Effectiveness of Back Exercise and Education for Lower Back Pain Prevention among Nurses at a Tertiary Hospital in Bangkok, Thailand

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ABSTRACT

Objective: To examine the effectiveness of back exercise and education to promote lower back pain relief among nurses at a tertiary hospital.

Methods: This quasi-experimental study was conducted using a sample of sixty nurses working at Siriraj Hospital. Eligible criteria included full-time registered or practical nurses who had undergone direct contacted with patients for at least six months and suffered from chronic lower back pain. The subjects were randomly divided into a training group and a control group. The training group followed a back exercise program including pelvic tilting, back extension, and knee to chest at least 3 days a week for 12 weeks while the control group performed daily activities as normal. Data were collected using a questionnaire at baseline, 4th, 8th, and 12th weeks.

Results: Significant differences of pain score and the Thai version of the Oswestry questionnaire were scored between the training and control groups (*P-value* < *0.001*), while beneficial effects improved significantly during the time points of exercise (*P-value* < *0.001*).

Conclusion: Back exercises and education can effectively relieve lower back pain and improve disabilities among nursing staff. Following our recommended procedures will improve the safety aspect for nurses working in tertiary hospitals.

Keywords: Lower back pain; back exercise; nurse (Siriraj Med J 2020; 72: 109-116)

INTRODUCTION

Lower back pain (LBP) is considered to be a major health problem among occupational diseases[1] and is usually found in musculoskeletal disorders (MSDs).[2] LBP is the leading cause of disability in daily life.

People with chronic LBP (CLBP) show muscle weakness and atrophy predominantly in the lumbar flexors and extensors due to deterioration of the multifidus muscle. Advanced symptoms are associated with reduced muscle size presenting a smaller cross-sectional area, leading to a decrease in muscle endurance, flexibility and back motion.

Trunk muscle strength protects the spine during activities.[3-5] Many previous studies indicated that exercise

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improved the strength, endurance, and flexibility of back muscles with also a positive impact on pain levels. Results demonstrated that healthy participants had more muscular strength and endurance than those with LBP.[6] However, some evidence suggested that only exercise or exercise together with education were effective for LBP prevention, while education alone was unlikely to result in any improvement in LBP.[7-9]

Incidence of LBP was 26.4% for people over 45 years of age as the top health problem in the USA.[10] In Thailand, the Division of Occupational Health, Ministry of Public Health found that approximately 79% of the study population had MSDs related to occupation and LBP was found in 52.4% of the subjects.[1]

Nursing is an occupation with a high risk of LBP related to the working environment. In Thailand, 65-84% of nurses suffer from LBP as a result of lifting or moving patients incorrectly, prolonged standing or sitting while working, improper working posture, lack of exercise and wearing high-heeled shoes.[1,11,12] Thus, nursing personnel require protection by reducing spinal health hazards. Siriraj Hospital is one of the tertiary hospitals in Bangkok where many nurses are working at risk. Policymaking should involve hospital assurance, risk management and health promotion and prevention schemes to address how to prevent employees from incurring serious and long-term injuries related to daily working operations. Education and back exercises are routinely included in musculoskeletal clinics for LBP management; however, the outcomes are equivocal with no evidence suggesting that one particular type of exercise therapy is clearly more effective than others.[13-16] Moreover, various exercises are prescribed randomly and no single standard of care is recommended. Clinical and biomechanical approaches for the prevention of LBP tend to follow the favorite exercises and beliefs of individual therapists. In this study, a simple and common back exercise program was selected, combined with the education necessary for members of the nursing staff suffering from mechanical back pain without any specific cause. The objective was to examine the effectiveness of education and exercise for LBP relief among nurses. The hypothesis was postulated that exercise could reverse neuromuscular impairment of back muscles and improve lower back pain. Education greatly improves self-awareness and self-protection, while behavioral change can result from exercise compliance. If proved effective, implementation of a combined exercise/education scheme could improve safety for nurses operating in the workplace.

MATERIALS AND METHODS

This quasi-experimental study was approved by the Institutional Review Board, Faculty of Medicine Siriraj Hospital (Si 377/2016). The sample size was calculated using the mean pain score from a previous study[17] and adding 25% to allow for missing data. The required sample size of subjects was sixty. Type I error was set at 0.05 and the power of the test was set at 0.80.

