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Research Article

A Study to Determine the Effectiveness of Ergonomic Training on Body Posture and Musculoskeletal Disorder in Hospital Nurses

S Kavitha M O T*, Vinodhini C

Department of Occupational Therapy, S.R.M University Kattankulathur, Kanchipuram - 603203, India.

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ABSTRACT

The study aims in determining the effectiveness of ergonomic training on work- related musculoskeletal disorders and body posture among hospital nurses. Thirty hospital nurses were selected based on the selection criteria. Pre-test assessments were obtained using Cornell musculoskeletal discomfort questionnaire, Visual analogue scale and Rapid upper limb assessment. The nurses were further split into experimental and control group with fifteen each. A comprehensive 8 week ergonomic training program was aided to the experimental group. Wilcoxon signed rank test was applied to determine the significance between the pre-test and the post-test values. P= 0.0001 (P <0.05 is considered significant). The frequency of the musculoskeletal pain has decreased with improved body posture. The study reveals the evidence for a need of a multicentre approach towards the treatment of work related musculoskeletal disorders. Study also illuminates the dynamic role of an occupational therapist in the field of ergonomics and intervening musculoskeletal disorders.

Keywords: Work related musculoskeletal disorders, body posture, ergonomic training, nurses.

INTRODUCTION

India has been battling traditional public health problems like communicable diseases, malnutrition and inadequate medical care, which are fuelled by fast-growing population, apart from the occupational health problems. Work related musculoskeletal disorder is one of the major occupational health problems in India and estimates have shown that it contributes to about 40% of all costs towards the treatment of work-related injuries[9].

Work related musculoskeletal disorders(WMSDs) are common among healthcare workers[1]. Physical workloads related to handling people are becoming heavier, raising the possibility of a higher prevalence of serious work related musculoskeletal disorders among healthcare workers[2]. Nursing is dominated largely by the female population Even though the basics of nursing profession remain the same, nursing practices have changed around the world. However, amidst the nursing care process, nurses themselves become a victim of many interactive reactions, including social, cultural, economic and political situations. A number of studies carried out in other countries have shown that nurses are at a higher risk of developing musculoskeletal problems, especially low back pain[5].

The nursing profession is known to have some of the highest prevalence rates of work-related musculoskeletal disorders (WMSD) among all healthcare professional groups. Silverstein et al reported repetitive movement, awkward postures, and high force levels as the three primary risk factors that have been associated with WMSDs. Nurses routinely perform activities that require lifting heavy loads, lifting patients, working in awkward postures, and transferring patients out of bed and from the floor. Different work related awkward postures adopted by the nurses that means deviation of body posture from its neutral position (such as bent ,twist back, a bent wrist or arms raised above the head), handling of various load during work and sometimes poor working conditions put nurses at a peak risk of WMSD[7].

However, physical job stressors were frequently cited to as risk factors for WMSDs, it has been found in recent researches that psychosocial stressors such as job demands (work pace) and low decision latitude or skill utilization (monotony) may lead to WMSD.

The high prevalence rates of WMSD in nurses have persisted over the years despite extensive efforts in promoting occupational health training and implementing various interventions in different countries. Anap DB et al (2013), suggests that studies involving ergonomics will be of importance in identifying prevention strategies. Prevention strategies, such as nursing training on proper lifting and transfer techniques, body awareness, and reduction in workload may be helpful .Interventions like spinal muscle strengthening, lower limb and upper limb exercises, relaxation and Ergonomic advice can treat the WMSD's.

As with most chronic diseases, WMSDs have multiple risk factors, both occupational and non-occupational. Several researchers have commented that single interventions are not effective and multifaceted intervention strategies are necessary in order to address all different aspects in the work of nurses that may have contributed to musculoskeletal disorders[10]. In line with the multifactorial risks of WMSD and through the principles of intervention

Author for Correspondence:

in occupational therapy a multi variant protocol was assimilated.

