

ASSESSMENT OF TRUNK MUSCLE ENDURANCE IN FEMALE NURSES USING LUMBAR FUNCTIONAL TEST

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ABSTRACT

Background: Strength, muscular endurance and flexibility are important component of healthy back function. Lack of endurance of trunk muscles is an important factor in etiology of low back pain. Nurses have a multidimensional role. They need to acquire various positions which lead to undue stress over low back, neck and hands amongst which prevalence of low back pain is highest.

Aims and Objectives: To test trunk muscle endurance using lumbar functional tests for Trunk extensors, Trunk flexors, Trunk lateral flexors (right), Trunk lateral flexors (left).



Materials and Methods: A cross sectional study was conducted with a sample of 80 nurses between age of 20-30 years also Nurses practicing more than 2 years having BMI within 18.5 - 24.99 kg/m² and Nulliparous women were included in the study. Subjects with history of Recent spine injury or trauma, Spine fracture, Pathological LBP, Subjects having history of any cardiovascular or pulmonary disorder or neurological conditions, Diabetes mellitus and hypertension, Mechanical LBP, Recent Cervical or Shoulder pathology were excluded. All subjects were selected by convenient type of sampling, Modified Oswestry Low Back Pain Disability Questionnaire was given to all the subjects and the subjects with the low back pain were excluded. A trial demo was given to the subject as to make them understand what they have to perform. Subjects were asked to hold the position and the no. of seconds was recorded. This no. of seconds was compared with the normal trunk endurance data.

Results: Trunk muscle endurance in Nurses was reduced then Normal published data.

Conclusion : The study concluded that there is reduced trunk muscle endurance in female nurses when compared to published normative data.

KEY WORDS: Trunk muscle endurance, Nurses, Lumbar functional test.

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INTRODUCTION

The vertebral column or spine is a part of axial skeleton. It houses the spinal cord and it is composed of 33 vertebrae and 23 intervertebral discs. The spinal stability is a three legged stool consisting of three subsystem i.e. passive [inert structures, bones and ligaments], active [muscles] and neural control. If any one of the

leg is not providing support it affects the whole stability of spine[1]. Core stability is the product of motor control and muscular capacity of the lumbo-pelvic-hip complex proposing that the stability of the pelvis and trunk is necessary for all movements of the extremity[2]. Strength, muscular endurance, and flexibility are important components of healthy back function[3].

A number of muscles cross the spine and contribute to lumbar mobility and stability. The muscular system is a complicated system composed of the deep muscles and the superficial muscles. The deep muscles are responsible for the control of stiffness and inter-vertebral relationships, and have their origin or insertion on the lumbar vertebrae. The superficial muscle system consists of the large global muscles that produce torque for spinal movement and handle external loads applied to the spine [4].

Static endurance of the trunk muscle is important for mechanical support. These must have the ability to sustained isometric contraction to support the trunk in any position [5]. Endurance is mechanically defined as the point of isometric fatigue, where the contraction can no longer be maintained at a certain level[6]. The muscles of the trunk are active in all the activities of human body whether one is sitting, standing, lifting, rolling. They are physiologically suited to provide low levels of activity for long period of time[6]. These muscles are physiologically postural muscles, being rich in type I fibres[7], which, uncharacteristically, have larger diameters than type II fibres[8,9].

The back extensors are postural muscles; they help to stabilize the whole vertebral column[5]. Trunk extensor-to-flexor muscles imbalances are major contributors to the etiology of back pain [6]. Lack of endurance of the trunk muscles is an important factor in low back pain (LBP). Low abdominal muscular endurance levels have been linked to the incidence of recurring low back pain. Abdominal muscular endurance is thought to be functionally more important than abdominal strength[10]. Hence adequate endurance of trunk muscles is necessary for good health.

Nurses have a multidimensional roles i.e. they're caregiver, decision maker, subject advocater, communicator as well as a teacher. They work to promote health, prevent disease with help subject to cope up with illness. But to ensure this various positions are taken by nurse which leads to an undue stress over the low back area, neck and hands. Amongst which prevalence of low back pain is highest. The key muscles involved in low back pain are the trunk muscles[11]. The injury to low back area affects the stability system of the spine which leads to

discomfort and pain in turn reduced quality of the service provided.

