoulders pain among 503 workers of an automobile factory (Response rate: 94.23%) was assessed. The eligible workers were randomly allocated into the following three interventional (pamphlet, lecture, workshop) groups and one control group. The Nordic questionnaire was used to assess the prevalence of neck and shoulder complaints. We followed and assessed the prevalence of neck and shoulders complaints among the study employees before and one year after the intervention. We used chi-square and Mann-Whitney tests to compare the prevalence of neck and shoulder complaints between the trial and control groups. A two-tailed P-value less than or equal to 0.05 was considered statistically significant.

Results: The prevalence of neck and shoulders complaints among the study employees at the recent week (p= 0.002) and year (p= 0.02) had been significantly decreased in the study employees after participating in the study workshop. The prevalence of neck and shoulders complaints at the recent week and year did not significantly changed in the study employees after receiving the pamphlet and lecture as ergonomic trainings.

Conclusion: Workshop as an ergonomic training method had an effective and powerful role on decreasing the prevalence of neck and shoulders complaints among workers.

Keywords: Ergonomic Intervention, Prevalence, Neck and Shoulders Pain, Training.

Cite this article as: Aghilinejad M, Kabir-Mokamelkhah E, Labbafinejad Y, Bahrami-Ahmadi A, Hosseini H.R. The role of ergonomic training interventions on decreasing neck and shoulders pain among workers of an Iranian automobile factory: a randomized trial study. *Med J Islam Repub Iran* 2015 (10 March). Vol. 29:190.

Introduction

Musculoskeletal Disorders (MSDs) complaints in neck and lumbar spinal regions have a high prevalence among industrial workers (1-2). In several countries, particularly in Iran as a developing country, neck and shoulders pain had been recognized as

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important causes of disability and morbidity in workers. Such physical risk factors as sustained awkward posture, repeated arm motions and work with the hands at or above the shoulder level are associated with upper extremity and neck disorders (3-4). In several Iranian studies, a high prevalence of neck and spinal disorders had been reported among industrial workers compared to the general population and even office workers (5-7).

Ergonomic Training Methods (ETM) are used for prevention and reduction of MSDs especially in neck and lumbar regions (8). In one Cochrane systematic review, most of the powerful trials and reviews reported that training was the most cost-effective interventional method in developing countries (9). Although ergonomic training had been included in most strategies of decreasing neck and lumbar spinal complaints, these interventions in most of the employees and work places did not have suitable effectiveness (2, 10). Lack of effective implementation strategies and inadequate implementation had been reported in describing the impact of ETM on neck and spinal complaints (11).

Among Iranian workers, ETM might have different impacts on the prevalence of MSDs; therefore, we decided to evaluate the role of ETM on decreasing the prevalence of MSDs among Iranian workers. The present trial was performed to assess the impact of three ETMs on the prevalence of neck and shoulders complaints among the active workers of an Iranian automobile industry.

Methods

Study Design

The role of the three ergonomic training methods on neck and shoulders complaints among the workers of an automobile factory were compared within the present randomized clinical trial with a parallel design. The trial population included 760 active workers (October 2012) of an Iranian au-