Scientific researches in the multifaceted ergonomic training are limited, to the community and the rural phases. Hospital nurses are proved to have more prevalence of work related musculoskeletal disorders and occupational stress.

MATERIALS AND METHODS

The study was conducted in the SRM Multispecialty Hospital (Ramapuram, Chennai). This study employed a quasi experimental study design to determine the effects of a multifaceted ergonomic intervention program in reducing WMSD. Convenient sampling method was employed in the study. A total of 30 nurses were taken in the study with 15 in control and experimental group each, along with an informed consent. Ethical approval was obtained from SRM College of Occupational Therapy prior to the study and also informed consent from the Medical superintendent of SRM Multispecialty hospital was taken. Nurses between the age of 22 and 49 were included with a history of musculoskeletal disorder of less than one year.All the participants were administered individually with Cornell musculoskeletal disorder questionnaire and visual analogue scale, in order to quantify the extent of musculoskeletal disorder and Rapid upper limb assessment to assess the problematic body postures.

Cornell musculoskeletal disorder questionnaire (female version)

Is a self-report questionnaire, with 12 questions assessing musculoskeletal disorder in various parts of the body and the frequency of disorder at the site of pain (r=0.876).

Visual analogue scale

It's a self-rating scale assessing the severity of pain. It's a 10 point rating scale describing pain from mild to severe (r=0.77).

Rapid upper limb assessment

RULA is an ergonomic assessment tool which considers biomechanical and postural load requirements of job tasks/demands on the neck, trunk and upper extremities and the level of musculoskeletal risk (r=0.92).

RESULTS AND DISCUSSION

The graph illustrates the distribution of disorder among the regions of neck, shoulder, upper back and lower back along with the frequency of disorder ranging from never to several times a day (Pre-test)

The above table illustrates the distribution of disorder among the regions of neck, shoulder, upper back and lower back along with the frequency of disorder ranging from never to several times a day.(Post-test)

There is significant difference between pre and post test score values based on Visual analogue scale (p value = 0.001, Rula lifting a fallen patient off the floor (p value =0.001), Rula Transferring patient from bed to wheelchair (p value = 0.001) and Rula Making bed with patient in it(p value = 0.001). Since the mean score in post-test is smaller than the pre-test, Intervention is effective.

*Figure 4- percentile discomfort in the control group (pre-test)*The graph illustrates the distribution of disorder among the regions of neck, shoulder, upper back and lower back along with the frequency of disorder ranging from never to several times a day (Pre-test)

Figure v- percentile discomfort in the control group (post-test)

The graph illustrates the distribution of disorder among the regions of neck, shoulder, upper back and lower back along with the frequency of disorder ranging from never to several times a day (Post-test).

There is significant difference between pre and post test score values based on Visual analogue scale (p value = 0.014, Rula lifting a fallen patient off the floor (p value =0.025). There is no significant difference between pre and post test score values based on Rula Transferring patient from bed to wheelchair (p value = 0.248) and Rula Making bed with patient in it (p value = 0.315).

DISCUSSION

Work- related musculoskeletal disorders arise from a multifactorial epidemiology ranging from repetitive strain injuries to increased work demand; leading to the failure of many single faceted studies which focused on a particular risk factor eluding the effects of other factors that might be contributing to the actual illness.

The present study is a comprehensive multifaceted intervention program among hospital nurses. The unique feature involved one-to-one onsite training so that the therapist could identify and correct the worker's faulty postures and work habits instantly and provide real time feedback. Hartvigsen et al. (2005) also carried out an intensive education program on home care nurses but the training was mainly in group sessions and not individualized. Similar approaches has also been reported in recent studies such as the "Ergocoach" concept by Kluifstra (2010) which involved ergonomic training to nurses working in neonatal Intensive Care Unit, to improve their working postures in that particular setting. In the Netherlands, teaching nurses working in critical care units

Table 1: Percentile discomfort in the experimental group (pre-test).

