

# Correlation Analysis Between Oswestry Disability Questionnaire and Abdominal Flexor Endurance among Non-Specific Low Back Pain Patients

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## Abstract

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*Introduction:* Forensic ergonomics plays a vital role in understanding the vital relationship between legal problems and injuries. Core stability has an important role to play for an efficient functioning of both the upper and lower limb along with the task of stabilizing the trunk and maintaining proper posture, through a coordinated and integrated manner. The inadequacy of the core poses a risk for the development of low back pain and dysfunction as a result of poor ergonomic posture.

The reason has been attributed to an altered neuromuscular balance leading to an imbalance of the endurance of the trunk muscles.

*Aim:* To study the relation between flexor muscle endurance and non specific low back pain.

*Materials and Method:* 6 subjects (3 males and 3 females) were selected on the basis of Oswestry disability index (ODI) questionnaire score of the age group of 22-45 years with a non specific origin of low back pain. The flexor muscle endurance times were noted using the McGill's flexor endurance test for each of them. A Pearson's correlation coefficient was then calculated and significance of the test was determined.

*Results:* The study revealed a Pearson's correlation coefficient  $r = 0.622$ , and a  $t$ -test value  $p < 0.001$ , implying a significant result.

*Conclusion:* It can be concluded that there is a moderate correlation between flexor muscle endurance and non specific low back pain with a revelatory result and it can be utilized for clinical use, such as work ergonomics in an efficacious manner.

**Keywords:** Core stability; Endurance; McGill test; Low back pain; Synergistic movements, Altered coordination; Forensic ergonomics.

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## Introduction

Forensic ergonomics has increased the awareness amongst the administrators, practitioners and researchers that musculoskeletal conditions such as low back pain (LBP) are often activity related and much of this activity occurs at the workplace.<sup>1</sup> Work-related factors can cause musculoskeletal disorders, aggravate their condition and impede rehabilitation.<sup>1</sup> Back pain and its accompanying problems plays an enormous burden on society,

health care systems and also toward the economies in the developed countries.<sup>2</sup> LBP results from localised muscle fatigue, in general, muscle fatigue is defined as a representation of a multifaceted phenomenon with physical and chemical changes in muscle, as well as alterations in nervous system efficiency, which are related to different causes, mechanisms and symptoms,<sup>3,4</sup> muscular endurance has been found to be more discriminant than strength to differentiate between healthy subjects and individuals with LBP.<sup>5</sup>

Stability of the core is essential as it responsible to produce complex functional tasks, produce and transmit the forces, in controlling the movements of the distal segment, all which is achieved through a synergistic work of the core muscles.<sup>6,7</sup> An inadequate stability of the core has been closely linked with injuries of the lower limb in athletes, as well as low back pain.<sup>6</sup> This has been closely attributed to a faulty neuromuscular control, and also to a higher degree of fatigability of the trunk muscles.<sup>8,9</sup> Since core stability cannot be directly measured, that can be assessed through its various components—endurance, flexibility, strength, function, and motor control.<sup>6</sup> Various studies have revealed that there is a close link between imbalance in the endurance of the trunk muscles with low back pain, rather than isometric strength.<sup>10</sup>

Hence, there is a need to assess the core endurance is essential using methods requiring less expense and equipments such as McGill's endurance test.

There is lack of sufficient work determining the relationship between low back pain and flexor muscle endurance, therefore, it is crucial to evaluate the subject from a clinical perspective, as an assessment apparatus but also as an important rehabilitation program.

## Materials and Methods

The study was conducted at the PhD laboratory, Centre for Physiotherapy and Rehabilitation Sciences, Jamia Millia Islamia, New Delhi. The data was collected between 24<sup>th</sup>–31<sup>st</sup> January 2019 with a study population involving 6 subjects (3 males and 3 females). The instruments used for the study included a stopwatch, plinth, stabilizing belts, goniometer and foam board for back support.

### Inclusion criteria

Male and female subjects with in the age group 22–45 years, with a low back pain history of more than 3 months and having a non-specific origin of low back pain were included. The subjects were made to fill up the Oswestry Disability questionnaire, and those found to be having moderate disability were chosen for the study.

### Exclusion criteria

Individuals with a past history of any injury to the spine, any spinal surgery, spinal pathology (eg: spondylosis, spondylolisthesis, spine tumors, cauda equina syndrome), slipped intervertebral discs, history of neurological symptoms and deficits, spinal infections, pregnant women were excluded from the study.

### Outcome Measure

The outcome assessment was done using the McGill's endurance test method that has a reliability of 0.97 for the flexor test.<sup>11</sup>

For the flexor endurance test, the subject's feet were stabilized either by using a stabilizing belt or manually on the plinth.<sup>12</sup> Both the knees were flexed to 90°, while the trunk was made to incline at an angle of 60°, both the angles were measured by a goniometer to check the correct alignment. The subject was asked to cross the arms over the chest with the examiner providing back support using a foam board at 60° inclination making sure that the back is straight and not slouched.<sup>11</sup>

The subjects were instructed to maintain this position while the foam board or the support was pulled back 10 cm to begin the test and time recording using stop watch began simultaneously. The time for how long the patient was able to sustain the position was noted. The test was terminated as soon as the patient was unable to maintain the position either through arching of the back or deviating from a neutral spine, or when the patient would touch the foam board behind them.<sup>13</sup>

It was made sure that the patient was not encouraged to sustain the position as it would cause error in the actual readings.<sup>12</sup>

The normal values for the flexor endurance test were as follows as determined by McGill et al.<sup>11</sup>

**Table 1:** Mean flexor endurance times (sec) with standard deviation and ratio normalized to extensor exercise.

Task	Men			Women			All		
	Mean	SD	Ratio	Mean	SD	Ratio	Mean	SD	Ratio
Flexor	144	76	0.99	149	99	79	147	90	0.86



Fig. 1: McGill flexor endurance test position.