Nurses working at Siriraj Hospital were recruited and selected based on eligible criteria. The samples were randomly divided into training and control groups. As inclusion criteria, the subjected were required to be registered or practical nurses, working full time in the same ward, with direct contact with patients for at least 6 months and suffering from chronic LBP (pain duration >3 months). Pregnant nurses and those with chronic LBP with specific pathology e.g. disc herniation, spondylolisthesis, LBP with red flag signs and symptoms, concomitant treatments such as other physiotherapy like TENS, heat modalities, analgesics, acupuncture, spine surgery, etc. or staff members unwilling to participate in the exercise were excluded.

Data were collected using a questionnaire comprising demographic characteristics, occupational information, pain score, and the Thai version of the Oswestry questionnaire score. Pain score was evaluated as a psychometric response by a visual analog scale (VAS). A score of 0 corresponded to no pain and a score of 10 indicated the most pain. Correlation between the vertical and horizontal orientations of the VAS was 0.99.[18] The Thai version of the Oswestry questionnaire score was used to evaluate the functional disability. Cronbach's alpha coefficient of reliability was 0.91.[19]

The training group participated in the exercise program which was led by sports scientists from the Department of Health Promotion for at least 3 days a week for 12 weeks, while the control group performed daily activities as normal. Exercises included pelvic tilting related to core stabilization, back extension to strengthen back muscles and possibly benefit lumbar disc bulging or protrusion, and knee to chest to promote lower back and gluteal muscle stretching and flexibility as shown in Fig 1 (a-c).[20-22] Furthermore, all participants were educated regarding the definition of LBP, risk factors, and early warning signs and symptoms to improve their health behavior by the researcher. Both groups were assessed at baseline, and results were followed up at the 4^{th}, 8^{th}, and 12^{th} weeks, respectively.

Each subject was given his/her own logbook to record dates of practice, duration and frequency of

(a). Pelvic tilting

(b). Back extension

(c). Knee to chest

Fig 1. Back exercise positions.

exercises to better monitor exercise compliance. During the follow-up visits, the researcher asked each subject if they had received any concomitant treatment. If the answer was "YES", the type, dosage and intensity were recorded.

Statistical analysis

Data were analyzed using SPSS version 18.0.[23] Demographic and occupational information were presented as descriptive statistics. Data were reported quantitatively using mean ± SD and qualitatively as percentage and frequency. Two-way repeated measures ANOVA with Bonferroni correction was used to compare pain scores and the Thai version of the Oswestry questionnaire score. Intention-to-treat was used for missing data. A *P-value* < 0.05 was selected as statistically significant.

RESULTS

Demographic characteristics

Demographic data are presented in Table 1. Females strikingly outnumbered males in the specific nursing occupation; however, there was no significant difference between the study and control group. Mean age in the control group was higher than in the study group. Other characteristics such as body mass index (BMI), educational level, personal habits like smoking, alcohol consumption and level of activities were similar between the two groups. Two participants dropped out during the study period as a result of accidental injury and unwillingness to continue.

Occupational information

Occupational factors showed no difference between the training and control groups, except for the duration of working which was significantly longer for the control group than for the training group (*P-value* = *0.024*) (Table 2). Likewise, mean age of the control group was higher than the training group, although it did not reach statistical significance (Table 1). One possibility for this could result from selection bias.

Pain score

The pain score showed interaction between both groups (*P-value* < *0.001*). At each time point, significant differences were found between both groups. At the 4^{th} week, the *P-value* = *0.009*, 8^{th} week *P-value* = *0.001*, and 12^{th} week *P-value* < *0.001*. There were significant differences in the training group (*P-value* < *0.001*) but no differences in the control group (*P-value* = *0.658*) (Fig 2).

TABLE 1. Demographic characteristics of participants (Total n=58).

