



# The Effect of Three Ergonomics Training Programs on the Prevalence of Low-Back Pain among Workers of an Iranian Automobile Factory: A Randomized Clinical Trial

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## Abstract

**Background:** Many workers suffer from low-back pain. Type and severity of spinal complaints have relationship with work load, and lack of adherence to ergonomics recommendations, among other important causes of low-back pain.

**Objective:** To assess the effect of 3 ergonomics training programs on the prevalence of low-back pain among workers of an Iranian automobile factory.

**Methods:** In a parallel-design 4-arm randomized clinical trial, 760 active workers of an automobile factory were studied. 503 workers were found eligible and randomized into 3 intervention groups (n=252), and a control group (n=251). The intervention groups consisted of 3 arms: 84 workers were educated by pamphlet, 84 by lectures, and 84 by workshop. Nordic questionnaire was used to determine the prevalence of spinal complaint before and 1-year after the interventions. The trial is registered with the Iranian Randomized Clinical Trial Registry, number IRCT2013061213182N2.

**Results:** Out of 503 workers, 52 lost to follow-up leaving 451 workers for analyses. The prevalence of low-back pain at the baseline was not significantly different among the studied arms. 1-year after the interventions, the prevalence did not change significantly from the baseline values for the lecture and pamphlet group. However, the prevalence of LBP experienced during the last year significantly ( $p=0.036$ ) decreased from 42% to 23% in participant took part in the workshop.

**Conclusion:** Training of automobile factory workers in ergonomics is more effective by running workshop than giving lecture or disseminating pamphlet.

**Keywords:** Human engineering; Prevalence; Low back pain; Education; Randomized controlled trial

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## Introduction

For more information on the prevalence of musculoskeletal disorders among employees of Iranian petrochemical industries see [www.theijoem.com/ijoem/index.php/ijoem/article/view/253](http://www.theijoem.com/ijoem/index.php/ijoem/article/view/253)



The prevalence of spinal complaints is high among industrial workers.<sup>1,2</sup> In occupational medicine, the type and severity of spinal complaints have relationship with work load.<sup>3,4</sup> It is shown that in automobile factories, certain activities such as manual handling and lifting of heavy objects are correlated with spinal complaints.<sup>5</sup> Several studies have confirmed the role of manual handling of objects in the development of spinal complaints.<sup>6-10</sup> In most Iranian automobile industries, manual handling and lifting heavy objects are constant part of work task, especially among workers in product lines. Several studies on Iranian workers reported that the prevalence of musculoskeletal disorders and spinal complaints is much higher than that reported in most international reports.<sup>11-13</sup>

It has been shown that training in ergonomics is effective in prevention of spinal complaints.<sup>14</sup> One study shows that of many available ergonomic interventions, “training” is the most cost-effective one in developed countries.<sup>15</sup> Some other studies could not find any significant effect of ergonomic interventions.<sup>2,16</sup> One of the main causes would be inadequate implementation of ergonomic training.<sup>17</sup> Most of these studies, however, were conducted in developed countries.

There is scarce information on the effectiveness of ergonomics training interventions in developing countries. We therefore conducted this study to assess the effectiveness of three ergonomics training programs on the prevalence of low-back pain (LBP) among active workers of an Iranian automobile factory.

## Materials and Methods

### Study design

A four-arm parallel design randomized clinical trial was conducted on workers of an Iranian automobile factory. The trial compared the effect of three ergonomics training programs on the prevalence of LBP among the studied workers. The study began in October, 2012, when the study population of active workers of an Iranian automobile factory in Tehran, Iran, was 760. Workers who did extra job within their free time; those with history of fracture or major trauma; workers with degenerative disk disease, spondylosis, spinal stenosis, neurological deficit, systemic illness and in vacation, were excluded from the study leaving 503 workers eligible to be included in the study.

The study protocol was explained to all eligible workers; they signed an informed written consent. The trial was approved by the Research Ethics Committee of Iran University of Medical Sciences. It is registered with the Iranian Randomized Clinical Trial Registry, number IRCT2013061213182N2.

A total of 503 workers was found eligible and entered the study.

### Treatment arms

The 503 workers who entered the study were randomized into four groups (Fig 1) including a control group (n=251), and three intervention arms based on the education method used—lecture (n=84), pamphlet (n=84), and workshop (n=84). The

### TAKE-HOME MESSAGE

- Many workers suffer from low-back pain.
- There is scarce information on the effectiveness of ergonomics training interventions in developing countries.
- Training of workers in ergonomic methods for the prevention of low-back pain should preferably be done through running educational workshops rather than giving lecture or disseminating pamphlets.

first intervention group received a five-hour educational lecture on LBP and the related ergonomics aspects. In these lectures after defining LBP, some statistics from national and international studies were reported. Then, getting appropriate positions at work and other activities that would alleviate the ergonomic risks of LBP were discussed. In the pamphlet group,

workers were given an educational pamphlet with black and white schematic diagrams describing the same topics presented orally for the first group. In the third intervention arm, we ran a five-hour workshop covering the same topics for participants. The workshop attendees discussed various aspects of LBP and ergonomics in groups.