**Results**

The results collected from the subjects were as follows

**Statistical Analysis**

The analysis of the data was done to reveal Pearson’s

correlation coefficient *r*, which helps to understand the extent of the relation between the two. The values of *r* can be interpreted as follows: 0.00–0.25 implies no to little relationship, 0.26–0.50 as fair amount of relationship, 0.51–0.75 as moderate to good relationship, 0.76–1.00 as good to excellent relationship.<sup>14</sup> The significance of the test was also determined using a two tailed *t*-test where *p* < 0.05 indicates a significant result.

**Table 2:** Low back pain disability and McGill flexor endurance times

Patient details	Oswestry Disability score	McGill flexor endurance time
Subject 1–38/M	[(16/45) × 100] = 35.5%	12.37 seconds
Subject 2–24/M	[(14/45) × 100] = 31.1%	20.1 seconds
Subject 3–33/M	[(15/50) × 100] = 30%	12.10 seconds
Subject 4–43/F	[(16/45) × 100] = 35.5%	6.35 seconds
Subject 5–35/F	[(13/45) × 100] = 28.8%	9.65 seconds
Subject 6–36/F	[(13/45) × 100] = 28.8%	8.43 seconds

The results of data analysis done were as follows:

The analysis demonstrated a Pearson’s correlation coefficient as 0.622, and a two tailed test *p*-value as 0.001, between the Oswestry disability score and the flexor endurance time. It was also observed that females showed a slightly lower endurance time than men.

The analysis shows a significant correlation between non specific low back pain, assessed by the Oswestry Disability questionnaire, and flexor muscle endurance performed by the McGill’s flexor endurance test. This implies that individuals with non specific low back tend to have less endurance of the flexor muscle.

**Table 3:** Correlation values

	ODI score	Endurance tests
Pearson’s correlation	1	0.622
Significance two-tailed	-	0.001
N	6	6

## Discussion

The purpose of the study was to find a correlation between non specific low back pain and the endurance of flexor muscles which is clinically important from ergonomic point of view. According to the results obtained, the subjects with non specific low back have shown significantly lower flexor endurance when compared to the normative data calculated by McGill et al, 1999. The test and the results provide us an insight into the stability of the spine and the performance of the trunk muscles.

One of the primary stabilizers of the trunk is the Transversus Abdominis (TrA), which is one of the first muscles to be active before the movement of the proximal or distal segment.<sup>15,16</sup> It functions by stiffening the lumbar and sacroiliac segments to prevent any uncoordinated and uncontrolled movements of the trunk with the limb movements<sup>16</sup> and helps to maintain correct posture during work. The thoracolumbar fascia (TLF) and the TrA are directly attached, and function of the TLF is to increase the Intraabdominal Pressure (IAP). Any weakness or inefficiency of the TrA reduces the shear strain function of the TLF, hence reducing the IAP making the lumbar spine unstable, increasing the inappropriate loading of the spine and contributing to poor ergonomic posture.<sup>17</sup>

It can be well understood that the trunk muscles are physiologically functioned to provide stability to the spine by working at low activity levels for a prolonged duration, hence they are abundant in Type I slow oxidative fibers.<sup>18</sup> The composition may be altered due to deconditioning and changing to anaerobically functional resulting into instability and pain.<sup>19</sup>

The spinal stability and control depends on the coordinated action of the deep muscles of the trunk.<sup>15</sup> It has been observed that recurrence of the non specific low back pain has been related with altered motor coordination and an increasing fatigability of the trunk muscle<sup>8,9</sup> and this may contribute to poor posture or poor ergonomics at work.

The muscles around the trunk when working in synergy, are able to provide adequate support. If any one of the groups, whether the agonist or the antagonist fails to activate and contract in a synergistic manner, the other group has to compensate by working more than it rather would. This leads to changes at a global level by changes in posture, or at a segmental level by alterations in the movement of each segment. All of this, leads to a lower endurance, an imbalance of strength as well

as endurance, between the agonist and antagonist muscle groups hence, back pain. This persistent pain further changes the muscle activation pattern in the abdominals as well as the paraspinals, leading to a dysfunction in the deep abdominals hence becoming a vital contributor and component which results into LBP development.<sup>20</sup> It also increases the risk of lower limb injuries due to altered activation patterns and muscle function in their endurance.

Therefore, core endurance training is essential and must be incorporated into rehabilitation programs so as to reduce the risk of injury and to prevent recurrence of pain. Along with endurance training, interventions that aim to restore the balance between the two muscle groups, a coordination between the core and lower limb muscle function, as well as adequate strength of the muscles is essential for the management of low back pain with a non specific origin.

## Limitations

The study sample was small, consisting of 6 subjects only, hence, the results cannot be generalized to the whole population. Most of the subjects were endomorphic, implying a change in the body composition and presence of more body fat than lean mass. This certainly would lead to a lower endurance result.

## Conclusion

The result of this study shows a considerable reduction in flexor muscle endurance in individuals with non specific low back pain. Moderate correlations were shown between the Oswestry disability score (ODI) and the flexor endurance times, and these values were shown to be highly significant. Hence, it can be concluded that there is a relationship between the two, and this can be incorporated as a tool of assessment and can be used in the rehabilitation programs to enhance patient's function and efficiency. This data may be used in the ergonomic training of people suffering from non specific low back pain at work. Correct posture during work is of utmost importance for adequate functioning of the neuromuscular system as well as the musculoskeletal system and appropriate load transfer.

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