Characteristic	Total (n=58)	Training group (n_1=28)	Control group (n_2=30)	*P*-value
Sex				
Male	8	3 (10.7%)	5 (16.7%)	0.707
Female	50	25 (89.3%)	25 (83.3%)	
Age (years)		36.54 ± 8.89	41.67 ± 10.70	0.053
Body Mass Index (kg/m²)		23.58 ± 4.29	23.56 ± 2.50	0.979
< 18.5 (Underweight)	4	3 (10.7%)	1 (3.3%)	0.414
18.5-22.9 (Normal range)	19	9 (32.1%)	10 (33.3%)	
23.0-24.9 (Overweight)	18	7 (25.0%)	11 (36.7%)	
25.0-29.9 (Obese class I)	15	7(25.0%)	8 (26.7%)	
≥ 30.0 (Obese class II)	2	2 (7.1%)	0 (0.0%)	
Education level				
Vocational certificate	19	10 (35.7%)	9 (30.0%)	0.445
Bachelor degree	29	15 (53.6%)	14 (46.7%)	
Higher than master degree	10	3 (10.7%)	7 (23.3%)	
Smoking habits				
Non-smoker	54	28 (100.0%)	26 (86.7%)	0.135
Ex-smoker	3	0 (0.0%)	3 (10.0%)	
Regular smoker	1	0 (0.0%)	1 (3.3%)	
Alcohol consumption				
Non-drinker	37	20 (71.4%)	17 (56.7%)	0.486
Ex-drinker	6	2 (7.1%)	4 (13.3%)	
Occasional drinker	15	6 (21.4%)	9 (30.0%)	
Leisure time physical activities				
Never	15	10 (35.7%)	5 (16.7%)	0.159
Sometimes	37	17 (60.7%)	20 (66.7%)	
Usually	3	0 (0.0%)	3 (10.0%)	
Always	3	1 (3.6%)	2 (6.7%)	
Congenital disease				
No	39	17 (60.7%)	22 (73.3%)	0.306
Yes	19	11 (39.3%)	8 (26.7%)	

TABLE 2. Occupational information of participants (Total n=58).

Characteristic	Total (n=58)	Training group (n_1=28)	Control group (n_2=30)	*P*-value
Nursing position				
Registered nurse	27	11 (39.3%)	16 (53.3%)	0.284
Practical nurse	31	17 (60.7%)	14 (46.7%)	
Ward				
Medical	23	12 (42.9%)	11 (36.7%)	0.630
Surgical	35	16 (57.1%)	19 (63.3%)	
Duration of working in ward (years)		13.66 ± 7.33	19.19 ± 10.42	0.024*
Overtime work				
Never	39	16 (57.1%)	23 (76.7%)	0.196
2-3 times per month	8	4 (14.3%)	4 (13.3%)	
2-3 times per week	8	5 (17.9%)	3 (10.0%)	
Almost everyday/Everyday	3	3 (10.7%)	0 (0.0%)	
Lifestyle outside the workplace				
Sitting >20 minutes				
No	18	11 (39.3%)	7 (23.3%)	0.189
Yes	40	17 (60.7%)	23 (76.7%)	
Standing >20 minutes				
No	14	6 (21.4%)	8 (26.7%)	0.641
Yes	44	22 (78.6%)	22 (73.3%)	
Walking >20 minutes				
No	6	2 (7.1%)	4 (13.3%)	0.671
Yes	52	26 (92.9%)	26 (86.7%)	
Use hand or arm repeatedly				
No	21	9 (32.1%)	12 (40.0%)	0.534
Yes	37	19 (67.9%)	18 (60.0%)	