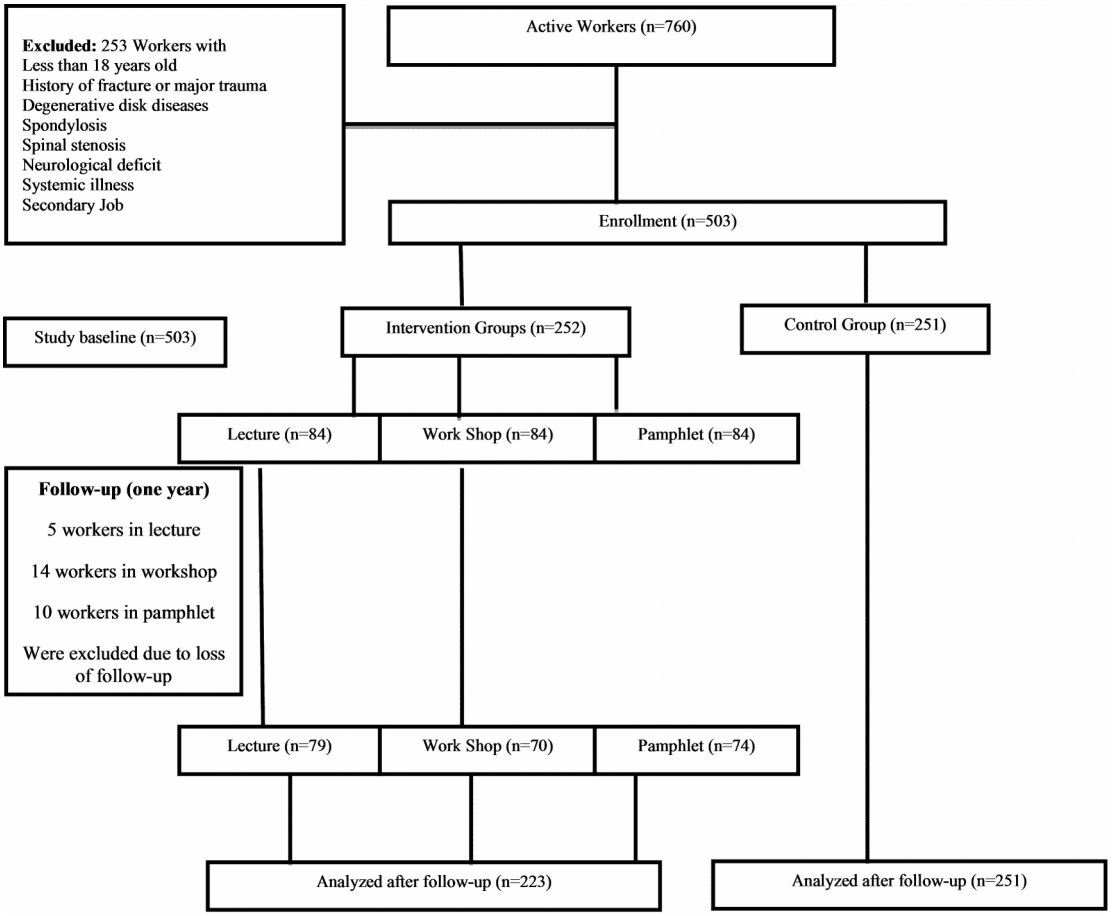

Fig. 1. Flow diagram of subjects through the trial

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tomobile factory in Tehran. Workers with the history or available medical documents of fracture (A bone fracture is a medical condition in which there is a break in the continuity of the bone) or major trauma, degenerative disk diseases, spondylitis, cervical neck stenosis, neurological deficit (Any Weakness or paralysis of a limb or the entire), systemic illness and those who had secondary jobs were excluded from the study. Finally, 503 workers remained in the trial.

The present trial was approved by the Ethical Committee of Iran University of Medical Sciences and was registered in the Iranian Randomized Clinical Trial registry system (ID: IRCT2013061213182N2). Informed consents were signed by the workers before randomization. Before the randomization process, personal and occupational characters of the workers were the same. According to the trial design, trial investigators decided to divide the eligible workers into a control (251 workers) group and three trial groups (252 workers) randomly (Fig. 1).

Study Intervention

After determining the possible risk factors through risk assessment and reviewing the literature, the trial investigators prepared the concept of the intervention. Trial participants were randomly divided, with a random table, into a control group and three trial groups and received one of the three ergonomic training methods: (1) In the first trial group, a five- hour educational oral lecture about describing neck and shoulders complaints and related ergonomic concepts was given to the workers (n= 84). After defining and reporting some statistics of the national or international neck and shoulders complaints reports to the participants, the researchers tried to describe the proper positions and other activities to the participants to cover possible ergonomic risks and prevent subsequent neck and shoulder complaint episodes (2). In the next trial group, workers received one educational gray-scale schematic pamphlet with the same concepts through an oral lecture given in the first trial group (n= 84); and in the third trial group, a five- hour workshop was performed for the participants with the same concepts provided to the other two trial groups. After learning about the educational concepts, the participants practiced and corrected their errors through team work (n= 84).

