

RESEARCH ARTICLE

Effect of eight-week core stabilization program on core muscle endurance and function in female staff nurses

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Received: October 21, 2017; Accepted: December 07, 2017

ABSTRACT


Background: Low back pain is a widespread pain condition in the working population. Anticipatory postural adjustment of the transverses abdominis muscle has received particular interest for the research of postural control in low back pain. The relationship between tibialis anterior anticipatory postural adjustment and the pain reported in low back during prolonged standing. **Aims and Objectives:** To find out the effect of core stabilization program on core muscle endurance and functions in staff nurses. **Materials and Methods:** Study design was quasi-experimental study, done with a sample size of 18 staff nurses, at SRM Ladies Medical Hostel, SRM Medical College Hospital and Research Centre, SRM University, Kattankulathur, India. Subjects were selected according to inclusion and exclusion criteria, and informed consent was taken, and intervened with a core stabilization exercise program for about 8 weeks; endurance and functional test were measured before and after the intervention. Paired *t*-test was done to find out the difference before and after the intervention. **Results:** Shows there is a significant difference ($P < 0.05$) in endurance test (flexor, extensor, and horizontal side support) and there is no significant difference ($P > 0.05$) in functional test (single leg distance hop test, timed leg hop test, and squat test). **Conclusions:** 8 weeks core stabilization training showed improvement of core endurance, but not on functions.

KEY WORDS: Core Stability; Anticipatory Postural Adjustment; Core Endurance; Core Function; Low Back Pain

INTRODUCTION

In India, about 40% of the occupational related issues are musculoskeletal disorders, especially the healthcare professionals, like nurses are very likely to occur musculoskeletal disorder as they are closer in handling the patients during the work time.^[1] In an occupational group, a nurse has several risks in low back pain, numbers of studies carried out recently.^[2-5] Nursing is special nature profession,

they are very close to the patients in need of help, and it is a very strenuous job nurses involving frequent bending, lifting, pulling, and pushing activities.^[6] In nursing aids, a nurse has awkward working postures due to sudden unexpected peak loads were observed depends on the patient's needs.^[7] In the majority of nurses, the presence of moderate to severe burnout syndrome in high-stress job due to unseen events frequently. Anticipatory postural adjustment of the transverses abdominis muscle has received particular interest for the research of postural control in low back pain.^[8] Thus, it has been suggested that muscle activation strategies associated with postural control may be a predisposing factor in the development of low back pain during prolonged standing.^[8] There was a study has examined the relationship between transverses abdominis anticipatory postural adjustment and the pain reported in low back during prolonged standing.^[8] The results of this study support and extend previous findings that showed acute pain provoked

Access this article online	
Website: www.njppp.com	Quick Response code
DOI: 10.5455/njppp.2018.8.1040407122017	

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in the low back alters anticipatory muscle activity of the deep abdominals.^[9] The goal of a core stability program in the field of physical rehabilitation is to maintain a sufficient amount of spinal stability and is obtained by training the muscles of the core and claimed that muscle strength may not be the optimal goal of a rehabilitation core stability program and suggested that core endurance is more important in the prevention of and recovery from low back pain.^[10] The purpose of the study is to find out the effect of core stabilization program on core muscle endurance and function in staff nurses.

MATERIALS AND METHODS

Participants

Totally 18 female staff nurses were selected based on inclusion criteria were aged from 23 to 30 years, working at least for 1–3 years as a staff nurse, workload of a minimum of 20 h/week, more than 2 h of long-standing per day. Low back pain, neurological deficit, severe cardiovascular disease, musculoskeletal disorders, spinal cord compression, severe structural deformity, pre- and post-natal condition, any abdominal surgeries, autoimmune disease, recent fracture, and previous spinal surgeries were excluded from this study. Initial assessment was taken then a core stabilization exercise regimen was administered to perform 45 min/day for 5 days/week, for 8 weeks. The study was done at SRM ladies medical hostel, SRM University, Kattankulathur, India. Informed consent was obtained from those who willing to participate in the study. The research was conducted according to the principles of the declaration of Helsinki.

