



# “EFFECT OF CORE STABILITY TRAINING ON TRUNK ENDURANCE IN HEALTHY YOUNG ADULTS: A PILOT STUDY.”

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## ABSTRACT

**Background:** This pilot study is carried out to see the effect of core stability training exercise on improving trunk endurance in healthy young adults. Studies demonstrated that healthy college going students had significantly lower trunk endurance test. Thus, strategies should include that emphasize trunk endurance and thus the effect of core stability exercise on trunk endurance should be measured. The core act in the course of the (nature's back belt) thoracolumbar fascia. The ability of the torso muscles to maintain appropriate levels of activation over long periods of time may be more important than maximum strength in terms of protecting the passive structures of the lumbo sacral spine from injury.

**Methodology:** 10 healthy subjects with age between 18 to 35 years were taken in this study. Informed and written consent was taken from the subjects. Trunk Endurance Tests are measured before the starting of the treatment and after the 4 weeks of core stability training. All subjects received core stability exercise training for 6 times a week for 4 weeks.

**Result:** Result shows significant improvement in the Trunk Flexors Endurance, Trunk Extensors Endurance, Trunk Right Lateral Flexors Endurance and Trunk Left Lateral Flexors Endurance.

**Conclusion:** Core stability exercises are effective to improve trunk endurance in healthy young adults.

**Keywords:** Core stability, Trunk endurance, Healthy young adults

## INTRODUCTION:

A core musculature box described as in the front abdominals, in the back paraspinals and gluteals, as the roof diaphragm and as the bottom hip girdle and pelvic floor musculature. The very important part of the core is serving by the abdominals. <sup>(1)</sup>

The core act in the course of the (nature's back belt) thoracolumbar fascia. The muscle, transversus abdominis have huge attachments to the medial and posterior segments of the thoracolumbar fascia <sup>(2)</sup>

In addition, the deep lamina of the back layer adheres to the lumbar spinous processes. In short, the thoracolumbar fascia acts as part of the " hoop " around the trunk <sup>(3)</sup> which provides connections between the lower extremity and upper extremity. <sup>(4)</sup>

The thoracolumbar fascia also acts as a proprioceptor, providing a response to the shape of the trunk, with a tightening in muscle content. Slow-twitch and twitch-twitch, two types of muscle fibers consist of core muscles. The slow-twitch fibers

form primarily the local muscles (a deep layer of muscle). These muscles are short in stature and ready to control intersegmental movements and respond to changes in posture and external loads. Important local muscles include the multifidi, transversus abdominus, deep transversospinalis and pelvic floor muscles. In people with chronic low back pain (LBP) Multifidi was diagnosed with atrophy. <sup>(5)</sup>

Fast-twisted fibers have a large-scale muscle system (the superficial layer). These are long and have big lever arms, make them to create a large amount of torque and great movement. The erector spinae, the rectus abdominis muscles, the external oblique and the quadratus lumborum are classified as the most important key muscles (McGill claims as a major stabilizer of the spine). <sup>(6)</sup>

Abdomen acts as the most important part of the core musculature. The transversus abdominis has received notice for its stabilizing property. Horizontally running fibers it has (except for very lower fibers, running parallel to the internal oblique muscle), forming a band around the abdomen. The differentiated function of transversus abdominis is formed by "Hollowing in" abdomen. Transversus abdominis and multifidians have been revealed to have a contraction of 30 ms before shoulder movement and 110 ms earlier than leg movement in healthy individuals, in terms of lumbar spine stabilization. However, the evidence suggests a delayed transversus abdominis and multifidious contraction earlier than leg movement in patients with LBP. <sup>(7)</sup>

To increase internal abdominal pressure and internal oblique and transversus abdominis act jointly from a hoop made of thoracolumbar fascia. Improved intraabdominal pressure has been revealed to provide spinal strength. <sup>(3)</sup>

The largest and most prominent abdominal muscle, the external oblique, acts as a check for anterior pelvic tilt. Multifidi and Abdomen muscles) need to incorporate only 5% to 10% of their maximum volitional contraction to harden part of the spine. <sup>(8)</sup>