Also, there is high prevalence of reduced muscular endurance with low back pain. A number of isometric tests of trunk muscle endurance have been described for the trunk extensors, flexors and lateral musculature of the trunk. The Biering—Sørensen test of trunk extensor endurance has received the most attention. This test has been shown to have good reliability whether or not there is a history of low back pain (LBP) [6].

For testing the trunk flexors, the trunk flexor endurance test which targets the anterior deep core muscles is significant in assessing trunk flexor endurance. For testing the lateral trunk musculature, the side support or side bridge exercise described by McGill et al. has been suggested to optimally challenge quadratus lumborum and the muscles of the anterolateral trunk wall.

Typically these tests require minimal, inexpensive equipment, and are safe and simple to employ in clinical environments where performance is evaluated by recording the maximum time a person can maintain the test position.

As there is increasing incidence of low back pain in nurses as their work is multidimensional which requires various muscular activities like lifting, bending, shifting and transferring which in turn reduces the quality of service they provide.

However to maintain this it is important to maintain self fitness. Also, there is dearth of literature regarding trunk muscle endurance of nurses.

Hence the broad aims of this study is to assess trunk muscle (extensors, flexors and lateral flexors) endurance using lumbar functional test in female nurses.

MATERIALS AND METHODS

80 nurses from the metropolitan city with the age between 20 – 30 years, were recruited. Inclusion criteria: 1.Nurses who are willing to participate; 2.Nurses practicing more than 2 years; 3.BMI within 18.5 - 24.99 kg/m²; 4. Nulliparous women. Exclusion criteria : 1. Recent spine injury or trauma; 2.Spine fracture; 3.Pathological LBP; 4.Subjects having history of

any cardiovascular or pulmonary disorder or neurological conditions, 5. Diabetes mellitus and hypertension; 6. Mechanical LBP; 7. Recent Cervical or Shoulder pathology. Prior to the study a written consent form was taken from each subject in the language best understood to them. Modified Oswestry Low Back Pain Disability Questionnaire was given to all the subjects and the subjects with the low back pain were excluded. Subjects were refrained from eating anything before one and half hour of testing.

Study Design: In this comparative study the sample size was 80. Type of study was cross-sectional and type of sampling was convenient.

Procedure: Subjects were screened according to the inclusion and exclusion criteria. Prior to the study a written consent form was taken from each subject in the language best understood to them. Modified Oswestry Low Back Pain Disability Questionnaire was given to all the subjects and the subjects with the low back pain were excluded. Subjects were refrained from eating anything before one and half hour of testing.

For trunk extensors : The subjects were laid down (i.e. prone) into the Biering-sorensen position in which the lower body was fixed to the test bed at the ankles, knees, and hips and the upper body extended in a cantilevered fashion over the edge of the test bench. The test bench surface was approximately 25cm above the surface of the floor. Subjects rested their upper bodies on the floor before the test. At the beginning of the test the upper limbs were held across the chest with the hands resting on the opposite shoulders, and the upper body was lifted off the floor until the upper torso was horizontal to the floor. Subjects are instructed to maintain the horizontal position as long as possible. The holding time is recorded. Normal value is **189 ± 60 secs.**

For trunk flexors : For flexor endurance test, the subjects were asked to sit on the test bench and to place the upper body against a support with an angle of 60 degrees from the test bed. Both the hip and knees are flexed to 90 degrees and the arms were crossed across the upper chest and the feet were placed under ankle straps. Subjects were instructed to maintain the body position while the supporting wedge was

pulled back 10cm to begin the test. The test ended when the upper body fell below the 60 degrees angle. Normal value is **149 ± 99 secs.**

For trunk lateral flexors: For side bridge test, the subjects were asked to lie on the mat on their sides with legs extended. The top foot was placed in front of the lower foot on the mat for support. Subjects were instructed to support themselves lifting their hips off the mat to maintain a straight line over their full body length, and support themselves on one flexed elbow and one feet. The uninjured arm was kept across the chest on opposite shoulder. The test ended when the hips returned to the exercise mat. Normal value is **72 ± 31 secs for right side** and **77 ± 35 secs for left side.**

A trial demo was given to the subject as to make them understand what they have to perform. Subjects were asked to hold the position and the no. of seconds was recorded. This no. of seconds was compared with the normal trunk endurance data. The obtained data was collected, recorded and analysed.

Outcome measures: Modified Oswestry Low Back Pain Disability Questionnaire was the outcome measure taken.