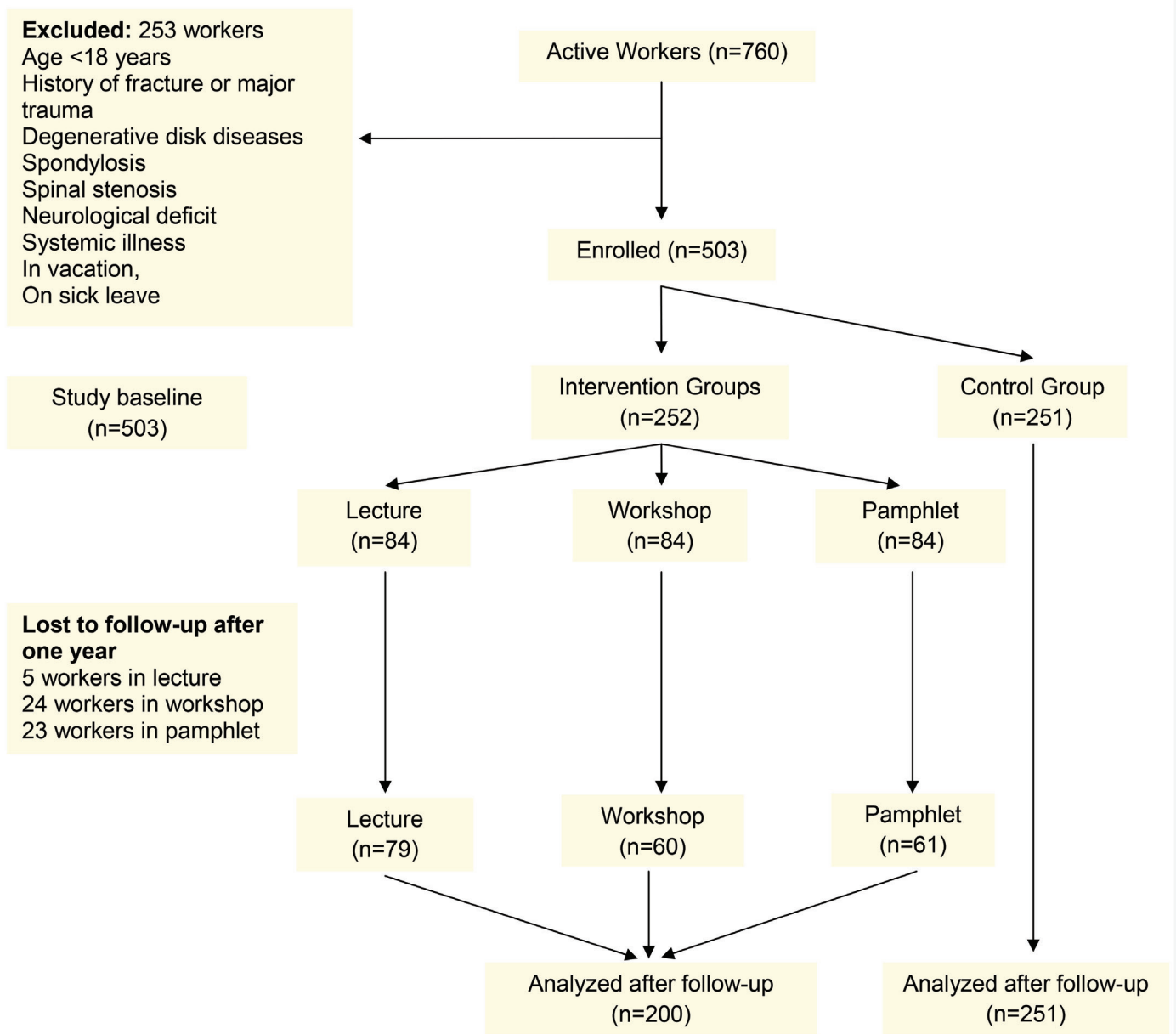


Figure 1: Trial profile

**Table 1:** Demographic data of the study participants (n=451). Values are median (IQR).

	Control group (n=251)	Trial groups (n=200)	p value
Age (yrs)	30 (2)	31 (5)	0.08
Work experience (yrs)	7 (4)	7 (3)	0.32
Body Mass Index (kg/m <sup>2</sup> )	24.4 (3.8)	24.2 (3.7)	0.85

**Measurements**

The demographic and work-related data for studied workers were obtained and recorded into a check list. Data on daily work hours were defined as the time spent in the workplace. Body mass index (BMI) was also calculated for each participant. LBP was defined as “experiencing pain or discomfort in the lower back that lasted for at least 2–3 working days.” The prevalence of LBP was measured using Nordic musculoskeletal questionnaire. Validity and reliability of the questionnaire has been assessed and approved in previous studies.<sup>18,19</sup> The questionnaire has been used in several studies for evaluation of musculoskeletal disorders, including computer and call center workers<sup>19</sup> and car drivers<sup>20</sup>. The prevalence of LBP was determined among the participants before and one year after the educational program.