The hip muscles are important in all ambulation activities, and they play an important role in stabilize the pelvis and trunk in walking gait <sup>(9)</sup>. For people with LBP and any muscular conditions such as ankle sprains, low tolerance and delayed hip extensor shooting (gluteus maximus) abductor muscles (gluteus Medius) have been identified earlier. <sup>(10)</sup> The psoas is just a weak flexor of the lumbar discs. <sup>(11)</sup> However, it has the ability to exert a powerful compression force on the lumbar discs. as a full situps, it can carry a load on the L5-S1 disk equivalent to 100 kg of weight. Tightness of the psoas muscle (hip flexor) can produce LBP by increasing the load on the lumbar disks. <sup>(2)</sup>

The diaphragm acts as the top of the " muscle box " of the core musculature, and the pelvic floor acts as the bottom. Tightening of the diaphragm increases internal pressure of the abdomen, thus adding to the steadiness of the spine. With transversus abdominis contraction pelvic floor muscles are activated. <sup>(3)</sup> People with sacral and iliac pain have impaired recruitment of the diaphragm and pelvic floor as shown by recent studies. <sup>(12)</sup> Diaphragmatic breathing techniques and pelvic floor activation can therefore be a key part of the context strengthening program. Core stability is the muscle control required in the region of the lumbar spine to keep functional stability. In the prevention of injuries and many other diseases core stability exercises are widely used. <sup>(13)</sup>

Core stability is the capability to manage the position and movement of the torso over the pelvis to permit for better production, transfer and control of energy and movement in integrated kinetic chain functions. <sup>(14)</sup>

The ability of the torso muscles to maintain appropriate levels of activation over long periods of time may be more important than maximum strength in terms of protecting the passive structures of the lumbo sacral spine from injury. <sup>(15)</sup>

The endurance capabilities of these muscles may be as important as or even more important than strength in the prevention and treatment of LBP. Extensors muscle endurance seems to be tested less often than muscle strength. Torso muscular endurance can be mechanically tested by timing a person's ability to hold a certain posture or to make certain movements with or without external load. <sup>(16, 17)</sup>

This pilot study is carried out to see the effect of core stability training exercise on improving trunk endurance in healthy young adults. Studies demonstrated that healthy college going students had significantly lower trunk endurance. Thus, strategies should include that emphasize trunk endurance and thus the effect of core stability exercise on trunk endurance should be measured.

## METHODOLOGY

### **SOURCE OF DATA:**

- Parul Institute of Physiotherapy, Vadodara, Gujarat

### **INCLUSION CRITERIA:**

- Subject with 18 to 35 years of age
- Healthy young adults

### **EXCLUSION CRITERIA:**

- LBP as a result of a specific spinal disease, infection, presence of tumor, osteoporosis, fracture, structural deformity, inflammatory disorder, radicular symptoms, or cauda equina syndrome & pregnancy.

### **METHOD OF COLLECTION OF DATA:**

Study type: - Pilot study

Sample size: - 10

The protocol is for 6 days a week for 4 weeks

Evaluation is taken before start of the core stability training and at the end of the core stability training.

### **OUTCOME MEASURES:**

- Trunk Flexor Endurance Test
- Trunk Lateral Endurance Test (Right/Left)
- Trunk Extension Endurance Test

### **MATERIAL USED:**

1. Plinth
2. Straps
3. Stopwatch
4. Lower stool
5. Wooden board

### **PROCEDURE:**

The study sample consists of 10 healthy subjects with age between 18 to 35 years. The subjects who met the inclusion criteria are included in this study. Informed and written consent was taken from the subjects. Trunk Endurance Tests are measured before the starting of the treatment and after the 4 weeks of core stability training.

