



EFFECT OF PAIN AND FUNCTIONAL DISABILITY ON LUNG FUNCTION IN YOUNG INDIVIDUALS WITH NON-SPECIFIC CHRONIC LOW BACK PAIN

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Abstract: Low back pain is one of the most common and painful conditions one can suffer from over the course of their life, there are very few studies which relate low back pain and functional disability on lung function among young individuals.

Aims:

The aim of the study is to evaluate the effect of pain and functional disability on lung function among young individuals with non-specific chronic low back pain.

Settings and Design: convenience sampling technique

Methods and Material:

Methods: A sample group of 50 subjects were assessed on the basis of inclusion criteria and a total of 18 male and 32 female were selected.

Chronic non-specific low back pain individuals taken from Physiotherapy, Orthopedic and General medicine OPD of Durgabai Deshmukh Hospital and research centre were screened for the observational study

Results:

There is a significant effect of pain (VAS) on functional disability (ODI) where the values are correlated by using Pearson correlation technique which shows relation between VAS and ODI is $R=0.414$, $P=0.003 < 0.05$, significant at 5% level of significance and conclude that there is a 41.4% positive and strong significant correlation between VAS and ODI among the respondents.

There is a minimal effect of pain (VAS) on respiratory parameter (FVC) in chronic non-specific low back pain patients. The values (VAS) and (FVC) are correlated by using persons correlation technique shows the

relation between VAS and FVC is $R = -0.088$, $P = 0.541 > 0.05$, hence it is non-significant at 5% level of significance and conclude that there is a 8.8% negative and non-significance correlation between VAS and FVC among the respondents.

The relation between ODI and FVC is $r = -0.506$ and $p = 0.000$ which is less than 0.05 which means there is a 50.6 % negative and strong correlation. As the ODI is increasing the corresponding FVC is decreasing.

Conclusions:

The overall results of the study show significant effect of pain on functional disability (ODI) and functional disability on respiratory parameter FVC but minimum effect of pain on FVC.

Key-words: Non-specific chronic Low back pain, Forced vital capacity, Oswestry disability index, Visual analogue score.

TEXT

INTRODUCTION

Low back pain (LBP) is the most common and painful condition one can suffer from over the course of their life; it is estimated that 84% of the world population suffers from LBP at least once ^[1]. It is classified as acute within 6 weeks from the moment it appears, sub-acute between 6 and 12 weeks and chronic after the 12th week ^[2]

Back pain may occur due to degeneration of the spine, jobs that require repetitive lifting of heavy weights, jobs that require prolonged sitting as well as standing and mechanical stress over the intervertebral disc. In the adult age group there may be various causes such as ankylosing spondylitis, disc prolapse. People with sedentary jobs are more likely to be prone for back pain than the people whose work includes various activities. In adolescents age group, the traumatic back pain and the postural back pain may be the common cause ^[3].

Non-specific chronic low back pain (NSCLBP) is defined as low back pain that is not attributable to a recognizable cause, specific pathology (e.g., infection, tumor, osteoporosis, fracture, structural deformity, and inflammatory diseases, such as ankylosing spondylitis, radicular syndrome, and cauda equina syndrome) with a duration of more than 3 months ^[4].

Non-specific low back pain is tension, soreness and/or stiffness in the lower back region for which it is not possible to identify a specific cause of the pain. The most important symptoms of nonspecific low back pain are pain and disability. It has been found that individuals with a particular Respiratory disorder report higher rates of LBP and vice versa ^[5].

The lifetime prevalence of nonspecific low back pain in developed countries is estimated to be 60% to 70%. The prevalence of back pain in India is 19.8%. The prevalence rate for children and adolescents is lower than that seen in adults but is rising, prevalence increases and peaks between the ages of 35 and 55^[6].

During the last few decades, respiratory involvement in the field of spinal health has been proposed to be one of the important factor and this has been proposed through various models such as a model of

movement dysfunction, the clinical puzzle integrated model and multifactorial causative model for diagnosing and treating NS-LBP ^[7].

