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Association of chronic low back pain with chest expansion: A cross sectional study

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Abstract
Background: In chronic low back pain (CLBP), thoraco-lumbar fascia is taut due to transverse abdominis dysfunction, resulting in altered lumbar curvature causing active insufficiency of diaphragm thus reducing its capability of expanding the thorax. This study attempts to understand the relationship of chronic low back pain with chest expansion which is a lesser explored dimension.
Methodology: 30 chronic low back pain patients of age 35-45 were included in the study. Pain value was measured by visual analog scale [VAS] and chest expansion was measured by inch tape at nipple level in sitting position. The collected data were analyzed by Karl Pearson's coefficient correlation test to find the relationship between chronic low back pain and chest expansion.
Result: There was a moderate negative correlation between chronic low back pain and chest expansion with r value of -0.55.
Conclusion: This study concluded that as chronic low back pain increases the chest expansion decreases moderately.

Keywords: Chronic low back pain (CLBP), visual analogue scale (VAS), chest expansion

Introduction
Chronic lower back pain is the persistence of pain beyond 3 months of symptoms. Very often, the pain is "non-specific", meaning related to a mechanical origin. The main factors inducing the pain to become chronic are individual factors, psychological factors or socio-professional factors. The lifetime prevalence of back pain exceeds 70% in most industrialized countries [1].
CLBP can have a biomechanical origin with muscles, ligaments, facet joints, annulus fibrosis and spinal nerve roots have been suggested as the cause of the pain. Causes of low back ache with or without radiation constitute idiopathic degenerative, traumatic, inflammatory, congenital, neoplastic, metabolic, postural, gynecological, and renal or renal systemic causes pain, muscle tension or stiffness localized below the costal margin and above the inferior gluteal folds in the lumbo sacral region; without leg pain occurs in non-radicular CLBP, radiating pain, often with numbness, paresthesia and or muscle weakness occurs in radicular CLBP [2]. The body and its components are interconnected like a chain and thus any change or abnormality in one structure leads to change in another structure, Inspiration causes enlargement of thoracic cage (Chest expansion) in all diameters. Anteroposterior and transverse diameters of the thoracic cage are increased by the elevation of ribs. Vertical diameter is increased by the descent of diaphragm. In general, change in the size of thoracic cavity occurs because of the movements of four units of structures – Thoracic lid, upper costal series, lower costal series and diaphragm [3].
Diaphragmatic and transverse abdominal tone is key factors in providing core stability of the body. Diaphragm plays a key role in both respiration and spinal control [4].
Chronic Low back pain results due to altered muscular length tension. It is because of this alteration in loading of the muscle either in lengthened or shortened position of transverse abdominis and thoraco lumbar fascia. The taut thoraco-lumbar fascia and the other back muscle fall at insufficiency position thus resulting in approximation of lumbar spinous processes and alteration in lumbar lordosis. This altered lumbar curvature cause the diaphragm to fall at active insufficiency and thus plummeting its capability of expanding the thorax.