All subjects received core stability exercise training<sup>15</sup>

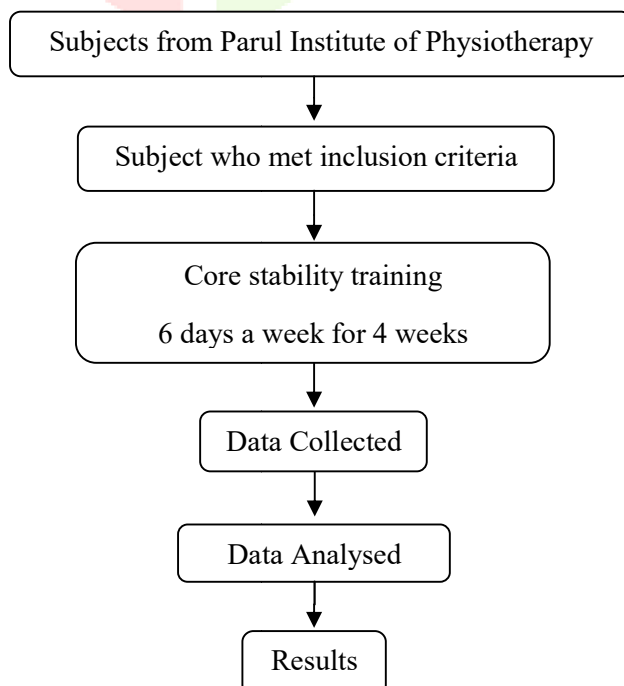
### Core stability training

Warm-up: Cat and camel, stretching of tight muscles

- Transversus abdominus (advance if able to perform 30 reps with 8 s hold)
  - Abdominal bracing
  - Bracing with heel slides
  - Bracing with leg lifts
  - Bracing with bridging
  - Bracing in standing
  - Bracing with standing row
  - Bracing with walking
  
- Paraspinals/multifidi (advance if able to perform 30 reps with 8 s hold)
  - Quadruped arm lifts with bracing
  - Quadruped leg lifts with bracing
  - Quadruped alternate arm and legs lifts with bracing
  
- Quadratus lumborum and obliques (advance if able to perform 30 reps with 8 s hold)
  - Side plank with knees flexed
  - Side plank with knees extended

- Trunk curls

Start the exercises with the 5 repetitions and 3-5 sec hold. Increase the intensity of the exercise progressively if able to perform.



## 1. Trunk Flexor Endurance Test

Starting position is patient should be seated, hip and knee bending to 90 degrees and arms across the chest, touching each hand to the opposite shoulder and lean against a board positioned at a 60-degree incline. Keep the head in a neutral position. (Figure 1.1)

Instruct the patient to maintain a neutral spine. Do not allow arch of back during the test.

Stabilize the feet by strap or therapist can anchor the toes manually.

Patient has to hold this 60-degree position for as long as possible without the back support.



**Figure 1.1: Trunk Flexors Endurance Test**



**Figure 1.2: Trunk Flexors Endurance Test**

### **Test protocol and administration:**

The Therapist moves the board about 4 inches (10 cm) back and starts stopwatch while the patient maintains the suspended position. (Figure 1.2)

Immediately end the test when there is an evident change in the trunk position. No part of the back should touch the back rest.

Record the time on the record sheet.