There is growing evidence of an association between altered respiratory function and back pain. The act of breathing is not possible with autonomic innervations alone. The somatic innervations to the muscles of respiration make breathing possible. In other words, breathing is a musculoskeletal activity to meet the needs of the visceral system, and thus to increase body functions. ^[8]

Several authors have reported altered breathing patterns in persons with chronic, nonspecific low back pain, including differences in lung capacity and diaphragm mechanics ^[9]. The abdominal pressure during inhalation creates a “sleeve” that tightens around the lumbar spinal area, stabilizing the spine and diminishing the electrical intervention of the spinal musculature. ^[10]

The central nervous system coordinates the motor activities of all trunk muscles (including the diaphragm) during both postural and respiratory tasks. Modulation of intraabdominal pressure occurs through coordinated activity of the diaphragm, abdominal and pelvic floor muscles (PFM), and such modulation may be important for the control of spinal stability ^[11].

In patients with LBP, the descending force of the diaphragm is low and therefore has no force to Create IAP ^[12]. Clinical instability in postural function of the diaphragm is thought to be an important cause of LBP ^[13]. The diaphragm is not only the main muscle of respiration but also contributes biomechanically in the maintenance of trunk stability as well as regulating the intraabdominal pressure ^[14].

In chronic low back pain, the coordinating function between the transverse abdominus and diaphragm is reduced. There are various studies which support the hypothesis that FVC is reduced in CLBP patients. The abdominal muscles prepare the diaphragm at the end of the expiration for next inspiration, and if the tone of abdominal muscles or the abdominal muscles recruitment is altered the effective deep inspiration gets affected; it may also be a possible cause for the reduction in the FVC ^[15]. A delayed contraction of Transverse abdominis and inhibition of multifidus have been observed in LBP-patients. These changes are associated with impaired spinal stability and are considered motor control deficits ^[16].

Biomechanically, the transverse abdominis and multifidus have 2 main respiratory effects, firstly it pulls the ribs along the margins and secondly it creates intra-abdominal pressure ⁽¹⁷⁾. Muscle imbalance and the spinal instability due to the Weakness of core muscles especially transverse abdominis and multifidus directly affects the respiratory function ⁽¹⁸⁾. Failure in these mechanisms alters its ability to generate effective respiratory force, which ends in permanent pulmonary dysfunction due to the plasticity of the tissue ^[19].

Respiratory muscle weakness also impairs the flow of air to inflate the lungs, thus ending in poor performance on expiration ^[20]. Chest wall restriction is one of the indications of reduced pulmonary function i.e. FVC ^[21]. The excursion of the diaphragm is reduced in CLBP patients and the recruitment manner of the diaphragm during inspiration shows an altered contraction pattern in CLBP patients as compared to the healthy controls ^[22].

Spirometry is the most common measure of pulmonary function and is a measure of volume and time. It is a simple and quick procedure to perform: patients are asked to take a maximal inspiration and then to forcefully expel air for as long and as quickly as possible ^[23]. Forced vital capacity is the volume of gas which is exhaled during a forced expiration starting from a position of full inspiration and ending at complete expiration ^[24]. It also has been reported in earlier studies, they suggest that chest wall restriction is the one of the indications of reduced pulmonary function such as FVC, 1 minute forced expiratory volume (FEV1) and the MVV ^[25].

Understanding the different components of respiratory regulation in NSCLBP may provide a new approach to the diagnosis and management of NSCLBP. Therefore, this present study endeavored on NSCLBP and attempted to add knowledge towards the constituent's related to respiratory component and to evaluate the influence of pain and functional disability on lung function among young adults suffering with chronic nonspecific low back pain, Chronic pain can reduce people's quality of life (QoL) due to suffering, failed treatments, medication dependence, social isolation, difficulties at work and emotional distress. Oswestry disability index is used to evaluate condition-specific disability and pain. Increase in ODI score causes reduction in value of respiratory parameters ^[26].

