

Correlation of Back Extensor Muscle Endurance with Oswestry Disability Index in Middle Aged Females with Chronic Low Back Pain

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Abstract: *The back extensor endurance is important to maintain ideal posture. There is paucity of literature on back extensor endurance in subjects with chronic low back pain in middle aged female population. The objective of our study was to compare the back extensor endurance in middle aged females with and without chronic low back pain and correlating it with the oswestry disability index. Total 30 participants were taken 15 in each group. Biering psorensens test and oswestry disability index was performed. The results showed subjects without low back pain had significantly better endurance ($p < 0.0004$). Significant negative correlation ($p < 0.0099$) was found between back extensor endurance and oswestry disability index.*

Keywords: back extensors endurance, chronic low back pain, oswestry disability index

1. Introduction

In today's society low back pain is one of the most common medical disorder in both the developed, developing as well as the underdeveloped countries[1]. In India the low back pain frequency has been found to range from 6.2 % to 92 % [2]. The prevalence of low back pain has been found to increase as the age increases and is more common among females[2]. Certain physical factors such as lifting heavy loads, continuous and repetitive workload, prolong static and faulty postures can put individual at risk of Low back pain. Also, psychological and social factors such as anxiety, depression, work dissatisfaction, mental and emotional stresses contribute to low backache. Especially in females, hormonal imbalance during post-pregnancy period and perimenopausal stage causes musculoskeletal changes. Apart from above mentioned factors long working hours, obesity have found to be associated with low back pain[2]. All these issues result in a considerable economic burden not only in India but all over the world which includes the healthcare facility budget, sickness absenteeism, work conditioning, work hardening and job simulation[1].

Chronic pain defined as pain that lasts beyond the expected period of healing that is more than 3 months.[3] It may not have a particular underlying pathological epidemiology. Chronic low back pain can also be explained as back pain which recurs frequently since it affects the individual over a long duration of period intermittently.[4]

In the lumbar region there is physiological and structural fragility which causes chronic low back pain. Mostly caused by an improper posture known as living functional impairment.[3] Along with the core muscles the back extensors include the multifidus muscle, erector spinae muscles contract and help to stabilize the trunk. The most superior structure is the thoracolumbar fascia which gives rise to latissimus dorsi muscle, the gluteus maximus, the internal and external oblique and the transversis abdominis and surrounds the erector spinae and the multifidus muscle of the lumbar region.[5] The coupled action of the latissimus

dorsi, contralateral gluteus maximus, and the tension through the thoracolumbar fascia will compress the lumbosacral region and make it stable.[6]

The erector spinae includes the longissimus and the iliocostalis muscle group and generally known as the extensors of the trunk. The longissimus thoracis, pars thoracis and the iliocostalis lumborum pars lumborum forms a deep layer.[5]. The superficial layer along with its long moment arm and excellent line of pull produces extension of the thoracic and lumbar regions. During trunk flexion from a standing position, the erector spinae are the muscles which are responsible for the eccentric contraction to control the motion.[6] These deep erector spinae as similar in orientation and function to the levator scapulae in the cervical region. These muscles are situated close to the axis of rotation and therefore do not have sufficient moment arm to be the prime movers into extension.[6] Due to their oblique orientation the muscles exert a posterior shearing force on the vertebrae. In addition to posterior shear, they also exert compressive forces and provide an extremely significant dynamic resistance to the constant anterior shear forces of the lumbar region caused by the lordotic position and the forces of gravity and ground reaction forces[6].

The trunk muscles being a postural muscles has to work during static and dynamic activities. Muscle endurance contributes to good posture and good health of the individual.[7] Endurance is the ability to work for prolonged periods of time and the ability to resist fatigue [8]. The trunk muscles are physiologically designed provide low level of activity for longer duration and called as postural muscle.[9]. Due to the weakness of lumbar spine and muscles around it, the alignment (position and compatibility) of the entire spine gets altered, thus causing faulty postures, instability of the lumbar spine and all the soft tissue and passive structures around the lumbar spine gets excessively burdened leading to lower back pain.[9] The common complaints of people with low back pain are back fatigue, tiredness in the back region and back muscle aching.[7] Thus our study is aimed to find out the back extensor muscle endurance and

correlate it with Oswestry Disability Index in middle aged females with chronic low back pain.

2. Methodology

This study is a Cross sectional Observational correlation study in which thirty females between 30-50 age group having low back pain with or without radiation in lower limb more than 3 months VAS less than 7 and BMI between 25.0-29.9 (overweight) to 30.0-34.9 (class 1 obesity) were included and Age and BMI matched females having no low back pain for at least last 3 months

Females having acute or sub acute low back pain, pathological (eg. Pott's spine, tumor, etc) and traumatic conditions (eg. Fractures) of the musculoskeletal and neurological system, Congenital deformity of spine and lower limb, previous back surgery, vascular disease, pregnancy or had an oophorectomy or hysterectomy, or menstruation alone were excluded. The subjects were explained about study procedure, written consent was taken. Group A consisted of 15 middle-aged female subjects with chronic low back pain and Group B consisted of 15 age and BMI matched female subjects without low back pain

The Biering-Sorenson's test was used to measure the back muscle endurance.