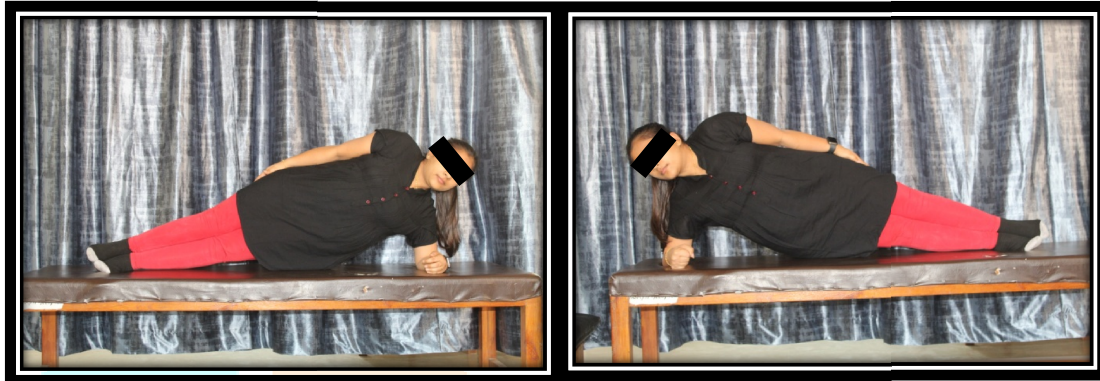
## 2. Trunk Lateral Endurance Test

Starting position is the patient is on his or her side with extended legs and aligning the feet on top of each other or in a tandem position (heel-to-toe).

Patient places the lower arm under the body and the upper arm on the side of the body.

Instruct the patient to assume a full side-bridge position and keep both legs extended and the sides of the feet on the floor. The head, neck, trunk, hips and legs should be in straight line. (Figure 2)

Patient should hold this position for as long as he/she can hold. Once the client breaks the position, the test is terminated.



**Figure 2: Trunk Lateral Endurance Test (Right/Left)**

### Test protocol and administration:

As the patient moves into the side bridge position the therapist starts the stopwatch.

Test is ended when there is a clear change in the trunk position or a movement away from the neutral spine (i.e., the hips falling downward)

The hips changing forward or backward in an attempt to sustain balance and stability

Record the time on the record sheet.

Repeat the test on the opposite side and record this value on the record sheet.

## 3. Trunk Extensor Endurance Test

Starting position is the patient should be in prone position, the iliac crests should be at the table edge and the upper extremity should take support on a lower stool which is placed in front of the plinth.

Therapist anchors the legs of patient using straps or by the body weight.

Patient should hold a horizontal, prone position for as long as he/she hold.

When patient falls below horizontal the test is terminated.



**Figure 3: Trunk Extensors Endurance Test**

**Test protocol and administration:**

When patient is ready, he/she lifts the trunk parallel to the floor with his/her arms crossed over the chest. (Figure 3)

Therapist starts stopwatch as patient assumes this position.

Test is ended when patient can no longer maintain the position.

Record the time on the record sheet.

**STATISTICAL ANALYSIS**

Descriptive statistical analysis was accomplished in the present study. Outcome measurement was measured using Trunk Flexors Endurance Test, Trunk Right Lateral Flexors Endurance Test, Trunk Left Lateral Flexors Endurance Test and Trunk Extensors Endurance Test. Significance were assessed at 5% level of significance  $p < 0.05$ .

Paired t-test as a parametric was used for analysis of Trunk Flexors Endurance Test, Trunk Right Lateral Flexors Endurance Test, Trunk Left Lateral Flexors Endurance Test and Trunk Extensors Endurance Test variables.

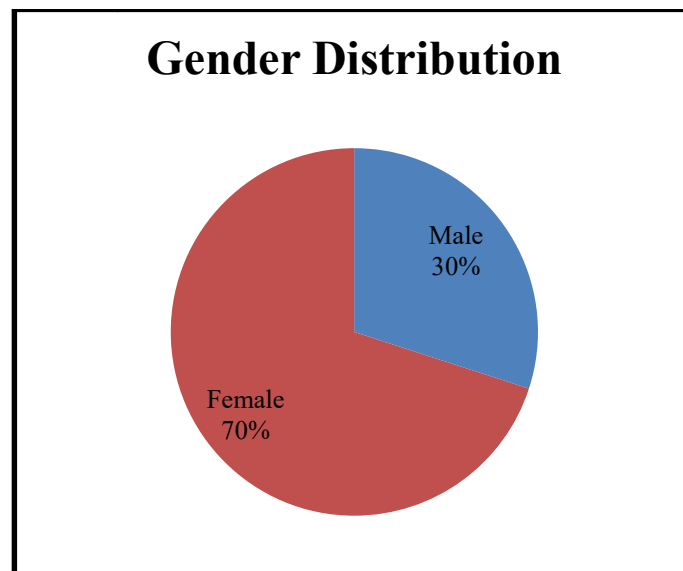
**Statistical software:**

The statistical software namely SPSS (Statistical Package for the Social Sciences) version 20.0 was used for the analysis of the data, Microsoft word and Excel was used to generate graphs, tables.