Frequency	Neck		Shoulder		Upper back		Lower Back	
	Count	Percent	Count	Percent	Count	Percent	Count	Percent
Never	1	6.7	6	40.0	2	13.3	0	0
Once in a week	11	73.3	1	6.7	7	46.7	3	20.0
1 - 2 times a week	1	6.7	5	33.3	2	13.3	2	13.3
3 - 4 times a week	2	13.3	3	20.0	1	6.7	2	13.3
Several times a day	0	0.0	0	0.0	3	20.0	8	53.3

Table 2: Percentile discomfort in the experimental group (post-test).

Frequency	Neck		Shoulder		Upper back		Lower Back	
	Count	Percent	Count	Percent	Count	Percent	Count	Percent
Never	2	13.3	5	33.3	5	33.3	1	6.7
Once in a week	1	6.7	1	6.7	0	0.0	0	0.0
1 - 2 times a week	9	60.0	8	53.3	7	46.7	12	80.0
3 - 4 times a week	2	13.3	0	0.0	2	13.3	1	6.7
Several times a day	0	0.0	0	0.0	0	0.0	0	0.0
Not Applicable	1	6.7	1	6.7	1	6.7	1	6.7

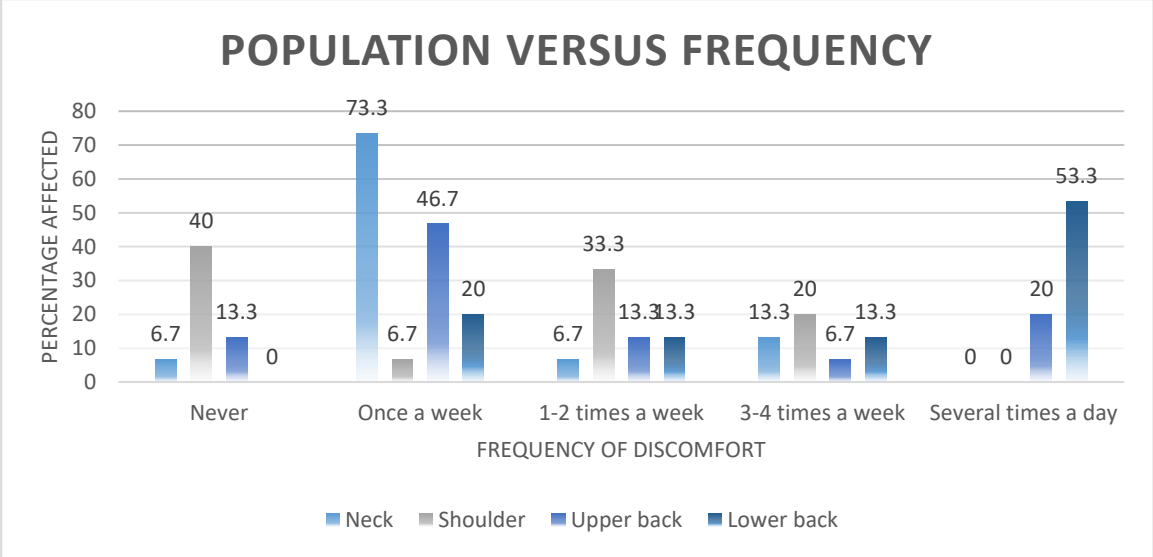

Figure 1: Percentile discomfort in the experimental group (pre-test).

Table 3: Comparison of visual analogue scale and rapid upper limb assessment in the experimental group.

Scale	Pre test		Post test		Z statistic	p value
	Mean±S.D	Min, Max	Mean±S.D	Min, Max		
Visual analogue scale	6.4±1.3	4,8	2.9±0.9	2,4	-3.334	.001
Rula lifting	6.7±0.4	6,7	3.7±1.03	2,6	-3.446	.001
Rula transfer	6.3±0.6	5,7	2.3±1.1	1,4	-3.429	.001
Rula making bed	3.6±0.8	2,5	1.9±0.8	1,3	-3.345	.001

*significant at 5% alpha level

to adopt the ergonomic approach in patient-handling has also been found to be effective in reducing injuries among nurses (Knibbe et al., 2007).