Study Measurements

Demographic and work-related data for the participants were obtained and recorded into the trial check lists. The prevalence of neck and shoulder complaints was measured in the trial participants with Nordic Musculoskeletal Questionnaire. NMQ was developed from a project funded by the Nordic Council of Ministers and included questions such as age, job duration, weight of loads, daily working hours and musculoskeletal complaints in each of the following body regions: neck, shoulder, elbow, wrist/hand, upper back, lumbar, one or both hips/thighs, one or both knees and one or both ankles/feet. The validity and reliability of the questionnaire have been approved in different studies and in several languages including the Persian language (12-13). The aim was to develop and test a standardized questionnaire methodology allowing comparison of low back, neck, shoulder and general complaints for use in epidemiological studies. The tool was not developed for clinical diagnosis. This questionnaire can be used as a questionnaire or an interview device (12). The NMQ has been used in several studies for the evaluation of musculoskeletal problems, including computer and call center workers (13) and car drivers (14). Previous studies reported that the NMQ is repeatable, sensitive and useful as a screening and surveillance tool. However, medical examination is essential to establish a clinical diagnosis.

Study Outcomes

Trial outcomes measured the primary and secondary prevalence of neck and shoulder complaints, defined as the experience of

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pain or discomfort in the soft tissue of the neck or shoulder regions, which had occurred at least for 2-3 work days during the past week or year. Noted pain has improved on the weekends, vacations and holidays. All medical examinations and questionnaire fillings were supervised by the research team. The primary prevalence of neck and shoulder complaints had been performed at base time trial, and the secondary measuring of the prevalence of neck and shoulder complaints had been performed one year after the trial interventions as trial follow-up period with NMQ.

Statistical Methods

Normality assumption was checked using the Kolmogorov-Smirnov test. Chi-square test was used to compare the prevalence of neck and shoulder complaints between the trial and control groups. Also, Mann-Whitney test was used for the variables which were not normally distributed (age and work experience). A two-tailed P-value less than or equal to 0.05 was considered statistically significant, and all the analysis was performed using SPSS (version 21).

Results

Among 503 invited workers, 474 answered the study questionnaire (Response rate: 94.23%). Before the analysis, the Median and Interquartile Range IQR of age and work experience of the participants were 30, 3, 7, and 4 years, respectively. No significant differences were found between the control and the trial groups in the median of age and work experience and BMI (p>0.005) (Table 1).

The primary prevalence of neck (96; 38.09% vs. 86; 34.21%; p= 0.373) and shoulders (93; 36.90% vs. 87; 34.66%; p=0.603) complaints in the last year was not significantly different between the trial and control groups. The primary prevalence of neck (89; 35.32% vs. 79; 31.47%; p=0.362) and shoulders (87; 34.52% vs. 79; 31.47%; p= 0.472) complaints in the last week was not significantly different between the trial and control groups. After one year (as the study follow-up time), the prevalence of neck and shoulder complaints at the past week and year did not significantly change among the study employees after receiving the lecture and pamphlet (p>0.05). The prevalence of neck complaints among the trial workers in the past year (33.30%vs. 31.4%; p= 0.029) and week (31.60% vs. 22.9%; p= 0.002) significantly decreased in the trial workers after taking part in the trial workshop. The prevalence of shoulders complaints among the trial workers in the past week (28.57% vs. 20%; p= 0.002) and year (32.14% vs. 31.43%; p= 0.020) significantly decreased in the trial workers after taking part in trial workshops (Table 2, 3).

Discussion

Findings of the present study showed that workshop as an ETM had a significant impact on decreasing neck and shoulder pain compared to other ETMs. Several studies had been conducted on the role of ergonomic training on the prevalence of musculoskeletal (MSD) complaints in different working populations. In Brisson et al. study, upper extremity complaints decreased from 19% to 3% among workers in video display units after training (15). Similarly, Bohr found that trained workers suffered less MSD related pain and complaints (14). Johnson reported that there was no significant declines in work related MSDs among the study workers (16). MSD risk factors, proper work practice and appropriate equipment selection, correct use of equipment and workstation adjustment

Table 1. Descriptive statistics of variables for employees (n=451)

Variable	Control group (n=251) Median (IQR)	Trial groups(n=200) Median (IQR)	p
Age (year)	30 (2)	31 (5)	0.08
Work experience (year)	7 (4)	7 (3)	0.32
Body Mass Index (kg/m^2)	24.44 (3.79)	24.22 (3.72)	0.85

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Table 2. Frequency Distribution of Neck complaints at last week and year among trial groups before and after trial intervention