Materials and Methods:

Non-specific chronic low back pain patients taken from Orthopedic and General medicine and physiotherapy OPD. NSCLBP patients who had at least three episodes over a 6-month period characterized symptoms of LBP with age group 18-30 years (males and females) were included patient undergoing physical therapy treatment or recently have taken any treatment, Spine pathologies – spinal infections, spondylolisthesis, spinal stenosis and spine fractures were all excluded

Ethical clearance: The ethical committee of Durgabai Deshmukh college of physiotherapy, Hyderabad approved this study

Study Location: Durgabai Deshmukh College of Physiotherapy DDH & RC, Hyderabad Study population: Males and females

Sample size: 50 Sample groups of Non-specific chronic low back pain patients were selected. Study Design: convenience sampling technique

Results: Subjects who were assessed with non-specific chronic low back pain showed the effect of pain on functional disability (ODI) and functional disability on respiratory parameter FVC but minimum effect of pain on FVC.

Table 1 shows the gender and their frequency in the study. A total of 18 male and 32 females were taken. A total of 36% of male and 64% of female are taken.

Table 1 shows the gender and population selected

Group Statistics					
	GENDER	N	Mean	Std. Deviation	Std. Error Mean
AGE	MALE	18	24.39	3.165	.746
	FEMALE	32	25.91	3.421	.605

Table 2 shows correlation between VAS, ODI and FVC values

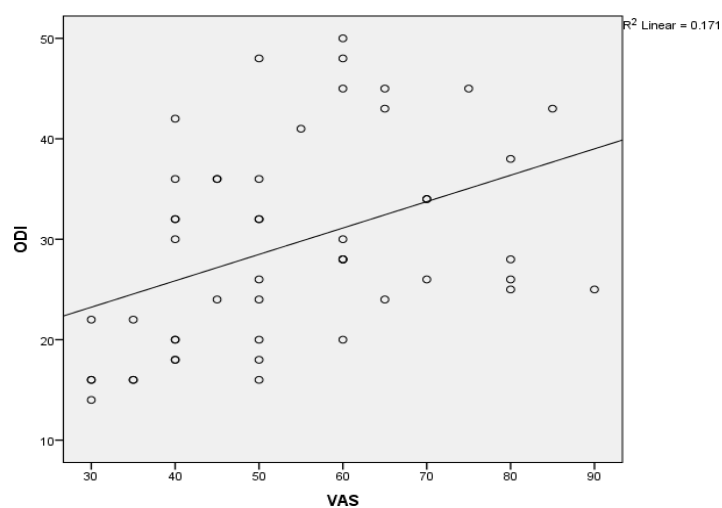
Correlations				
		VAS	ODI	FVC
VAS	Pearson Correlation	1	.414**	-.088
	Sig. (2-tailed)		.003	.541
	N	50	50	50
ODI	Pearson Correlation	.414**	1	-.506**
	Sig. (2-tailed)	.003		.000
	N	50	50	50
FVC	Pearson Correlation	-.088	-.506**	1
	Sig. (2-tailed)	.541	.000	
	N	50	50	50
**. Correlation is significant at the 0.01 level (2-tailed).				