The present program also helped to improve the physical function of the nurses by engaging them in an exercise program for 8 weeks. The nursing teams have adopted these exercises into their daily routine to do the exercises together as a group, however it is not clear how long this exercise habit can be maintained, but at least from the results, there were positive benefits from this program. The study by Oldervoll et al. (2001) reported on the significant reduction in musculoskeletal pain in two groups of nurses who underwent aerobic exercise training and strength training, respectively. This benefit on musculoskeletal symptoms was maintained for upto 7 months post-training, but there was no difference between the two groups.

The previous study by Cheung et al. (2006) on over 200 home care nursing personnel have identified three main

Table 4: Percentile discomfort in the control group (pre-test).

Frequency	Neck		Shoulder		Upper back		Lower Back	
	Count	Percent	Count	Percent	Count	Percent	Count	Percent
Never	4	26.7	5	33.3	1	6.7	0	0
Once in a week	5	33.3	1	6.7	9	60.0	2	13.3
1 - 2 times a week	1	6.7	3	20.0	2	13.3	2	13.3
3 - 4 times a week	2	13.3	5	33.3	1	6.7	1	6.7
Several times a day	3	20.0	1	6.7	2	13.3	10	66.7

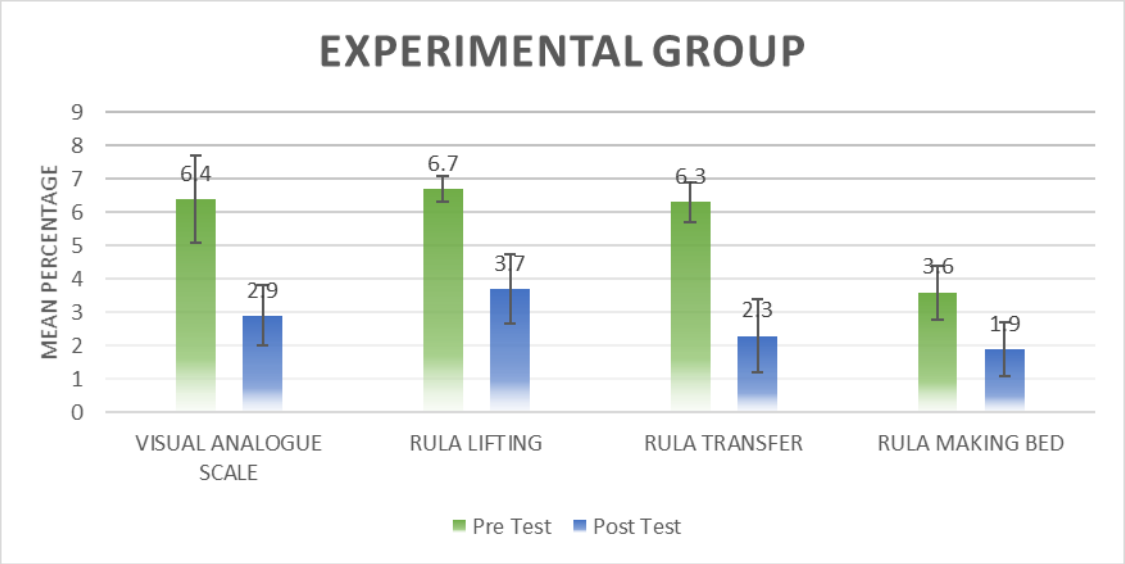

Figure 2: comparison of visual analogue scale and rapid upper limb assessment in the experimental group.