Biering-Sorenson's test : A treatment couch was chosen and the participant was made to lie prone on it, with the edge of iliac crests aligned with the edge of the treatment couch. Three straps were used to fixate the lower body to the couch. One at the greater trochanter of the femur. Second at the popliteal fossa and third at the ankle as close to the malleolies as possible.[1]. The straps were tightened securely and care was taken that there was minimal discomfort to the participants because of the straps. The participants were allowed to rest their upper body on a stool for comfort and to minimize fatigue, whilst the lower body was secured by the straps on the treatment couch.[1]. As the test begun the participants had to place their arms diagonally across their chest and had to maintain the body in a neutral position for as long as possible.[1]. A stopwatch was used to measure the time the participant could hold the position. Test was terminated if : excessive fatigue takes place, downward tilt of trunk by more than 10°, unbearable pain or when 240 seconds were reached.[1]. During the test the participants were verbally encouraged to maintain the position for as long as they could. This procedure was repeated for three times to get three readings, one minute of break was given in between the tests so as to give the back muscles rest and to avoid undue fatigue. During the rest pause the participant placed the hand back on the stool. Mean of the three readings was taken for the study.

To assess the disability due to low back pain the Oswestry Disability Index was used and it has shown to be valid and rigorous measure of condition specific disability. The participant were given an Oswestry Disability Index questionnaire and was explained about how to fill it.



Figure 1: Subject performing Biering-Sorenson's test

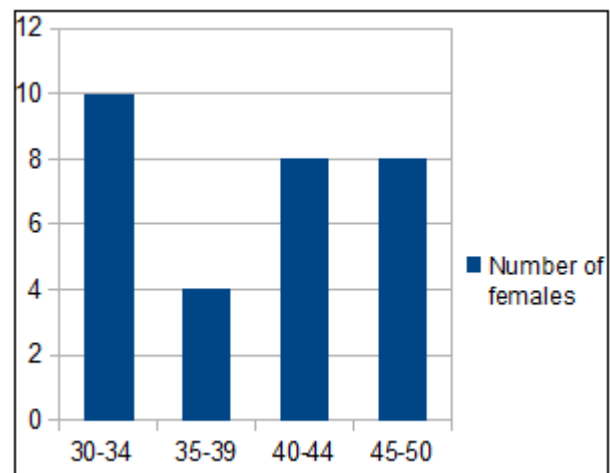
3. Result and Analysis

The data was analyzed using Graph-pad InStat 3.10

The means were compared using descriptive statistic. Comparison of back extensor endurance between the groups was done using unpaired t test. Spearman's correlation coefficient was used to correlate the Biering-Sorenson score and the Oswestry Disability Index in females with low back pain since the data was not passing the normality test

Table 1: Age group distribution

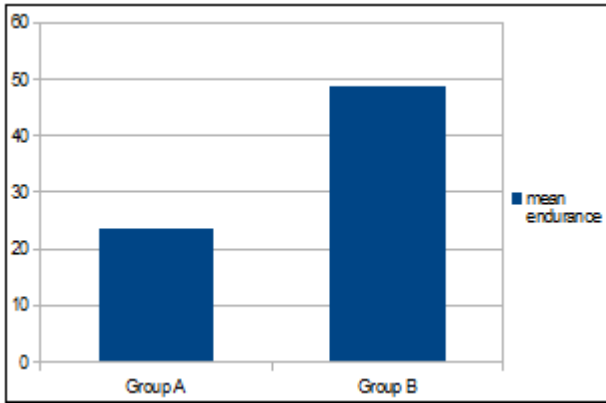
Age groups	Number of females
30 – 35	10
36 - 40	4
41 - 45	8
46 - 50	8



Graph 1: Age group distribution

Table 2: Back extensor muscle endurance in subjects with and without low back pain

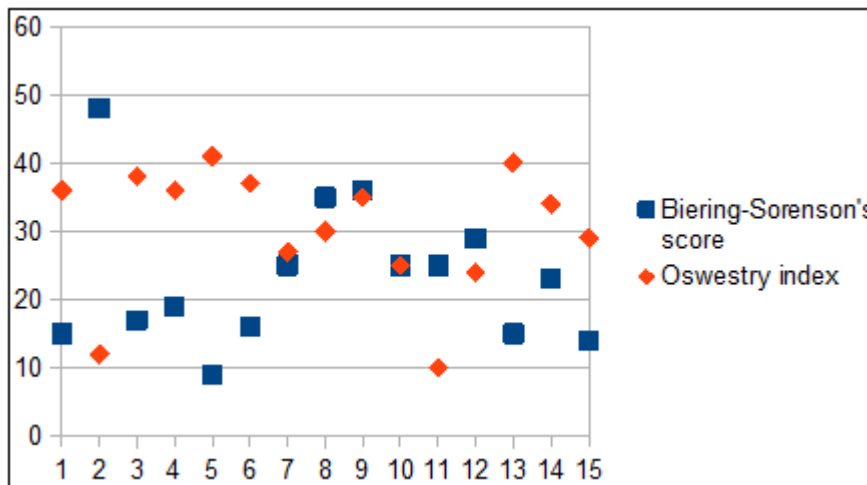
	Mean endurance	SD	'P' value
Group A	23.4	+10.3	0.0004 Extremely Significant
Group B	48.66	+16.5	



