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Effect of Ergonomic Principles Education on Temporary Musculoskeletal Disorders of Personnel in Hospital Service

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Authors
Saeedi E.[1] *BS*,
Sajedifar J.[2] *MSc*,
Shirdelzade S.*[3] *MSN*,
Mehri A.[4] *MSc*,
Azizy E.[5] *BS*

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[1]Student Research Committee, Gonabad University of Medical Sciences, Gonabad, Iran
[2]Occupational Health Engineering Department, Public Health Faculty, Neyshabur University of Medical Sciences, Neyshabur, Iran
[3]Nursing Department, Nursing Faculty, Neyshabur University of Medical Sciences, Neyshabur, Iran
[4]Occupational Health Engineering Department, Public Health Faculty, Iranshahr University of Medical Sciences, Iranshahr, Iran
[5]Student Research Committee, Gonabad University of Medical Sciences, Gonabad, Iran

Correspondence
Address: Nursing Department, Nursing Faculty, Neyshabur University of Medical Sciences, Janbazan Street, Neyshabur, Iran. Postal Code: 9675133587
Phone: +98 (51) 43344012
Fax: -
shirdel.sara@gmail.com

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ABSTRACT

Aims Work-related musculoskeletal disorders are highly prevalent in personnel of hospital service. The aim of the present study was to investigate the effect of ergonomic principles education on temporary musculoskeletal disorders of personnel in hospital service.

Materials & Methods This study is a two-group pre-test, post-test experimental study that was done on 50 people of service staff of educational hospitals of Gonabad, Iran, in 2014. Participants were entered by simple randomized sampling method and then randomly assigned into two intervention and control groups (25 samples in per group). Nordic musculoskeletal questionnaires (NMQ) and Rapid Entire Body Assessment (REBA) questionnaires were completed for both groups. Then ergonomic education was conducted for intervention group and after one month the questionnaires were completed. Mann-Whitney U and Wilcoxon tests were used. The collected data were analyzed by SPSS 16 software.

Findings According to REBA, there was a statistically significant difference after intervention ($p \leq 0.001$) in two groups. Also, Nordic questionnaire showed a significant difference in upper back ($p \leq 0.003$), lower back ($p \leq 0.022$), and thigh ($p \leq 0.016$) scores after intervention.

Conclusion Ergonomic education can reduce the incidence of musculoskeletal disorders of personnel in hospital service.

Keywords Musculoskeletal Disorders; Ergonomic; Health Personnel

CITATION LINKS

[1] Perceived demands and musculoskeletal disorders among hospital nurses [2] Risk factors for musculoskeletal disorders among nursing personnel in Greek hospitals [3] Comparisons of musculoskeletal disorders among ten different medical professions in Taiwan: A nationwide, population-based study [4] Multifaceted ergonomic intervention programme for community nurses: Pilot study [5] The ILO list of occupational diseases [6] Low back pain and lumbago-sciata in nurses and a reference group of clerks: result of a comparative prevalence study in Germany [7] Viral hepatitis in helath service workers in the Province of Wielkopolska [8] Determination of the usage of body mechanics in clinical settings and the occurrence of low back pain in nurses [9] Risk factors and musculoskeletal complaints in non-specialized nurses, IC nurses, operation room nurses, and X-ray technologists [10] Ergonomic evaluation and design of tools in cleaning occupations [11] Posture assessment methods in occupational ergonomics [12] Course of low back pain among nurses: A longitudinal study across eight years [13] Ergonomic interventions for reducing musculoskeletal disorders [14] Application of Ergonomics to Industrially Developing ... [15] Ergonomic risks and musculoskeletal disorders in production agriculture: Recommendations for effective research to practice [16] Comparison of self-report, video observation and direct measurement methods for upper extremity musculoskeletal disorder physical risk factors [17] Interrater reliability: The kappa statistic [18] Assessment of musculoskeletal loads of electric factory workers by rapid entire body assessment [19] Issues associated with force and weight limits and associated threshold limit values in the physical handling work environment [20] REBA: A rapid entire body assessment method for investigating work related musculoskeletal disorders [21] Rapid entire body assessment (REBA) [22] The effect of an educational on knowledge, attitude and ergonomic behavior [23] Evaluation of a training program for the prevention of lower back pain among hospital employees [24] Effectiveness of computer ergonomics interventions for an engineering company: A program evaluation [25] Use of evidence for prevention of work-related musculoskeletal injuries [26] Risk factors associated with the reporting of musculoskeletal symptoms in workers at a laboratory of clinical pathology [27] A detailed analysis of musculoskeletal disorder risk factors among Japanese nurses