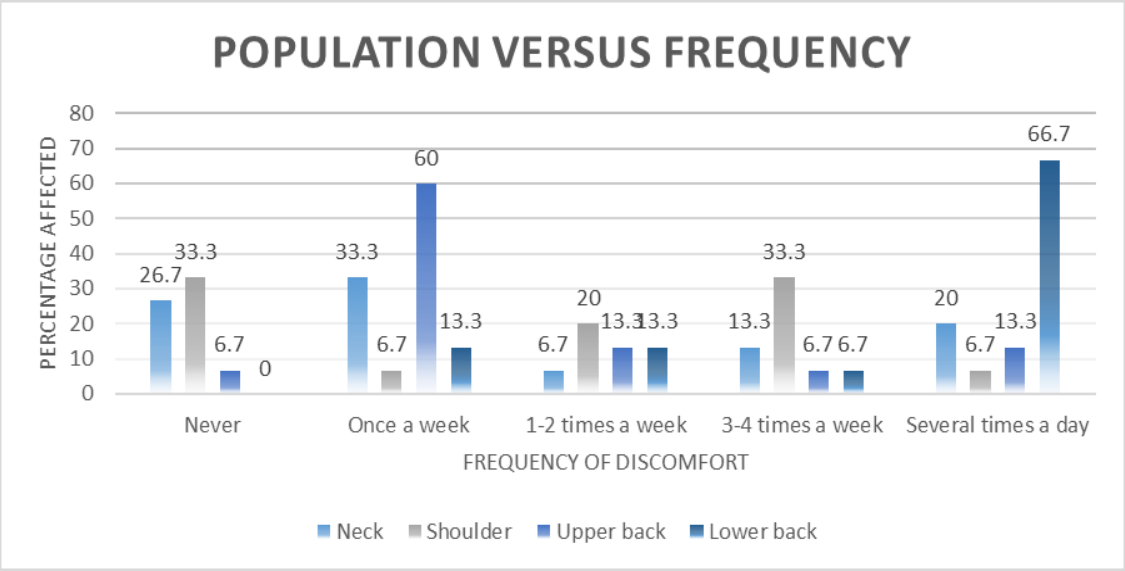

Figure 3: percentile discomfort in the control group (pre-test).

risk factors for the high prevalence of back pain in this group, and these are: office work, static posture and psychological job demands. In the present study, various interventions were selected in order to target the specific risk factors for the hospital nurses in terms of their poor working postures, the physical demands of their work, the equipment used. The psychological job stressors have also been addressed in terms of relaxation strategies and coping skills in the present study. Hence the results were able to produce an overall improvement in the nurses' personal and working health. This may also be the reason why previous studies have not produced such favourable results when only ergonomic training or only exercise training was provided, as these intervention would only address some of the issues but not all.

The study illustrates the frequency of work related musculoskeletal disorders among nurses in the study. About 60% of the population suffered from Low back pain several times a day and 16.7% suffered from low back ache about once a week. Upper back pain was prevalent among 16.7% of the population with pain occurring several times a day. And only 10% of the population suffered by neck pain several times a day. The results go in accordance with the study conducted by (Ribeiro et al, 2012), found that the prevalence of WRMSD in at least one body segment was 83.4%, followed by low back (53.9%), neck (36.4%), upper back (35.7%) and shoulders (33.8%).

The results demonstrates the effectiveness of ergonomic training in decreasing musculoskeletal pain. About 53.3% of the training group had low back ache and 20% had upper back ache several times a day before the intervention, low back ache occurrence decreased to 3-4 times a week (6.7%), 1-2 times a week (80%), 6.7% of the population never suffered from low back ache. Upper back ache decreased to 1-2 times a week (46.7%). Neck frequency to 1-2 times a day (60%) and shoulder frequency 1-2 times

Table 5: Percentile discomfort in the control group (post-test).