Graph 2: Back extensor muscle endurance in subjects with and without low back pain

Table 3: Correlation of Biering-Sorenson score and oswestry disability index

	Mean	SD	'r' value	'p' value
Back extensor endurance	23.4	+10.32	-0.64	0.0099 very significant
Oswestry disability index	30.27	+9.42		



Graph 3: Correlation of Biering-Sorenson score and oswestry disability index

4. Discussion

This study was done to find out the correlation between back extensor muscle endurance and the oswestry disability index in middle-aged females with low back pain. Age and BMI matched females without low back pain were taken to compare the endurance of back extensor muscle. The subjects were divided into two groups, group A and group B. Group A consisted of middle-aged females with chronic low back pain. Group B consisted of middle-aged females without low back pain. The mean age of females in group A was 40 ± 7 years and the mean age of females in group B was 39 ± 6 years. The mean BMI of females in group A was 29.9 ± 2.6 and the mean BMI of females in group B was 29.8 ± 2.5 .

The subjects were made to perform the Biering-Sorenson's test to evaluate back extensor muscle endurance and the reading was noted in seconds. The mean muscle endurance of subjects in group A is 23.4 ± 10.3 seconds and the mean muscle endurance of subjects in group B is 46.6 ± 16.5 seconds. Thus the back extensor muscle endurance of group B is considered to be significantly better than group A ($P < 0.0004$). The correlation between the Biering-Sorenson's score and oswestry disability index is significant as it showed negative correlation in group A (r value = -0.6418, p value = 0.0099).

The back extensor muscles are classified as postural muscles which aid in maintaining upright standing posture and controls lumbar forward bending.[9]. It is also classified as postural/antigravity muscles, as these are rich in large diameter type one muscle fibres, they are suited to support low levels of activities for a longer period of time.[9]. Mohammad Reza Nourbakhsh et al found the paraspinal muscle in participants with chronic low back pain fatigues faster as their endurance is low when compared with those in asymptomatic individuals.[9] Thus the back extensor muscles are not able to maintain the alignment of lumbar spine causing faulty postures. Malalignment of the lumbar spine causes the soft tissues and passive structures around the lumbar spine to get excessively burdened leading to chronic low back pain.[3][9] According to Mohammad Reza Nourbakhsh among the different factors tested, back muscle endurance had the highest association with low back pain, where as other factors had low association with low back pain such as the length of back extensor muscles, the strength of hip flexor muscles, hip adductor muscles and abdominal muscles also had a substantial association with low back pain.[9]

As these muscles are active and always recruited whether one is sitting, standing, lifting etc adequate back muscle endurance is necessary in order to prevent low back pain. The back muscle endurance is not given much importance until they experience low back pain. According to Mary T. Moffroid et al in USA, low back pain episode is said to

happen to 80% of the population at some phase or the other in their lives and almost half of this population will have a recurrence within a year progressing to chronic low back pain.[7]

Though the subjects in Group B had no symptoms of low back pain but their back muscle endurance is less when compared to the normative value of back muscle endurance which is 240 seconds.[10] Thus they may have a risk of developing low back pain in future if endurance training is not started for them. The low endurance in symptomatic as well as asymptomatic middle-aged females may be attributed to lack of fitness exercises, lack of recreational activities, post pregnancy trunk muscle weakness not taken care.[9]. The back muscle endurance has the highest association with low back pain and sedentary behavior[9]. As per literature, lack of exercises leads to poor back muscle endurance, thus increasing the risk for low back pain whereas more leisure activities or occupational physical activities were linked with greater back muscle endurance.[9]. Therefore assessment and training of back muscle endurance should be practiced frequently as a part of clinical strategy to prevent and manage low back pain in middle age female population.[9]

5. Conclusion

The back extensor muscle endurance in middle age female subjects with chronic low back pain is significantly less as compared to asymptomatic age and BMI matched subjects. Although asymptomatic subjects' endurance is less than normative value. Significant negative correlation is present between back extensor muscle endurance and disability associated with low backache. Hence it is important to incorporate back extensor endurance training especially in middle aged female population both symptomatic and asymptomatic.

Future Scope Larger sample size and future study can be done for training the back extensor endurance in the middle-aged female with chronic low back pain.

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