**RESULT:**

**Table 1: Gender Distribution of all participants**

Gender	Number of Persons
Male	03
Female	07
Total	10

**Graph-1: Gender distribution****Table 2: Comparison of pre and post test values**

Variants	MEAN±SD		T VALUE	P VALUE
	PRE	POST		
<b>TFE</b>	157.5 ± 71.72	171.9 ± 68.42	5.73	0.001
<b>TEE</b>	75.60 ± 37.34	107.4 ± 38.15	4.77	0.001
<b>TRLFE</b>	28.20 ± 20.66	35.7 ± 22.09	4.66	0.001
<b>TLLFE</b>	29.9 ± 27.68	37.6 ± 26.48	5.70	0.001

**Table 2 Shows Mean ± Standard Deviation of pre- and post-test values.**

Trunk Flexors Endurance (TFE) pre test value is 157.5 ± 71.72 (Mean ± SD) and post test value is 171.9 ± 68.42 (Mean ± SD), t-value is 5.73 and p value is 0.001.

Trunk Extensors Endurance (TEE) pre test value is 75.60 ± 37.34 (Mean ± SD) post test value is 107.4 ± 38.15 (Mean ± SD), t-value is 4.77 and p value is 0.001.

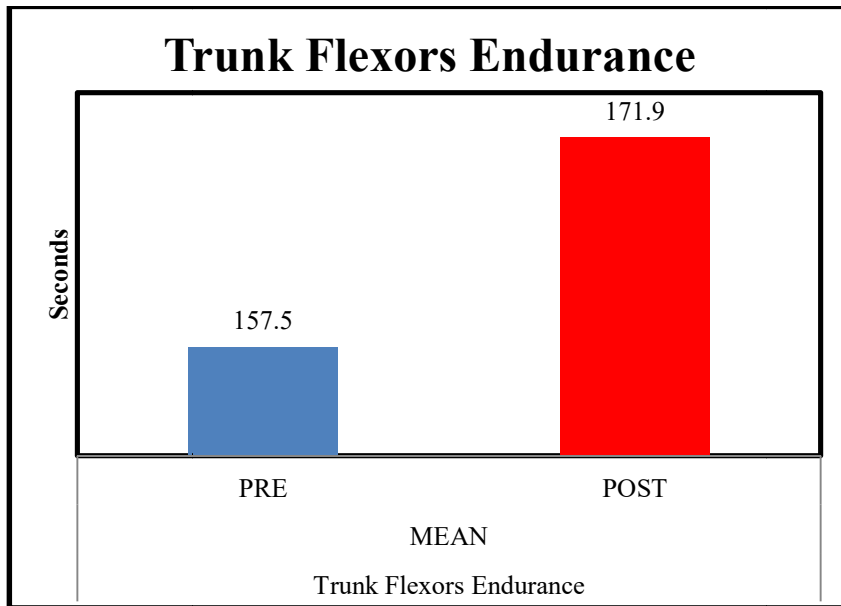
Trunk Right Lateral Flexors Endurance (TRLFE) pre test value is 28.20 ± 20.66 (Mean ± SD) post test value is 35.7 ± 22.09 (Mean ± SD), t-value is 4.66 and p value is 0.001.

Trunk Left Lateral Flexors Endurance (TLLFE) pre test value is 29.9 ± 27.68 (Mean ± SD) post test value is 37.6 ± 26.48 (Mean ± SD), t-value is 5.70 and p value is 0.001.

Result shows significant improvement in the Trunk Flexors Endurance, Trunk Extensors Endurance, Trunk Right Lateral Flexors Endurance and Trunk Left Lateral Flexors Endurance (P < 0.05).