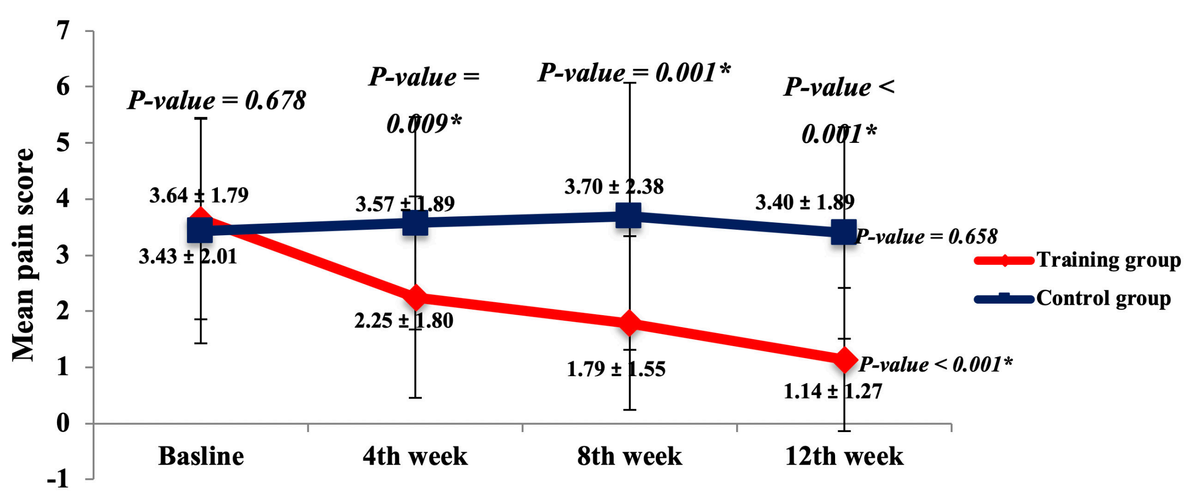

Fig 2. Comparison of pain score between training and control groups.

For the training group, LBP relief was significant at the 4th, 8th, and 12th weeks compared with pain at the baseline (*P-value* < 0.001). Pain score at the 12th week was significantly lower than at the 4th (*P-value* < 0.001) and 8th weeks (*P-value* $= 0.001$), while pain score at the 8th week was significantly lower than at the 4th week (*P-value* $= 0.004$). Pain scores remained the same in the control group at all time points.

Thai version of the Oswestry questionnaire score

Disabilities related to LBP using the Oswestry questionnaire score (Thai version) gave similar interactions between the training and control groups (*P-value* < 0.001). There were significant differences between both groups at the 8th week (*P-value* $= 0.001$) and 12th week (*P-value* < 0.001), while for each group, there were significant differences in the training group (*P-value* < 0.001) but no differences in the control group (*P-value* $= 0.323$) (Fig 3).

For the training group, disability scores at the 4th, 8th, and 12th weeks were significantly lower than the baseline (*P-value* < 0.001). The score at the 12th week was significantly lower than at the 4th (*P-value* < 0.001) and 8th weeks (*P-value* $= 0.026$), while the score at the 8th week was significantly lower than at the 4th week (*P-value* $= 0.001$) but no differences were observed in the control group at all time points.

Compliance with exercise was 85.7%. Four participants in the training group and five participants in the control group had concomitant treatment during the study; however, their scores were replaced with the last observation carried forward (LOCF) to maximize data reliability.

For statistical analysis, a two-way repeated measures ANOVA, including post hoc testing with Bonferroni correction, was used for comparisons between the training group and control group. Furthermore, intention-to-treat (ITT) was also used for data analysis. All participants, including those who withdrew, were included. However, participants who withdrew during the study had no data to analyze; if they followed the back exercise program, their pain score and Thai version of the Oswestry questionnaire score should be less than the baseline. Therefore, the last observation carried forward (LOCF) was used to replace the missing data. This technique ensured that the estimated result was similar to the actual data.[24]

DISCUSSION

The causes of lower back pain are complex and associated with abdominal and back muscle weakness, atrophy and loss of muscular endurance and flexibility. Back exercise forms part of the comprehensive treatment of LBP, emphasizing more active participation of patients particularly in chronic cases. Our results indicated that back exercise and education reduced pain and disability by following an exercise program for at least 3 days a week for 12 weeks. The back exercise program was designed for strength, endurance and flexibility training of the commonly involved muscles. Strengthening exercises were performed at least 2 days a week with at least 2-3 days a week for the flexibility exercises. Performing the exercise program for 12 weeks was necessary because no neuromuscular adaptation occurs within the first few weeks and exercise and muscle hypertrophy is typically experienced after 6 to 7 weeks of exercise.[25] Therefore,