TABLE 3. Statistics Of Age, Height, Weight, Bmi, Odi, Vas, Fvc

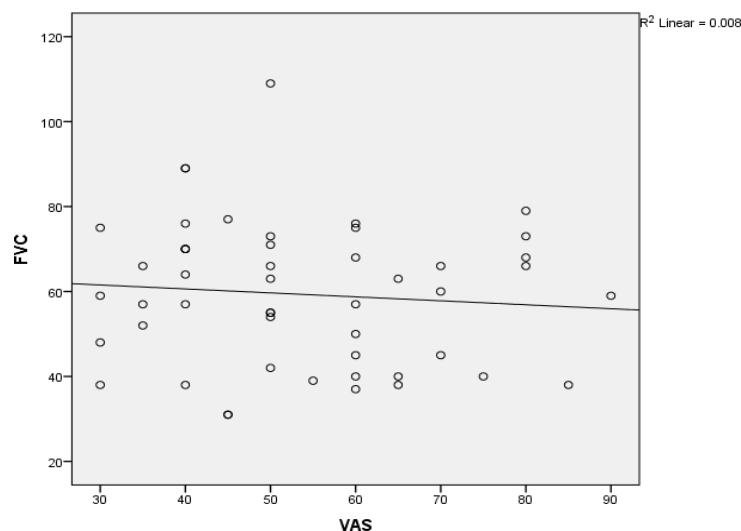
	AGE	HEIGHT	WEIGHT	BMI	ODI	VAS	FVC
N	50	50	50	50	50	50	50
MEAN	25.36	163.70	67.18	24.696	29.44	59.34	53.60
STANDARD DEVIATION	3.379	7.066	11.647	3.717	10.086	16.735	15.877

Table 3 shows the mean of age = 25.36, height = 163.70, weight= 67.18, Bmi= 24.696, odi =29.44, vas = 59.34, fvc = 53.60.

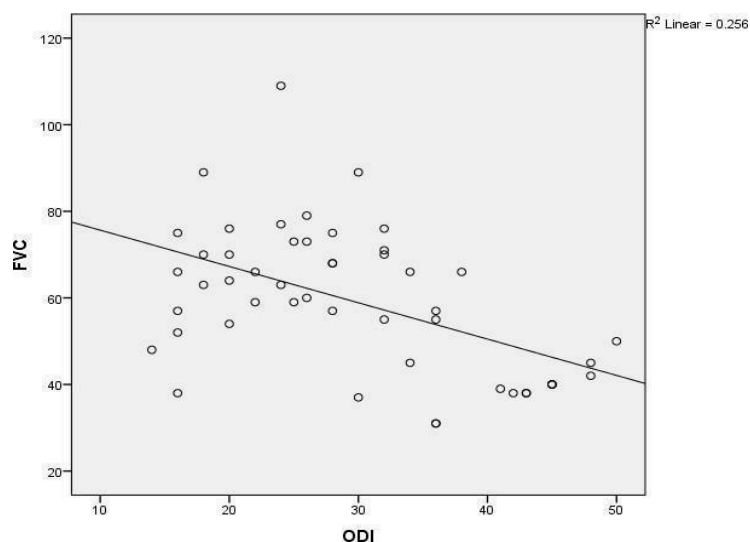
The graph 1 mentioned shows a moderate positive correlation of VAS and ODI



The graph 2 mentioned shows a negative correlation of VAS and FVC.



The graph 3 mentioned shows a negative correlation of ODI and FVC. As ODI is increasing FVC values are decreasing



Results of the study show the relation between VAS and ODI is $R=0.414$, $P=0.003 < 0.05$, hence it is significant at 5% level of significance and conclude that there is a 41.4% positive and strong significant correlation between VAS and ODI among the respondents.

There is a minimal effect of pain (VAS) on respiratory parameter (FVC) in chronic non-specific low back pain patients. The values (VAS) and (FVC) are correlated by using persons correlation technique shows the relation between VAS and FVC is $R=$

-0.088 , $P=0.541 > 0.05$, hence it is non- significant at 5% level of significance and conclude that there is a 8.8% negative and non- significance correlation between VAS and FVC among the respondents.

The relation between ODI and FVC is $r = -0.506$ and $p = 0.000$ which is less than 0.05 which means there is a 50.6 % negative and strong correlation. As the ODI is increasing the corresponding FVC is decreasing.

Discussion:

The results of the study, “Effect of pain and functional disability on lung function in young individuals with non-specific chronic low back pain” show that there is a significant effect of pain on functional disability and non-significant effect on respiratory parameter that is forced vital capacity (FVC) in chronic non-specific low back pain patients.

