



An Observational Study on Gluteal Muscle Surface Electromyography and Physical Activity in Male Adults with Non-Specific Low Back Pain

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Nonspecific low back pain is defined as a low back pain without a plausible cause alike to that in the European guiding principles. Every year around 15%-45% of adults suffer from low back pain and 5% of people visit hospital with a new episode. Approximately 10% were having work absenteeism and about 20% had persistent symptoms for 1 year. Gluteus medius weakness and gluteal muscle tenderness are common symptoms in people with nonspecific LBP. Surface electromyography (sEMG), a measure of muscle activity, allows both a patient and clinician to have direct and immediate access to muscle functioning that is not possible with manual palpation or visual observation. In addition too much or too little physical activity is associated with low back pain.

Objective: To analyze the activity of gluteus maximus and medius with surface EMG among young male adults with nonspecific low back pain. To analyze the correlation between IPAQ and NPRS

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among young male adults with nonspecific low backpain.

Participants and Methods: This observational study was conducted in six dots health enhancement academy with total of 50 participants. The participants were selected based on inclusion and exclusion criteria. The sampling method used is convenient sampling method. The outcome measure used was (sEMG), IPAQ and NPRS.

Results: There is a significant, weakness of right and left gluteus medius. The EMG activity of right and left gluteus medius ($R=44.37$, $L=44.34$) indicates the weakness compared to EMG activity of right and left gluteus maximus ($R=47.41$, $L=47.01$). There is a significant correlation between NPRS and IPAQ; the p value 0.027 which is <0.05 .

Conclusion: This observational study results proved that there is a significant difference between EMG activity of gluteus medius and maximus, in which gluteus medius muscles were weaker than gluteus maximus muscles among young male adults. There is a significant correlation between numerical pain rating scale and international physical activity questionnaire, which states that increase in physical activity, can increase severity of pain among young male adults.

Keywords: IPAQ; NPRS; gluteus Medius; gluteus Maximus; sEMG; Nonspecific low back pain.

1. INTRODUCTION

Low back pain is highly prevalent complaint and is reportedly associated with decreased activities of daily living (ADLs) and quality of life (QOL). A specific diagnosis of low back pain cannot be obtained in approximately 80% patients with low back pain, indicating that patients with low back pain are often diagnosed with nonspecific low back pain [1].

In the clinical guidelines Nonspecific low back pain is defined as low back pain that is not attributing to a recognizable, specific pathology [2]. A minority of cases of back pain result from physical causes such as trauma to back by a motor vehicle crash or a fall among young people. Other activities such as heavy lifting and prolonged sitting (especially in cars, trucks, and poorly designed chairs) can provoke back pain [1].

Muscle weakness or imbalance of hip abductors and rotators, specifically the Gluteus maximus and Gluteus medius resulting in faulty lower extremity kinematics has been observed in a number of debilitating and painful conditions of the back, hip and knee. Gluteus medius weakness and gluteal muscle tenderness are common symptoms in people with nonspecific LBP [3].

Surface EMG show well suitable for both the patients and the researchers to explore lower back muscle actions in laboratory studies as well as in clinical trials [4]. It is also a technique in which electrodes are placed on the skin covering a muscle to detect the electrical activity of the

muscle [5]. Signal amplitude of surface EMG is positively related to the amount force produced by the muscle. Studies have reported both linear and nonlinear relationships between electromyography (EMG) signal amplitude and force production during the contraction of skeletal muscles [6].

Physical activity has numerous health benefits related to physiological and psychological health and can reduce all causes of mortality and risk factors of wide variety of chronic diseases which includes musculoskeletal diseases, previously some studies have been found out there is an inverse relation between physical activity and low back pain and some studies are also found out that either low level of physical activity or high level of physical activity is associated with low back pain [7,8].

Recent studies proved Gluteus Medius weakness in low back pain subjects compared to unaffected side or with normal counterpart and also in individuals with chronic low back pain had weaker gluteus medius muscles than control subjects without back pain [9].