Interventions

Core stabilization exercises - abdominal drawing-in maneuver crunch, right Horizontal side support, left horizontal side support, prone plank, supine shoulder bridge, quadruped alternate arm and leg, hip flexor squat (“wood-chopper”). Outcome measures were endurance test such as flexor endurance, extensor endurance, and horizontal side support right and left side endurance. Functional test such as single leg distance hop test timed single leg hop test, and squat test was taken before and after the intervention.

Statistical Analysis

The data were analyzed using statistical package for SPSS 20.0. 95% confident interval was set for all analysis. Paired *t*-test is used to compare the difference between pre-test and post-test values of all outcomes measures.

RESULTS

According to Table 1 the mean and standard deviation (SD) of pre- and post-test of trunk flexor endurance is 37.89 s, 25.62 s, and 64.83 s, 22.08 s, respectively, the $P=0.00$ ($P<0.05$). Pre- and

post-test of trunk extensor endurance are 64.78 s, 35.85 s, and 97.39 s, 36.48 s, respectively, the $P = 0.00$ ($P < 0.05$). Pre- and post-test of horizontal side support for right side are 32.39 s, 20.63 s, and 60.72 s, 12.97 s, respectively, the $P = 0.00$ ($P < 0.05$). Pre and post-horizontal side support for the left side is 27.06 s, 14.32 s, and 54.61 s, 15.31 s, respectively, the $P = 0.00$ ($P < 0.05$). Hence, there is significant difference exist between the endurance tests. According to Table 2 the mean of pre-test of squat test is 15.06 s, 3.82 s, and 15.56 s, 3.14 s, respectively, the $P = 0.120$ ($P > 0.05$). Pre and post of single leg hop distance test are 65.33 cm, 27.50 cm, and 67.39 cm, 23.79 cm, respectively, $P = 0.44$ ($P > 0.05$). The mean and SD of pre and post of timed single leg hop test is 19.28 s, 5.79 s, and 18.50 s, 4.38 s, respectively, the $P = 0.25$ ($P > 0.05$). Hence, there is no significant difference exist between the functional tests.

DISCUSSION

As per the above results, in this study, there is significant difference exist between the pre- and post-test values of flexor endurance, extensor endurance, and horizontal side support

Table 1: Mean, SD, “P” value of endurance test

Outcome measures	Test	Mean±SD	P
Flexor endurance test	Pre-test	37.89±25.62	0.00
	Post-test	64.83±22.08	
Extensor endurance test	Pre-test	64.78±35.85	0.00
	Post-test	97.39±36.85	
Horizontal side support right side	Pre-test	32.39±20.63	0.00
	Post-test	60.72±12.97	
Horizontal side support left side	Pre-test	27.06±14.32	0.00
	Post-test	54.61±15.31	
	Post-test	18.50±4.38	

The table shows a significant difference between pre-test and post-test of flexor, extensor, horizontal right, and left side endurance test at $P<0.05$ (0.00). SD: Standard deviation

Table 2: Mean, SD, “P” value of functional test

Outcome measures	Mean	Standard deviation	P
Squat test	Pre-test	15.06	0.12
	Post-test	15.56	
Single leg distance hop test	Pre-test	65.33	0.44
	Post-test	67.39	
Timed single leg hop test	Pre-test	19.28	0.25
	Post-test	18.50	