**Statistical analysis**

SPSS® for Windows® ver 21.0 was used for data analysis. Quantitative variables were tested for normality using one-sample Kolmogorov-Smirnov test. McNemar's test was used for comparing the prevalence of LBP before and after the intervention in each group.  $\chi^2$  test was used to compare the prevalence of LBP among the studied groups. Normally distributed continuous variables were presented as mean±SD; otherwise median and interquartile range (IQR) was used. Mann-Whitney U test was used to compare two non-normally distributed variables. A two-tailed p value <0.05

was considered statistically significant.

**Results**

Out of 760 active workers of the factory, 503 were found eligible and enrolled in the study (Fig 1). After one year, 52 workers lost to follow-up leaving 451 workers (a response rate of 89.7%) for analyses. The median (IQR) of age, work experience and BMI was not significantly different among the studied groups (Table 1).

The prevalence of “LBP experienced during the last week” was not significantly (p=0.162) different between the intervention (89/252; 35.3%, 95% CI: 29.4%–41.3%) and control group (74/251; 29.5%, 95% CI: 23.8%–35.2%). The prevalence of “LBP experienced during the last year” was also not significantly different (p=0.165) between the groups (94/252; 37.3%, 95% CI: 31.3%–43.3% vs 109/251; 43.4%, 95% CI: 37.3%–49.6%) (Table 2).

After one year of follow-up, the prevalence of LBP experienced during the last week did not significantly change with education (Table 2). The prevalence of LBP experienced during the last year, though did not significantly change in those who trained by lecture and pamphlet, was significantly decreased after participating in the workshop (p=0.036) (Table 2).

**Discussion**

We found that running workshops for training of workers in ergonomics is more

**Table 2:** Prevalence of LBP experienced during the last week and year among the study groups before and one year after the intervention.

LBP experienced during	Study Group	Prevalence of LBP				p value
		Before the interventions		After one-year of follow-up		
		n	Affected (%)	n	Affected (%)	
Last week	Lecture	84	33 (39)	79	28 (35)	0.063
	Workshop	84	29 (35)	60	23 (13)	0.389
	Pamphlet	84	27 (32)	61	25 (41)	0.314
	Control	251	74 (29.5)	251	81 (32.3)	0.690
Last year	Lecture	84	34 (40)	79	28 (35)	0.082
	Workshop	84	35 (42)	60	14 (23)	0.036
	Pamphlet	84	36 (43)	61	22 (36)	0.821
	Control	251	109 (43.4)	251	111 (44.2)	0.890

effective than education with lecture or pamphlets in reducing the prevalence of LBP among workers of an automobile factor. Several studies on the effect of ergonomic training on prevalence of musculoskeletal disorders (MSD) were conducted on various worker population. Brisson, *et al*, in their randomized clinical trial found that complaints of the upper extremity decreased from 19% to 3% among workers of video display units after participating in a training course.<sup>21</sup> Similarly, Bohr found that trained workers suffered less frequently from MSD-related pain and complaints.<sup>20</sup>

Although training in health and safety aspects of work was administered mainly for the prevention of work-related MSDs, findings of various studies are inconsistent. Daltroy, *et al*, in a randomized controlled trial with 5.5-year follow-up showed that training in safety issues does not have any long-term impacts on the prevention

of LBP.<sup>22</sup> Johnson also found no significant decline in the prevalence of work-related MSD among a group of workers who had been trained in patient handling and moving skills according to the Stockholm Training Concept.<sup>23</sup>

Workshop on ergonomics contains some concepts that help workers to know about MSD risk factors, proper work practice and appropriate equipment selection, correct use of equipment, and workstation adjustment. This type of intervention has extensively been promoted for MSD prevention.<sup>24,25</sup> Failure of other ergonomic interventions such as lecture and pamphlet in the present study might be due to inadequate sample size and methodological differences.<sup>22</sup> One of the possible causes for failure in detecting effectiveness for interventional programs might be the difficulty in changing the workers behavior that warrants consultation and guidance before starting the training intervention.



Effective ergonomic training needs consideration of changes in the behavior and cultural habits of workers. These changes were time consuming and it seems that a one-year follow-up may not be enough to expect a dramatic change in the behavior of workers and thus in the prevalence of spinal complaints.

The production factories and industries have different production processes, employment size, and characteristics. Therefore, performing a study on only one part of such factories might not be adequate to reach a scientific conclusion. Furthermore, controlling of confounding variables under such circumstances is usually difficult.

One of the limitations of the present study was the self-reporting nature of the study; there is generally a tendency in workers to over-report their MSDs.<sup>26</sup> However, random allocation of employees to the study arm would abolish this confounder. Inclusion of a control group in the study is one of the strengths of the present trial.

Another limitation of the study was that we selected the participants only from an automobile factory. It would have been better if we studied workers from different factories with different work load and tasks. MSDs are multifactorial and other non-work-related factors such as psychological and social factors might also be responsible for the development of the disease. It is therefore better to control as many as possible variables in future studies.

In conclusion, we found that training of workers in ergonomic methods for the prevention of LBP should preferably be done through running educational workshops. This method though has various limitations compared to giving lecture and disseminating pamphlet (eg, limitation of the participants to less than 30 persons), is more effective.

**Conflicts of Interest:** None declared.

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