Introduction

Musculoskeletal disorders are one of the most common work-related injuries and disabilities in developing countries and the most common work-related disability causes financial and medical expense [1, 2]. Musculoskeletal disorders can lead to increasing healthcare usage, reducing work productivity, and lowering levels of health related to the quality of life [3].

Among different professions in industry, healthcare professions are ones responsible for prevention, treatment, and rehabilitation patients and clients. To put it more simply, they experience risky levels of developing work-related disorders. Personnel services are the biggest high-risk group of musculoskeletal disorders in healthcare professional's team [4]. The nature of their duties is the effective factor for causing these disorders [1]. Statistics show musculoskeletal injuries are the most non-pyrogenic work-related problems in healthcare personnel which is induced during patient transportation. Lifting patients up is one of the major problems of personnel in hospital service that could hurt their back muscles. This is the most common and expensive work-related injury which follows high work absence annually [5-7]. Various key factors are responsible for mentioned disorders, including high physical activity, lifting things and patients up, transporting them, and also obesity, age, and gender [8, 9]. Inappropriate body posture, as well as the weakness of designed workstations, are also substantial factors of work-related musculoskeletal disorders (WMSDs) and lowering effectiveness [10]. As most of musculoskeletal injuries were not recorded anywhere, its statistics are like an ice mountain showing only the presence of problem, not its domain nor extent [11]. 600000 people losing their work time and 45-54 billion dollars expense annually are the results of these injuries only in the US [12, 13].

In most developing countries, worker's low awareness and usage of safety instruments and means are causing WMSDs. Furthermore, medical expense is increasing for workers. In these countries, the expense paid for the musculoskeletal disorders is approximately half of what they need [14]. Musculoskeletal disorders can result in work injuries, medical and insurance expense, and decrease work capacity which all subsequently leads to increasing production expense. Moreover, losing one worker can cause decreasing in competition ability of the industry and make it an overwhelming one [15]. Therefore, prevention of WMDs became a national priority in some countries [16]. Hence, planning any prevention, treatment, or rehabilitation program need to know the epidemiology and effective factors of these disorders.

The aim of the present study was to investigate the effect of ergonomic principles education on temporary musculoskeletal disorders of personnel in hospital service.

Material and Methods

This pre-test, post-test experimental study was performed on 50 people of service staff of educational hospitals of Gonabad, Iran, in 2014 (February 11 and June 5) with simple randomized sampling method. Inclusion criteria included no history of accident or musculoskeletal surgery, working more than 1 year, age between 20-60 years, working in one of two educational hospitals of Gonabad, no history of musculoskeletal anomaly or trauma, and no history of psychological disorders in last 6 months as it can cause backache (One of the most common musculoskeletal disorders). Exclusion criteria were having the accident or musculoskeletal trauma during the intervention period, dissatisfaction for continuing the intervention and work fire.

The samples randomly assigned into two control and intervention groups (25 samples in per group).

For both groups demographic, Nordic musculoskeletal questionnaires (NMQ) and Rapid entire body assessment (REBA) posture chart fulfilled, then the intervention group received an educational program while control group did not receive any education.

Demographic questionnaire included items about age, gender, marital status, and etc. that had content validity and reliability.