Time	Study groups	Total	Before intervention n (%)		Total	After intervention n (%)		p
			Positive*	Negative**		Positive*	Negative**	
Last year	Lecture	84	35 (41.7)	49 (58.3)	79	26 (32.9)	53 (67.1)	0.069
	Workshop	84	28 (33.3)	56 (66.7)	70	22 (31.4)	48 (68.6)	0.029
	Pamphlet	84	33 (39.3)	51 (60.7)	74	26 (35.1)	48 (64.9)	0.119
Last week	Lecture	84	31 (36.9)	53 (63.1)	79	31 (39.2)	48 (60.8)	0.071
	Workshop	84	26 (31.0)	58 (69.0)	70	16 (22.9)	54 (77.1)	0.002
	Pamphlet	84	32 (38.1)	52 (61.9)	74	25 (33.8)	49 (66.2)	0.075

*positive: all of workers who had neck or shoulder pain in specific period of time that noted in the table
**negative: all of workers who had not neck or shoulder pain in specific period of time that noted in the table

Table 3. Frequency distribution of shoulder complaints at last week and year among trial groups before and after trial intervention

Time	Study groups	Total	Before intervention n(%)		Total	After intervention n(%)		p
			Positive*	Negative**		Positive*	Negative**	
Last year	Lecture	84	34 (40.5)	50 (59.5)	79	27 (34.2)	52 (65.8)	0.066
	Workshop	84	27(32.1)	57 (67.9)	70	22 (31.4)	48 (68.6)	0.020
	Pamphlet	84	32 (38.1)	52 (61.9)	74	27 (36.5)	47 (63.5)	0.115
Last week	Lecture	84	33 (39.3)	51 (60.7)	79	28 (35.4)	51 (64.6)	0.063
	Workshop	84	24 (28.6)	56 (71.4)	70	14 (20.0)	56 (80.0)	0.002
	Pamphlet	84	30 (35.7)	53 (64.3)	74	26 (35.3)	48 (64.7)	0.054

*positive: all of workers who had neck or shoulder pain in specific period of time that noted in the table
**negative: all of workers who had not neck or shoulder pain in specific period of time that noted in the table

had been described in ergonomic training methods. This intervention had been heavily promoted for MSD prevention (17,18). Failure of other ergonomic interventions such as lecture and pamphlet in the present study might be due to the inadequate sample size and methodological differences (19). One of the possible causes for failure in detecting effectiveness for interventional programs in noted studies might be due to difficulty in changing the workers behaviors and some consultations. Effective ergonomic training needs to change in the behavior and cultural habits of workers in different countries. These changes were time consuming and seem that one-year follow-up may not be long enough for sever changes or differences in the prevalence of neck and shoulders complaints. The production factories and industries had different production processes, employment size and characters; therefore, performing randomized studies only on one part of this complex might not have adequate power to control the confounding variables.

Matching can help dealing with the confounding variables. In the present study, we tried to randomly select our participants among the employees of the product line with regular and same work tasks. Median of age, work history and BMI as three main confounding variables were not significantly different between the control and interventional groups. One of the possible biases in the present study might be related to information bias due to the self-reporting nature of MSD assessment tools. In this study, musculoskeletal disorders were assessed according to self-reports of the Nordic questionnaire and might have led to the over estimation of MSD prevalence among the workers. Due to the random allocation of the employees, over estimation of symptoms was the same among the study groups. One of the strengths of the present study was that during the one year follow-up time between the interventions and measuring the secondary outcome, nearly all the employees participated in the final assessment and we had the lowest miss rate.

Our study had some limitations; firstly we selected study populations form one auto-

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mobile factory. It was better to select the study population from different factories with different workloads and tasks. Secondly, musculoskeletal complaints were multifactorial and some other non-work related factors such as psychological and social issues might have been responsible for MSD development. It is suggested that in the future studies, noted factors be controlled. The findings of this study showed that workshop ergonomic training had significantly higher impact on MSD prevalence among employees than other ergonomic training methods such as pamphlet or even lecture. Therefore, it may be used for the prevention of neck and shoulders complaints in work places.

Conclusion

Workshop as an ergonomic training method had an effective and powerful impact on decreasing the prevalence of neck and shoulders complaints among workers.

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