Statistical analysis: In this study 80 subjects were included to assess the trunk muscle endurance in female nurses using lumbar functional test. Data was analysed to compare the trunk muscle endurance between nurses and normative data. In this study Modified Oswestry Low Back Pain Disability Questionnaire was priorly taken and then they were asked to perform the lumbar functional tests and holding time was recorded. To compare the difference between the normative data and data collected by nurses, one sample t test was used. The level of significance was $p < 0.0001$.

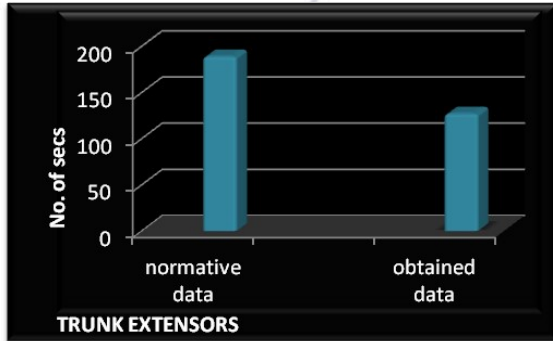
RESULTS

The mean value of trunk extensors of normal individuals was 189s and that of nurses was 127s which is shown in Table 1. The p value was less than 0.0001 which shows that it is highly significant. It depicts that the endurance of trunk extensor muscles in the nurses is significantly reduced when compared to normal individuals. Hence the above graph shows that there is significant difference in the trunk extensor

muscle endurance of nurses when compared to normative value.

Table 1: Comparison of normal and obtained data of trunk extensor muscles.

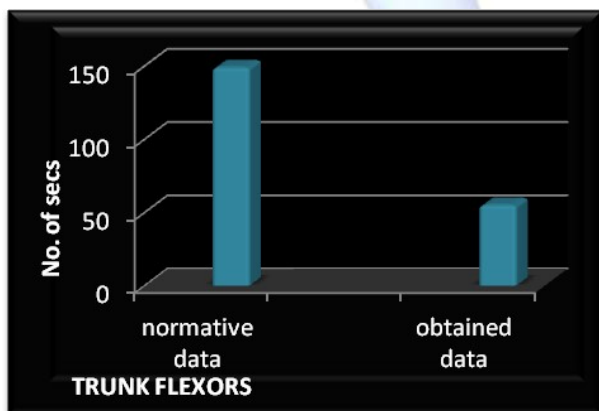
Data	Mean (Trunk Ext)	P Value	Significance
Normative Data	189s	Less Than 0.0001	Significant
Obtained Data	127s		



The mean value of trunk flexors of normal individuals was 149s and that of nurses was 56s which is shown in Table 2. The p value was less than 0.0001 which shows that it is highly significant. It depicts that the endurance of trunk flexor muscles in the nurses is significantly reduced when compared to normal individuals. Hence the above graph shows that there is significant difference in the trunk flexor muscle endurance of nurses when compared to normative value.

Table 2: Comparison of normal and obtained data of trunk flexor muscles.

Data	Mean (trunk flx)	P value	Significance
Normative data	149s	Less than 0.0001	Significant
Obtained data	56s		

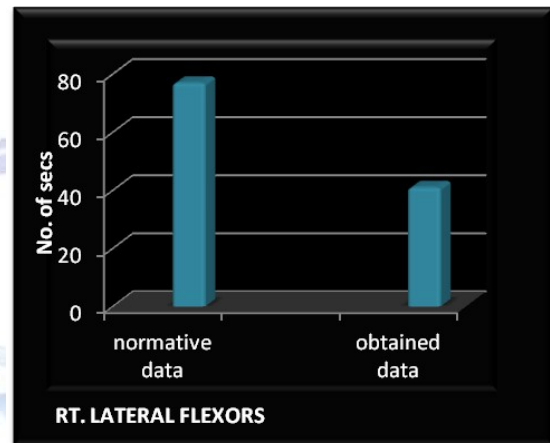


The mean value of Rt. Trunk lateral flexors of normal individuals was 72s and that of nurses was 40s which is shown in Table 3. The p value was less than 0.0001 which shows that it is highly significant. It depicts that the endurance

of Rt. Trunk lateral flexor muscles in the nurses is significantly reduced when compared to normal individuals. Hence the above graph shows that there is significant difference in the Rt. Trunk lateral flexor muscle endurance of nurses when compared to normative value.

Table 3: Comparison of normal and obtained data of Rt. lateral flexor muscles.