Frequency	Neck		Shoulder		Upper back		Lower Back	
	Count	Percent	Count	Percent	Count	Percent	Count	Percent
Never	4	26.7	5	33.3	1	6.7	0	0.0
Once in a week	4	26.7	1	6.7	7	46.7	1	6.7
1 - 2 times a week	1	6.7	2	13.3	3	20.0	3	20.0
3 - 4 times a week	1	6.7	4	26.7	2	13.3	0	0.0
Several times a day	5	33.3	3	20.0	2	13.3	11	73.3

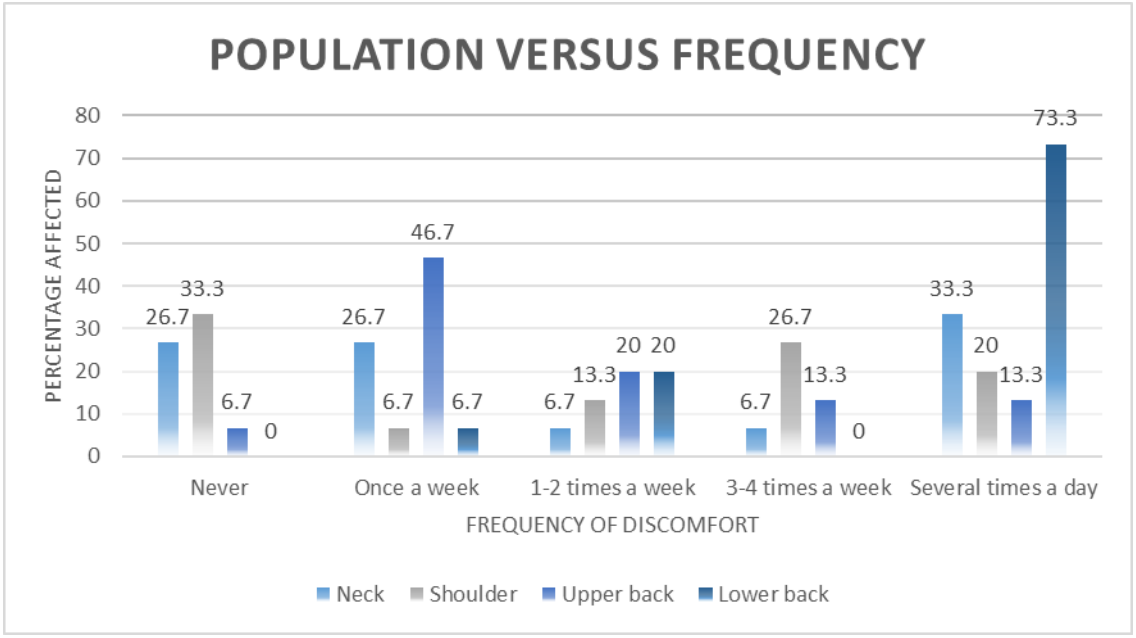

Figure 4: Percentile discomfort in the control group (post-test).