The table shows no significant difference between pre-test and post-test of all functional test ($P>0.05$)

endurance of right side and horizontal side support endurance of left side. In this study, there was no significant difference between pre-test and post-test values of all functional tests such as squat test, single leg distance hop test, and timed single leg hop test, after 8 weeks of core stabilization program in female staff nurses. This study was supported by various studies that after 8 weeks of stabilization exercise of thoracic spine, outcomes were measured through pain scale, spinal mouse, biodex balance system, and McGill's trunk muscle endurance tests. It was found that there was significant difference exist between the exercise group and control group, they conclude that thoracic pain, postural sway, and spinal alignment were reduced and core endurance in university students was improved.^[11] In another study conducted on high school track and field athletes to measure the dynamic balance and core endurance, they found that after 6 weeks of core stabilization program, there was significant increase in the core endurance tests such as abdominal fatigue test, back extensor test, and side bridge test for both right and left side endurance was improved.^[12] Another study was conducted on 28 healthy individuals to determine the relationship between core stability, functional movement, and performance, and they found that there was no correlation exists between endurance tests such as flexor, extensor, and right and left side support endurance test, and functional movement screen. In terms of performance, the core stability and functional movement screen have weak correlation as it does not a strong predictor of performance.^[13] Another study was conducted on 33 participants were all active duty U.S. service members were underwent core strengthening exercise, and after 8 weeks core stabilization program, they found a positive correlation on core endurance.^[14] After 6–8 weeks of training up to 50% of mitochondrial content rapidly increases but as when training stops it decreases rapidly. After 2 weeks of the last exercise session, the training-induced will be increased up to 50%. Further, after the end of 6 weeks of training, the (succinate dehydrogenase-activity) which is the mitochondrial content will be back to pre-training level. The endurance capacity and the mitochondrial content have a close relationship with each other. The individuals who were trained highly have 3–4 times higher of mitochondrial content than the untrained.^[15,16] However, it is considered why for the endurance capacity the mitochondrial content should be high? The two crucial factors for endurance performance are the % VO_2 max that can be sustained during prolonged exercise (% VO_2 max) and maximal oxygen consumption (VO_2 max). During exhaustive exercise, the body can utilize the highest amount of oxygen, i.e., VO_2 max. The capacity to transport oxygen to the working muscles and the capacity of the heart is mainly determined by VO_2 max. Under normal conditions, there are minor effects of mitochondrial content on VO_2 max.^[17] The individuals who were well-trained not only have VO_2 max with high rate and but also have VO_2 max with high fractional utilization (% VO_2 max). The mitochondrial content and aerobic capacity have its close relation with the % VO_2 max. This is due to the fact that when given

submaximal overload with other fatigue-related substances the presence of high content of mitochondria will increase the utilization of fat and reduce lactic acid formation.^[17,18] This outcome was supported by previous studies; this study was to examine the effectiveness of a core endurance exercise protocol. About 2 days/week for 8 weeks the training took place. Flexion, extension, and side flexion tests were used to assess trunk endurance. Broad jump, vertical jump, 40-m sprint, shuttle, 2000-m maximal rowing ergometer test, overhead medicine throw ball were used in the assessment of functional performance. The result revealed there is an improvement significantly in the 2 side flexion tests and extensors. However, no significant differences were found for the any of the functional performance tests.^[19] Another study was also supported our results that study conducted to find the core endurance program on 45 college age rowers for 8 weeks, they found that side flexions for both right and left improved for core group, but functional performance aspects were not improved by core endurance program.^[19]

Strengths and Limitations

In this study, we are intended to concentrate on long-standing workers especially the female staff nurses, as they were not many studies on them, so our intention was prevent the low back pain in order them work effectively for longer period of time in their life. Limitations of the study are the sample size only 18 samples were included, as it was not a better effect size, additional therapist for assistance was needed, difficulty to follow exercise protocol by staff nurses whose duty is night shift. Future studies can be conducted on other work groups as well, strength test, flexibility test, motor control test, and functional scale as outcome measures, this exercise protocol can be given to any other specific long-standing population, it can be used as treatment protocol for low back pain, different age groups can be selected, can be done on large sample size.

CONCLUSION

This study concluded that there is an effect of 8 weeks of core stabilization exercise on core endurance, but no effect on functional test in female staff nurses.

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How to cite this article: Gopika S, Rajesh D. Effect of eight-week core stabilization program on core muscle endurance and function in female staff nurses. *Natl J Physiol Pharm Pharmacol* 2018;8(5):623-626.

Source of Support: Nil, **Conflict of Interest:** None declared.