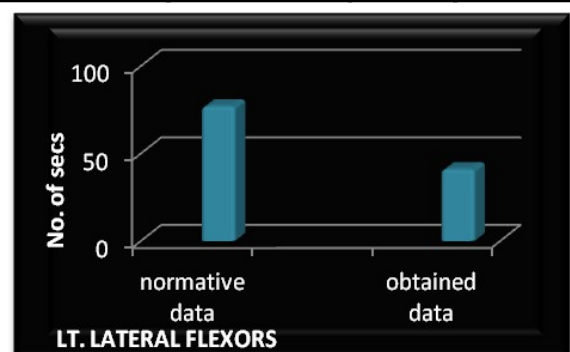
Data	Mean (Rt.Trunk Lat Flx)	P Value	Significance
Normative Data	72s	Less Than 0.0001	Significant
Obtained Data	40s		



The mean value of Lt. Trunk lateral flexors of normal individuals was 77s and that of nurses was 41s which is shown in Table 4. The p value was less than 0.0001 which shows that it is highly significant. It depicts that the endurance of Lt. Trunk lateral flexor muscles in the nurses is significantly reduced when compared to normal individuals. Hence the above graph shows that there is significant difference in the Lt. Trunk lateral flexor muscle endurance of nurses when compared to normative value.

Table 4: Comparison of normal and obtained data of Lt. trunk lateral flexor muscles.

Data	Mean (Lt.Trunk Lat Flx)	P value	Significance
Normative Data	77s	Less than 0.0001	Significant
Obtained Data	41s		



DISCUSSION

Nurses have a multidimensional roles, but to ensure this various positions are taken by nurses which leads to an undue stress over the low back area, neck and hands. Amongst which prevalence of low back pain is highest. Strength, muscular endurance and flexibility are important component of healthy back function. Static endurance of these muscles is important for mechanical support. The injury to low back area affects the strength and endurance of spine muscles. Lack of endurance in the trunk muscles is an important factor in increasing incidence of recurring low back pain.

Hence the present study focuses over the assessment of trunk muscle endurance in female nurses using lumbar functional test . Nurses between 20 – 30 years with sample size of 80 in a metropolitan city were taken. Subjects having recent spine injury or trauma, pathological LBP, any history of cardiovascular or pulmonary disorder or neurological conditions or Diabetes mellitus and hypertension, Mechanical LBP, Recent Cervical or Shoulder pathology were excluded.

Results were interpreted using one sample t test mean age being 22 years which revealed statistically significant difference in trunk muscle endurance between female nurses and normative data.

In our study we found that the nurses have reduced trunk muscle endurance mainly due to wrong postures during lifting, bending, shifting and transferring the patients, attaining this wrong posture for more no. of hours leads to muscular fatigue.

Muscle fatigue reduces the muscular support of spine and also increases the mechanical stress of the functional components of spine, also it reduces muscle response to loads.

Prolong muscular fatigue gradually leads to reduction in muscle endurance and strength. Also it is found that nurses aides flexed forward for more than 72 degree every 53s and spent 13 min an hour (22% of the time) to bent forward 36 degree or more (Nordin et al.), Magora A. et al found that a large part of nurses work time is spent in forward lean postures.

As stated by Punnett L. et al faulty postures put

high static and dynamic endurance demands on the trunk muscles and places nurses at high risk for LBP, also nurses have a particularly high prevalence of LBP (Bolanle MS Tinubu et al.) which further contributes to reduced trunk muscle endurance in them.

Thus the present study proves that there is reduced trunk muscle endurance in female nurses as compared to normative data.

Limitations and suggestions: Limitations: 1.The study was performed over a small sample size; 2.Only nulliparous nurses were taken into consideration. Suggestions: 1. Large sample size can be used; 2. Boys can be taken into the study.

CONCLUSION

The trunk extensors, flexors and the lateral flexors of the nurses lack in endurance when compared to normative data; hence the study concluded that there is reduced trunk muscle endurance in female nurses when compared to published normative data.

Clinical Implications: 1. Early trunk muscle endurance, improving exercises can be incorporated into the day to day life style of nurses; 2. Awareness in community, in different nurses colleges and hospital about the cause of reduced trunk muscle endurance in nurses and its adverse effects by conducting seminars, lectures on correct handling techniques and thus reducing stress over the spine; 3.Ergonomic advice can be given.

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Conflicts of interest: None

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