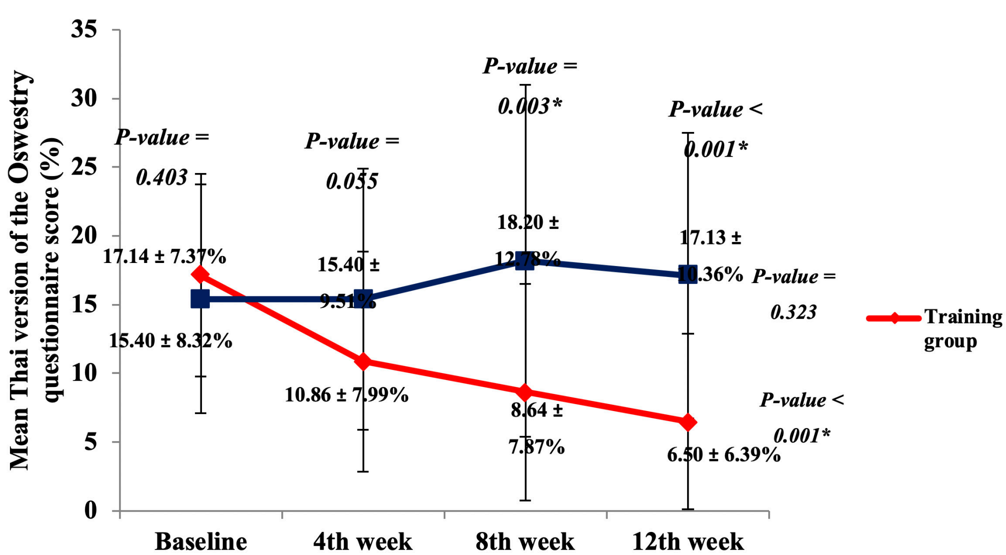

Fig 3. Comparison of the Thai version of the Oswestry questionnaire score between training and control groups.

a 12-week duration was selected as suitable for this study to prove the benefit of both biomechanical and physiological effects. Our results were consistent with other studies indicating that strengthening exercises reduced pain and disability associated with LBP after 6 weeks to 12 months of the exercise program.[26-31] Likewise, core muscle strengthening for at least 3 months was beneficial in aspects of pain relief and functional improvement. Nevertheless, no significant difference was demonstrated in exercise groups up to 12 months compared with the exercise group of over 12 months for participants with chronic LBP.[32] Furthermore, outcomes of core stability combined with general exercise were similar.[33]

In addition, our exercise program was combined with education to facilitate behavioral change, modify health beliefs and attitudes, and motivate the participants to follow the exercise program. Some studies suggested that education alone did not appear to prevent LBP but exercise combined with education showed a positive result.[16,34] Compliance with the exercise routine is a key success factor to combat chronic LBP. In this study, logbooks were given to participants for more accurate monitoring during the follow-up visits, with compliance of 85.7%.

Dealing with chronic LBP is a sophisticated process which involves not only pain relief but also functional restoration. CLBP is often heredity and not episodic like acute LBP; therefore, prevention is sometimes better than treatment. Strategies to prevent chronic pain involve early diagnosis and early treatment of acute pain conditions. At present, the concept of treatment is more aggressive for acute pain control. Some may argue that our study design was not consistent with the hypothesis. Unlike acute LBP, the study design for prevention is to reduce the recurrence of pain and prolong the duration of the new episode of pain which would be impossible and incompatible with the natural course. A prevention scheme in the context of chronic LBP in the workplace would involve limiting the progression of pain severity, disability and suffering. Here, we recruited CLBP subjects with mild to moderate pain severity that had minimal disability following the Thai version of the Oswestry questionnaire score. If CLBP progressed or more injuries took place, then pain and disability would be expected to flare up. However, both pain amelioration and functional improvement were shown at all time points compared with the control group. As mentioned above, our results supported the research hypothesis.

Demographic data and occupational information of participants showed no significant differences between the training and control groups except for duration of working. In the control group, duration of working was significantly longer than in the training group, possibly due to the mean age differences of the subjects as well as recruitment or setting bias. Mean age of the control group was higher than the training group although it did not reach statistical significance. Whether this difference affected pain severity and functional ability is doubtful. Degenerative change of the spine is more likely to develop in older people; however, it does not equate to back pain.

Back exercise programs combined with education are beneficial for nurses with CLBP who suffer from mild to moderate LBP with minimal disability. These may prevent clinical progression through pain reduction and functional improvement as an easy, low risk, self-managed way to control LBP.

There were some limitations in this study. Firstly, the follow-up period was rather short because of time limitations and maybe not long enough to demonstrate the flare-up of symptoms and recurrence. Secondly, participants were only subjectively measured by a questionnaire survey. Objective measurements were not conducted due to budget limitations.

CONCLUSION

Our results suggested that back exercise and education effectively relieved LBP and improved muscle function among nurses. Therefore, our proposed scheme for LBP prevention should be implemented in all tertiary hospitals in Thailand to improve both safety and working conditions of the nursing staff.

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