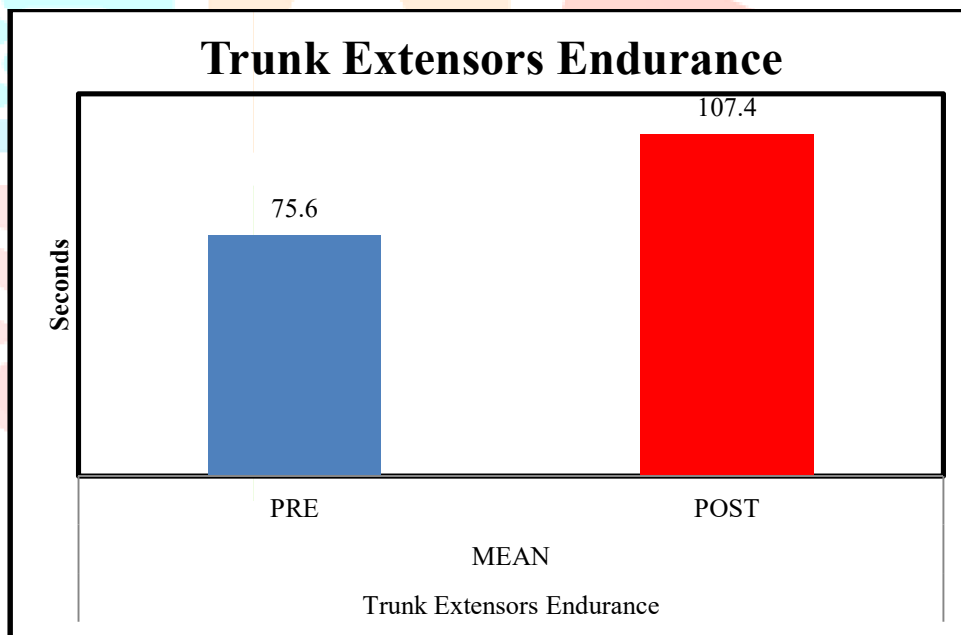
**Graph-2: Comparison Trunk Flexors Endurance**



**Graph-2 shows mean trunk flexors endurance pre and post values.**

Pre test mean is 157.5 seconds and post test mean is 171.9 seconds.

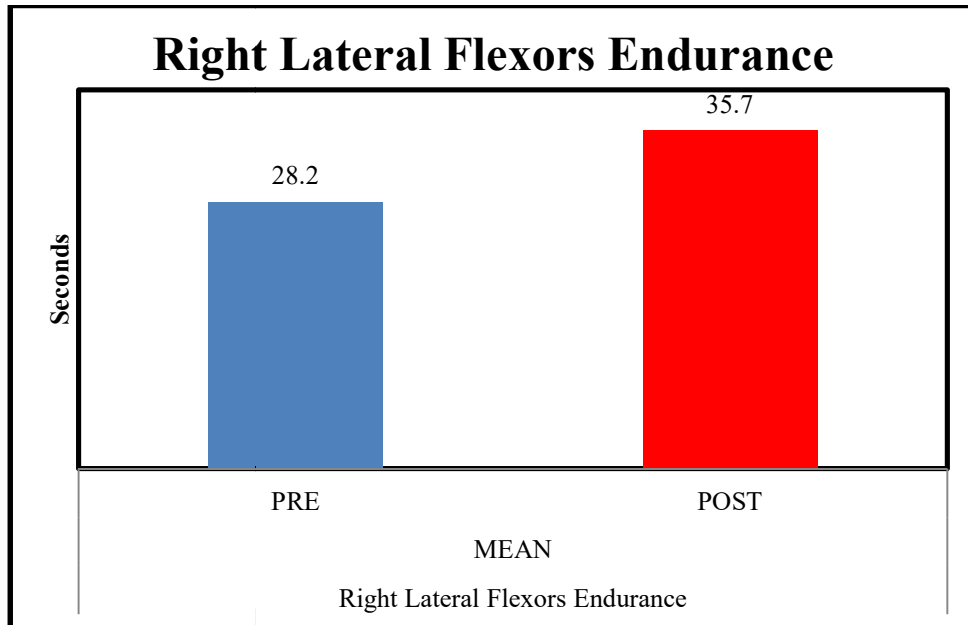
**Graph-3: Comparison Trunk Extensors Endurance**



**Graph-3 shows mean trunk extensors endurance pre and post values.**

Pre test mean is 75.6 seconds and post test mean is 107.4 seconds.