The Nordic questionnaire is a standardized self-administered one that developed by Nordic Council of Ministers, Finland, in 1987 to screen musculoskeletal disorders in an ergonomics context and contains two sections. In section 1, respondents identified the presence and severity of musculoskeletal disorder in different parts of the body (Neck, shoulders, upper and lower back, elbow, wrist and hands, thigh, knees, and ankle/feet). In section 2 respondents must answer additional and more detailed questions relating to the neck, shoulders, and upper and lower back. This scale has content validity and reliability with kappa coefficient of 0.72~1.00. Cohen suggested the Kappa result to be interpreted as follows: values≤0 as, indicating no agreement and 0.01-0.20 as none to slight, 0.21-0.40 as fair, 0.41- 0.60 as moderate, 0.61–0.80 as substantial, and 0.81-1.00 as almost perfect agreement [17].

Also, REBA posture chart was used, which was developed by Mc Atamney and Hignett in 1995 for rapid assessment of body. In this chart all parts of body are classified in two groups, included A and B. The group A consisted neck, legs, and trunk; group B compromised of lower arms, upper arms, and wrist. One of researchers observed the person posture and proposed a score for group A and B body parts and

then the score of C is obtained from A and B scores. Many studies reported an acceptable reliability and validity of REBA tool in various tasks or different jobs and found a good correlation between REBA scores and NMQ results [18-21].

The educational program consisted of one session (2 hours) in which appropriate fundamental of body mechanics educated by speech and group discussion. Questionnaires were recompleted one month after education for both groups.

For analyzing REBA and NMQ scores, non-parametric tests were used, as REBA score had not normal distribution and NMQ score was ordinal. In order to compare, if there is any significant difference between groups before the intervention Mann-Whitney U test was used. For comparing REBA and NMQ changes before and after the intervention, the Wilcoxon test was used. Data were analyzed by SPSS 16 software.

Findings

Most of participants were male (52.0%), married (80.0%), had less than 3 children (82.0%), had no other job (86.0%), and had no exercise (54.0%), but approximately all of them had high activity.

The statistical mean age of participant was 37.90±9.17 years old (Table 1).

There was not any significant difference between REBA and NMQ scores of both the intervention and control groups before the intervention ($p \geq 0.05$) and both groups were similar to musculoskeletal disorders prevalence.

Table 1) Statistical mean of demographic data of service personnel of Gonabad educational hospitals (n=25 in each group)

Variables/ Group	min	max	M±SD
Age (years)			
Intervention	22.00	65.00	39.28±10.25
Control	25.00	53.00	36.56±7.93
Weight (kg)			
Intervention	45.00	108.00	69.92±13.50
Control	41.00	98.00	63.32± 11.84
Height (cm)			
Intervention	150.00	185.00	165.08±11.41
Control	150.00	190.00	164.00±10.29
Record of service (years)			
Intervention	2.00	35.00	11.52±7.68
Control	2.00	30.00	8.92±6.93

A significant difference between groups was found in REBA score ($p \leq 0.001$). Although, the prevalence of musculoskeletal disorders in the most parts of body decreased after the intervention. A significant difference was observed after the intervention only in NMQ scores of upper back ($p \leq 0.003$), lower back ($p \leq 0.022$), and thigh ($p \leq 0.016$; Tables 2 and 3).

No relationship had found between demographic data and REBA and NMQ sores.

Table 2) Comparison prevalence of musculoskeletal disorders before and after the intervention in REBA test (n=50 in each group, the numbers in parentheses represent percentage)

Risk level/Group	Before	After
Negligible		
Intervention	0	0
control	0	0
Low risk		
Intervention	0	1 (4.0)
control	0	0
Medium risk		
Intervention	4 (16.0)	3 (12.0)
control	2 (8.0)	2 (8.0)
High risk		
Intervention	15 (60.0)	19 (76.0)
control	12 (48.0)	12 (48.0)
Very high risk		
Intervention	6 (24.0)	2 (8.0)
control	11 (44.0)	11 (44.0)

Table 3) Comparison of musculoskeletal disorder prevalence before and after intervention in NMQ test (n=50, the numbers in parentheses represent percentages)