In the present study Males are 36% whereas females are 64% with mean age of 24.39 males and 25.91 females, shown in table 1 states that females are more affected than the male individuals. The biological response to pregnancy and childbirth, the physiological stress of child rearing, and the increase in abdominal weight until menopause are additional risk factors for LBP that indicate that women are more affected than men. A study by **Yì Xiáng J. Wáng 2016** literature review demonstrated that females had higher prevalence of LBP across all age groups.

In the present study, subjects had normal BMI. Though body mass index is normal, we find ODI scores to be altered. This might be due to increased mechanical demand during abnormal posture or work-related activity. This increases the load transfer down the lumbar spine, hence more compressive force is experienced by the lumbar spine with the increase in BMI.

A study by **Bhatti** (2019) states that there was negative association between FVC and overweight subjects, while there was positive association between FVC and Obesity. But our study shows that with normal BMI, there can be alterations in ODI and not in FVC.

Dimitriadis et al. found a significant decrease in some pulmonary function parameters (vital capacity: VC, FVC, and MVV) in patients with chronic neck pain. Also, previous studies on low back pain states that there is a weak but highly significant correlation between pain, disability and quality of life. This supports the current study that in patients with chronic low back pain the quality of life is getting affected.

Zacharias D et al studied the pulmonary function in patients with chronic neck pain and found a statistically significant reduction in vital capacity, expiratory reserve volume and maximum voluntary ventilation, but the peak expiratory flow, FEV1 and FEV1/ FVC ratio were not affected. In the present study also, there is no significant effect of pain on FVC in young individuals with low back pain.

LBP is the most prevalent musculoskeletal disorder which affects everyone at least once in their life and it is also one of the primary reasons for an individual visit to a physician. These patients often report physical discomfort and functional limitation. This association may be due to patients' difficulty in performing daily living activities which contribute to functional limitations and disability. This affects the social and emotional consequences of their living status.

In Rathinaraja's study, it is said that LBP directly affects muscle imbalance and spinal instability due to weakness in the major muscles, especially the multifidus and transverse abdominis. Biomechanically these muscles have 2 main respiratory effects, firstly it pulls the rib cage along the margins and secondly it increases the intra-abdominal pressure. Failure in these mechanisms alters its ability to generate effective respiratory force, which ends in permanent pulmonary dysfunction due to the plasticity of the tissue. Respiratory muscle weakness also compromises the maximum amount of air to inflate the lungs, thus ending up in poor respiration. A study by **Amit barua**, analyzed the relation between respiratory parameters (FVC and MVV) and chronic low back pain (VAS, ODI score and duration) through linear regression analysis and has shown increase in VAS, ODI and duration causes reduction in FVC values.

In the present study the subjects are young and VAS scores aren't high. If the subjects are younger

and their symptoms aren't severe, it's possible that there wouldn't be as pronounced an effect on physiological measures like FVC. This could suggest that the relationship between symptom severity and physiological changes may not be as evident in this particular population or context. The present research study was done on a small sample size, and additional respiratory parameters and quality of life were not assessed.

This study concludes that as pain severity increases, there's a corresponding decrease in functional ability, which in turn didn't affect lung function as is found in other studies may be because our study subjects were young. This study doesn't underscore the complex interplay between pain, physical function, and physiological parameters like lung function in young individuals with chronic low back pain. However, it's essential to consider additional research and factors that may influence these relationships.

ACKNOWLEDGMENT

I am indebted to my guide Dr. T. MADHAVI (PT), (PHD), M.P.T (ORTHOPAEDICS) CCCE, Associate professor, Durgabai Deshmukh College of physiotherapy. I would like to express my sincere thanks to principal Prof. G. CHAYA NANDINI MPT, (ORTHOPAEDICS).

I am grateful for having this opportunity to thank Dr. RAMU D MS ORTHOPAEDICS, Head of the department and Dr M Nageshwar his team Dr. GURU PRASAD, Dr. SAI PRASAD, Dr. SAINATH, Dr. ALEEM and my colleague Dr. HARI PRIYA (MPT)

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