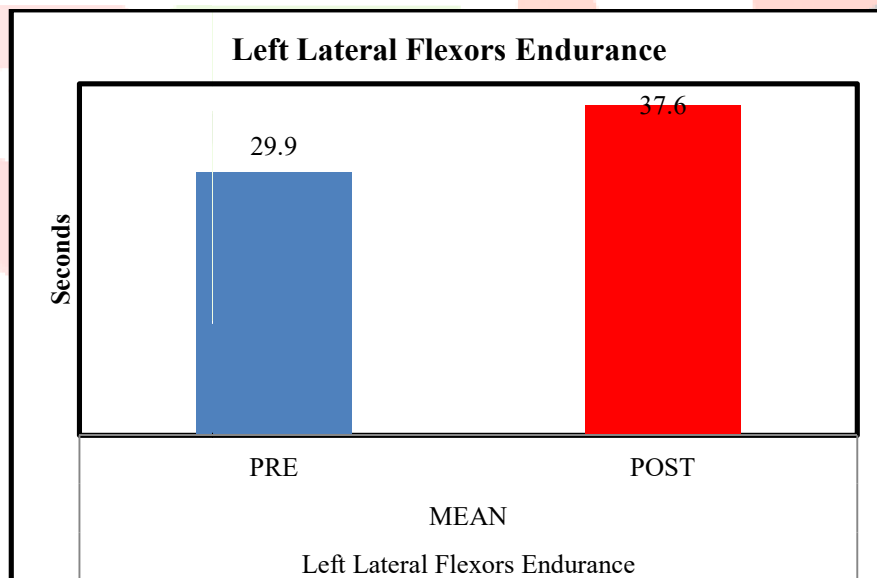
**Graph-4: Comparison Trunk Right Lateral Flexors Endurance**



Graph-4 shows mean trunk right lateral flexors endurance pre and post values.

Pre test mean is 28.2 seconds and post test mean is 35.7 seconds.

**Graph-5: Comparison Trunk Left Lateral Flexors Endurance**



Graph-5 shows mean trunk left lateral flexors endurance pre and post test values.

Pre test mean is 29.9 seconds and post test mean is 37.6 seconds.

**DISCUSSION:**

The purpose of this study is to see the effect of core stability training on trunk endurance in healthy young adults.

This study results shows there is significant improvement on trunk flexors endurance, trunk extensors endurance, trunk right lateral endurance and trunk left lateral endurance with core stability exercise plus conventional Physiotherapy in healthy young adults.

Chidozie Emmanuel Mbada et al studied on healthy adults and established a set of reference values for static back endurance in healthy Nigerians. According to this values the Indian college going students having lower trunk endurance values.<sup>18</sup>

Yash Khorawa et al studied on the college going students for the trunk endurance and found very poor trunk endurance in college going students.<sup>19</sup>

The core stability exercises are also effective in reducing pain in patients with low back pain.

McGill shows various trunk endurance tests which are valid and reliable to implement clinically for the evaluation of the trunk endurance.

Studies also show that the lower trunk endurance is associated with non-specific low back pain. Thus the effect of core stability exercise in patients with non specific low back pain should also measure in the future studies.

This pilot study is done only on 10 subjects. So future study should be done with the more sample size.

Present study shows that the collage going healthy young adults having lower trunk endurance and the trunk endurance is increased by the core stability exercises. Thus, the protocol should be implement which is effective to improve trunk endurance in healthy young adults.

**CONCLUSION:**

Core stability exercises are effective to improve trunk endurance in healthy young adults. Thus the core stability exercise should include in the routine exercise protocol in healthy young adults with low trunk endurance.

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