Body Parts	Before		After	
	Intervention group	Control group	Intervention group	Control group
Neck				
Yes	6 (24.0)	10 (40.0)	7 (28.0)	6 (24.0)
No	19 (76.0)	15 (60.0)	18 (72.0)	19 (76.0)
Shoulder				
Yes	6 (24.0)	11 (44.0)	8(32.0)	5(20.0)
No	19 (76.0)	14 (56.0)	17(68.0)	20(80.0)
Elbow				
Yes	3 (12.0)	8 (32.0)	7 (28.0)	1 (4.0)
No	22 (88.0)	17 (68.0)	18 (72.0)	24 (96.0)
Wrist				
Yes	4 (8.0)	9 (36.0)	9 (36.0)	8(32.0)
No	21 (92.0)	16 (64.0)	16 (64.0)	17(68.0)
Back				
Yes	8 (32.0)	14 (56.0)	2 (8.0)	6 (24.0)
No	17 (68.0)	11 (44.0)	23 (92.0)	19 (76.0)
Lower back				
Yes	13 (52.0)	19 (76.0)	10 (40.0)	11 (44.0)
No	12 (48.0)	6 (24.0)	15 (60.0)	14 (56.0)
Thigh				
Yes	3 (12.0)	6 (24.0)	10 (40.0)	10 (40.0)
No	22 (88.0)	19 (76.0)	15 (60.0)	15 (60.0)
Knee				
Yes	12 (48.0)	14 (56.0)	6 (24.0)	11 (44.0)
No	13 (52.0)	11 (44.0)	19 (76.0)	14 (56.0)
Ankle				
Yes	8 (32.0)	6 (24.0)	14 (56.0)	7 (28.0)
No	17 (68.0)	19 (76.0)	11 (44.0)	18 (72.0)

Discussion

The aim of the present study was to investigate the effect of ergonomic principles education on temporary musculoskeletal disorders of personnel in hospital service.

REBA test had shown most of personnel in hospital service were at high and very high-risk of

developing musculoskeletal disorders (88.0%).

Non-parametric tests found the control and intervention groups had significant difference after intervention in REBA score and also in upper back, lower back, and thigh scores of NMQ. Other studies have suggested similar results, Zeidi *et al*. have found changes in body posture in neck, feet, and trunk regions, but there was no significant difference in work-related ergonomics problems before and after education [22]. In a research in France, Fanello and Jousset showed that interventions and educational program simultaneously could decrease the backache and low back pain [23]. In another study, which was performed on computer's operators, Goodman *et al.* found after the intervention, the work stations improved and the work dissatisfaction related to physical problems decreased [24].

Stetler *et al*. suggested multidimensional intervention including risk factors omission, engineering and management control, and education, is more effective and can decrease musculoskeletal disorders [25]. In the present study, after the education the risk level decreased, body posture improved and the pain complication also decreased in different parts of body. In a study done on pathology laboratory personnel in order to examine the relationship of demographic and clinical factors, occupational history, personal characteristics, work-related anxiety and ergonomic analysis of work station, Ramandan *et al*. had found that there is significant relationship between inappropriate body posture and musculoskeletal disorders prevalence. The vast extent of musculoskeletal disorders suggested their inducing factors that are complex and numerous [26]. Drek *et al*. found that musculoskeletal disorders of all body regions, had significant relationship with load elevating and difficult physical work. They suggested ergonomic intervention can improve body posture and decrease musculoskeletal disorders in workplaces [27].

Ergonomic interventions could prevent and decrease musculoskeletal disorders in high-risk personnel including personnel in hospital service. Therefore, suggested a body ergonomic maintenance educational program to be considered for preventing and reducing the incidence of these disorders in personnel of hospital service. In order to gain this goal, it suggests a) ergonomic concept education to managers and personnel and increasing personal capabilities to improving ergonomics habits, b) design work posts, machines and tools upon human factors engineering, anthropometry data, and also anatomical and physiological structures of employees for best accommodation with workplace. The limitation of this study was the few samples because of few service personnel working in Gonabad's training hospitals.

It is suggested to study this approach on more samples and especially on personnel in intensive units, where they have to work harder and patients need more help.

Conclusion

Ergonomic education can reduce the incidence of musculoskeletal disorders of personnel in hospital service.

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Ethical permissions: This study was approved by Ethical Committee of Gonabad University of Medical Sciences (GMU.REC.1392.80).

Conflict of interests: The Authors state that there is no conflict of interests.

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