The present study was designed to assess the EMG activity of gluteal muscles and the level of physical activity in young male adults associated with Non Specific Low Back Pain. Surface EMG possibly provides objective data in monitoring the alternation of signal amplitude of myoelectric activity of gluteal muscles in young male adults. Early detection of the reduced activity of gluteal muscle will have a positive effect in the treatment of low back pain.

2. MATERIALS & METHODOLOGY

This study is an observational study conducted in physiotherapy department of six dots health enhancement academy, kazhipattur for 3 months under the supervision of staff in charge. A total of 50 participants based on the inclusion and exclusion criteria were included in the study. Informed consents were obtained from all participants. The sampling method followed to select the participants is convenient sampling method. The inclusion criteria for this study is male participants with Nonspecific low back pain, aged 18-29, and those who are willing to participate in the study. The participants are excluded if they have any specific pathology which is causing low back pain like intervertebral disc prolapse, spondylolisthesis, spinal stenosis, spinal fractures, history of low back surgery, Inflammatory arthritis. NPRS scale is used to evaluate the low back pain in the participants. Physical activity is assessed by the IPAQ questionnaire. Gluteal Muscle activity is assessed by using surface EMG. Electrode placement for Gluteus Maximus: 1/2 the distances between the greater trochanter and sacral vertebrae. Electrode placement for Gluteus Medius: proximal 1/3 of distance between ilia crest and greater trochanter [10].

2.1 Statistical Analysis

SPSS was used for statistical analysis, continuous data was compared by one sample 't' test and independent 't' test, Pearson correlation coefficient analysis for correlation.

3. RESULTS

50 male subjects selected according to the inclusion criteria by convenient sampling method and collected data were statistically analysed. Mean and standard deviation were calculated to find out the statistical differences, P value was set as <0.05.

The mean age of the subject was 21.04(S.D=1.33), the mean BMI was

22.88(S.D=2.37).the demographic characteristics of participants were analysed using one sample 't' test.

The EMG activity for right gluteal muscle among young adults with nonspecific low back pain was analyzed using the Independent 't' test. The mean value for right gluteus maximus 47.41µV/s whereas for right gluteus medius 44.34 µV/s which states that right gluteus medius is weaker than the right gluteus maximus; the 'P' value is 0.00 which is <0.05. The EMG activity for left gluteal muscle among young adults with nonspecific low back pain was analyzed using the independent 't' test. The mean value for left gluteus maximus 47.01µV/s whereas for left gluteus medius 44.34µV/s which states that left gluteus medius is weaker than the left gluteus maximus; the 'P' value is 0.00 which is <0.05 (Table 1).

The EMG activity of gluteal maximus among young adults with nonspecific low back pain was analysed using the Independent 't' test. The mean value for right gluteus maximus 47.41µV/s whereas for left gluteus maximus 47.01µV/s which states that both gluteus maximus showed equal EMG activity; the 'P' value is 0.08 which is >0.05. The EMG activity of gluteal medius among young adults with nonspecific low back pain was analyzed using the Independent 't' test. The mean value for right gluteus medius 47.37µV/s whereas for left gluteus medius 47.34µV/s which states that both gluteus maximus showed equal EMG activity; the 'P' value is 0.95 which is >0.05 (Table 2).

The NPRS and IPAQ was calculated using Pearson correlation table. As shown in table 3 there was a significant correlation between physical activity and pain scores($r=1$, $r=0.443$); the p value 0.027 which is <0.05 (Table-3). As the r value is 1 and 0.443 there is a perfect positive relationship between the variables. That whenever there is an increase in the physical activity there is an increase in the low back pain.