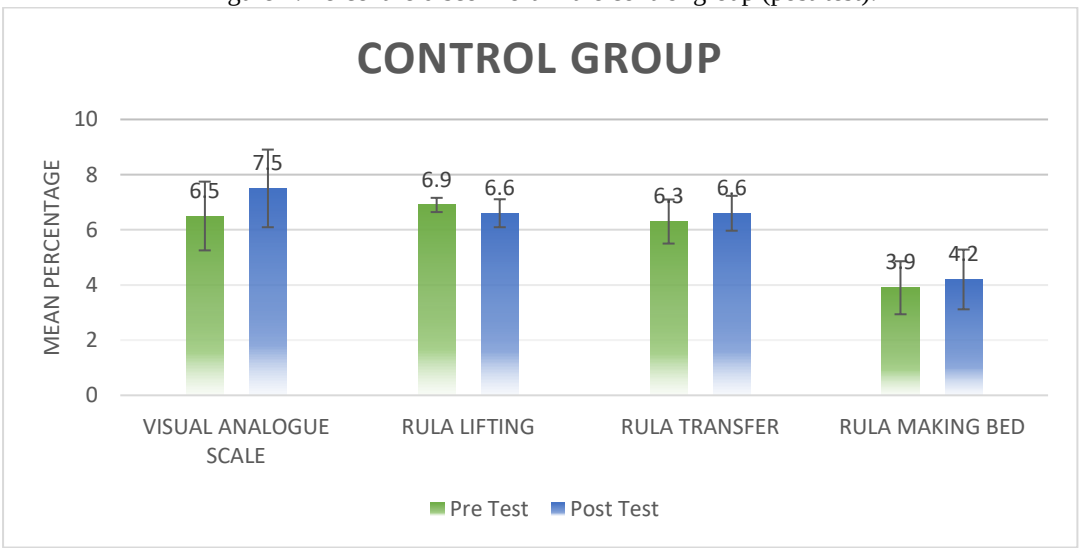

Figure 5: comparison of visual analogue scale and rapid upper limb assessment in the control group.

(53.3%).The results are in line with the studies of (Garg and Owen, 1992, Lynch and Freund, 2000, Yassi et al., 2000) combined education and ergonomic interventions both found a decrease of musculoskeletal symptoms. The study conducted by Szeto et al 2012, with the multi-faceted intervention also have proved a significant reduction in the musculoskeletal symptoms.

Comparison of the pre-test and the post-test values of the visual analogue scale shows a mean decrease of 3.5 from the pre-test value (p=0.0001). The specific body posture of the nurses improved based on the RULA scores of lifting the patient from the floor with mean 6.7 to 3.7 (p=0.0001), Transferring patient from the bed to the wheelchair with the mean 6.3 to 2.3 (p=0.001), Making bed with the patient of mean 3.6 to 1.9 (p=0.0001). Results are similar to that

Table 6: Comparison of visual analogue scale and rapid upper limb assessment in the control group.

Scale	Pre test		Post test		Z statistic	p value
	Mean±S.D	Min, Max	Mean±S.D	Min, Max		
Visual analogue scale	6.5±1.2	5,9	7.5±1.4	5,9	-2.455	.014
Rula lifting	6.9±0.3	6,7	6.6±0.5	6,7	-2.236	.025
Rula transfer	6.3±0.8	4,7	6.6±0.6	5,7	-1.155	.248
Rula making bed	3.9±0.9	3,7	4.2±1.0	3,6	-1.005	.315

*significant at 5% alpha level

obtained by Habibi and Soury 2015 in their study of ergonomic training with improved the body posture score obtained from the Rapid upper limb assessment with an average 25 points decrease in the right side of the body and 20 points decrease in the left side of the body in the group subjected to training.

The study also illustrates the comparison of the musculoskeletal pain among the control group. The low back ache rates increased from 66.7% to 73.3% affecting several times a day. Shoulder frequency increased from 6.7% to 20.0% several times a day. Neck frequency increased from 20.0% to 33.3% also several times a day. However the neck frequency stated to be stable through the pre and post-test values.The comparison of the pre-test and the post-test of visual analogue scale in the control group shows a mean increase of 1.5 from the pre-test value. The specific body posture of RULA scores showed slight increase from the post-test values.

CONCLUSION

The study gratified the effectiveness of a comprehensive ergonomic training on body posture and musculoskeletal disorder. This study also illuminates the dynamic interventions habituated by an occupational therapist through a holistic approach employed in the field of ergonomics

Future studies concerning ergonomic training in alleviating work related musculoskeletal disorders can employ various key variations. A wide population based study can be deployed involving various hospitals along-side with various other professionals. The study can be based on the randomised controlled trial with longer intervention phases along with evaluation of the long term effects and follow up. The study can be functionally practical in various other populations such as physical therapist, occupational therapist, physicians, lab technicians and dentists. Multiple variant modules can be modified in order to meet the dynamics of the populations' needs. Study can also involve in identifying risk factors of various speciality of nurses and solving their ergonomic inefficacies.

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CONFLICT OF INTEREST

Conflict of interest declared none.

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