Table 1. Comparison of EMG activity right and left side gluteal muscles

	Side	Muscle	Mean	S.D	T-Value	P-Value
1.	Right	Gluteus maximus	47.41	0.93	5.39	0.00
		Gluteus medius	44.3	2.65		
2.	Left	Gluteus maximus	47.01	0.627	10.56	0.00
		Gluteus medius	44.34	1.097		

Table 2. Comparison of EMG activity of gluteusmaximus (right and left side), gluteus medius (right and left side)

Muscle	Side	Mean	S.D	t-value	P-value
1. Gluteus maximus	right	47.41	0.93	1.78	0.08
	left	47.01	0.627		
2. Gluteus medius	right	44.37	2.65	0.54	0.95
	left	44.34	1.097		

Table 3. Correlations between physical activity (ipaq) and pain scores (nprs) among young male adults with nonspecific low back pain

	IPAQ	NPRS	Significance
IPAQ PEARSON CORRELATION	1	0.443	0.027
NPRS PEARSON CORRELATION	0.443	1	

Based on the above results the EMG activity of right and left gluteus medius (R=44.37, L=44.34) indicates the weakness compared to EMG activity of right and left gluteus maximus (R=47.41, L=47.01). There is a significant correlation between NPRS and IPAQ; the p value 0.027 which is <0.05.

4. DISCUSSION

Low back pain has been considered as a cause of functional disability in the world wide. Gluteal muscles are one of the prime stabilizers of pelvis; they play an important role in transferring forces to spine in upright position. Particularly Gluteus Maximus is a powerful hip extensor and lateral rotator Where as the Gluteus medius is an important muscle which helps in maintaining the frontal plane stability of the pelvis. Thus any imbalances in the gluteal muscles causes instability of the pelvis which may change the function of postural control [11].

As defined by clinical practice guidelines non specific low back pain is not referred with a pausable cause. Although the exact pathophysiology of non specific low back pain is not clearly understood, lack of gluteus muscle activity is observed in the people with low back pain compared to subjects without low back pain. The evaluation of functioning of gluteal muscles by assessing their mayo electrical activity through surface EMG will be of great value.

Based on the results of this study, among the gluteal muscles, gluteus medius is weaker than the gluteus maximus. EMG activity of right and left gluteus medius (R=44.37, L=44.34) indicates the weakness compared to EMG activity of right

and left gluteus Maximus (R=47.41, L=47.01). This study agrees with previous studies showing gluteus medius weakness in the low back pain patients. Jie Qiao.MM et al stated that Gluteus medius is weaker in people with low back pain compared to unaffected side or with normal counterparts [9]. Barton Bishop, Jay et al found that individuals with chronic low back pain had weaker gluteus medius muscles than control subjects without back pain [12].

Current study also identifies that there is a significant correlation between the NPRS and IPAQ in young male adults. Lack of physical activity and being in sedentary life style has been considered as a risk factor for development of non specific low back pain [13]. in this study it showed a positive relationship between the variables. Thus increase in physical activity will have an increased effect on low back pain.

Lower extremity kinematics are very much useful in maintaining the gait cycle. These kinematics are disturbed if there is any imbalances in the hip abductors and rotators specifically the Gluteus Maximus and Gluteus Medius. The weakness of these muscles will result in the change in the gait cycle and can cause an increase in low back pain and hip pain in walking [14].

Early assessment of the gluteal muscle activity may prove to be a good tool to predict the future possibility of the subject to develop LBP thus helping therapists to work on prevention of the condition [15]. Thus, adding hip abductor strengthening program in the rehabilitation protocol for nonspecific LBP patients may help in reducing their symptoms of pain and improve their quality of life [11].

5. CONCLUSION

This observational study results proved that there is a significant difference between EMG activity of gluteus medius and maximus, in which gluteus medius muscles were weaker than gluteus maximus muscles among young male adults. There is a significant correlation between numerical pain rating scale and international physical activity questionnaire, which states that increase in physical activity, can increase severity of pain among young male adults.

6. LIMITATIONS AND SUGGESTIONS

In this study the sample size is very small and it is limited only to young adults. Further research can be done with higher sample size and with different age group.

CONSENT

Informed consents were obtained from all participants.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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