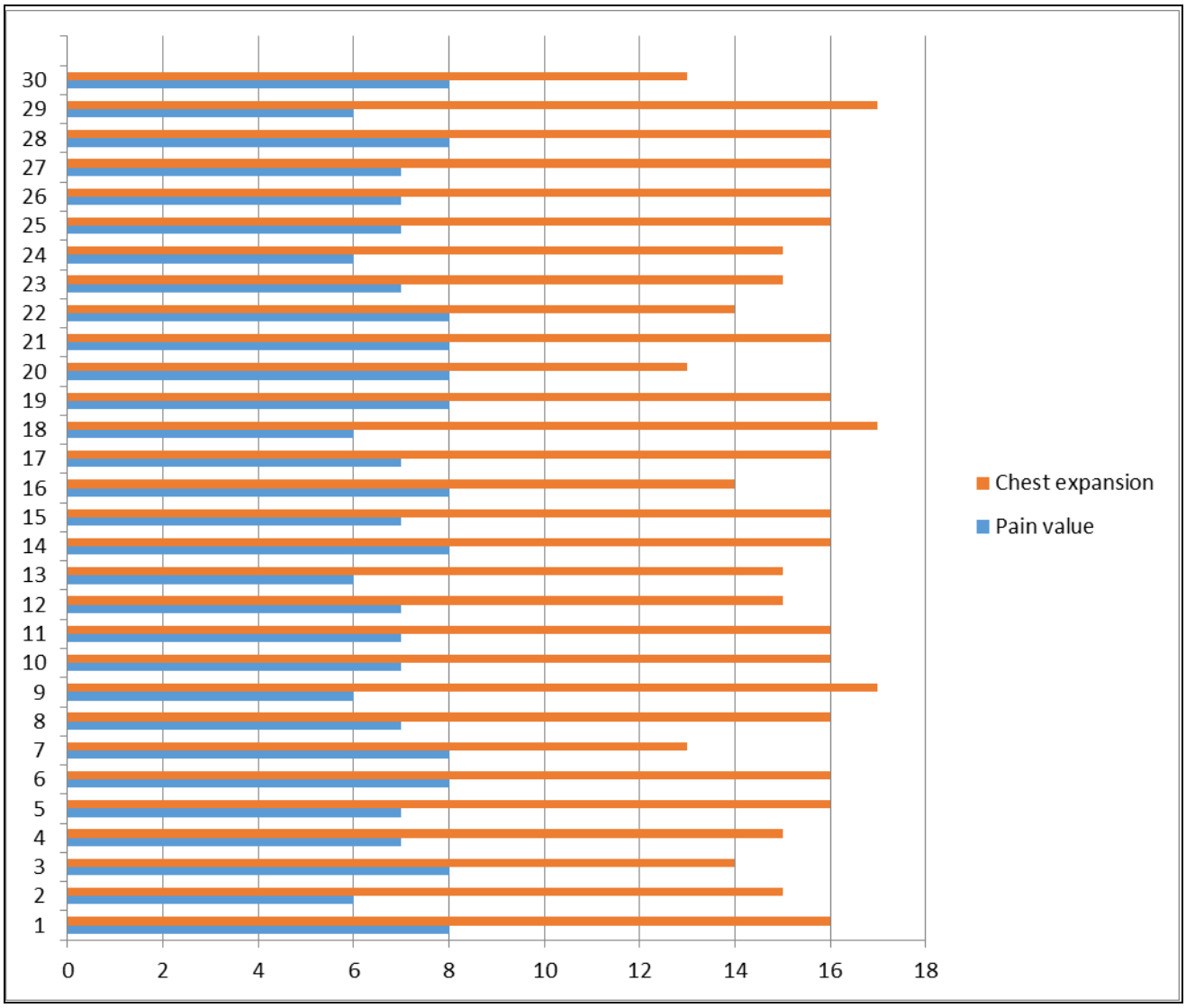
People with respiratory problems find difficulty in doing exercises and therefore they are more prone for the development of wrong postures and therefore leading to wasting and weakness of postural muscles and chronic muscle spasm resulting from psychological stress contributing to aggravation of chronic low back pain [5].

Methodology

Review Board of RVS College of Physiotherapy, Coimbatore has approved this descriptive study and a written consent was obtained from the participants after giving clear instructions regarding the procedure and its implications. This study was conducted in physiotherapy outpatient department of RVS College of Physiotherapy, Sulur, Coimbatore.30 adult males between 35 to 45 years were selected for the descriptive cross-sectional study. Pain values were measured using visual analog scale [6]. Chest expansion was measured using inch tape at nipple level [4th intercostal space] in sitting position [7]. The values were analyzed by Karl Pearson's coefficient of correlation.All extraneous variables were clearly identified and ruled out from the study.

Data Analysis and Results

The collected data were analyzed by Karl Pearson's coefficient correlation test.



Graph 1: Shows Distribution of Chronic low back pain and chest expansion value

The above bar diagram shows the linear correlation between 2 variables [chronic low back pain and chest expansion] among 30 patients.

Data's were analyzed by Karl Pearson's coefficient of correlation. The calculated r-value is -0.55. The negative value denotes that there is negative moderate correlation between pain and chest expansion in CLBP patients.

Discussion

As normal breathing pattern allows maximal lung expansion and therefore maximal gas exchange where diaphragm is the principal muscle for inspiration, evidence suggests it may also contribute to trunk stiffness and postural control.

In the present study there is a negative correlation between chronic low back pain and chest expansion which means as the pain value increases, the chest expansion decreases.

The result was supported by Mohan *et al*., (2018) [8] conducted a study to investigate alterations in breathing, respiratory strength and endurance, core stability, diaphragm mobility, and chest expansion among patients with NS-LBP and healthy individuals. The specific aim of the study was to correlate between respiratory function and other variables among NS-LBP patients. Thirty-four patients with NS-LBP were matched with 34 healthy participants before undergoing total faulty breathing scale, spirometer, respiratory pressure meter, chest expansion, ultrasound, and pressure biofeedback

measurements. There were signs of faulty breathing in the NS-LBP patients when compared to the healthy participants. Diaphragmatic mobility and respiratory muscle endurance were lower in the NS-LBP group. Chest expansion exhibited a significant decrease at the level of the fourth intercostal space in the NS-LBP group, but respiratory muscle strength and core stability were not significant between the two groups. Positive correlations were found to be fairly significant regarding respiratory muscle strength. The findings of this study indicated altered respiratory characteristics in the NS-LBP patients, and suggested that they would improve through respiratory exercises. The result of the study shows that there is a negative correlation between low back pain and chest expansion [8].

Respiration has a continuous fluctuating effect on intra discal pressure. This respiration induced intra discal pressure changes may play a role in the nutrition and consequently in the mechanical behaviour of the intervertebral disk. An appropriate thoracic expansion could therefore be very important in LBP-patients. If the deep intrinsic (local) spinal muscles fail to provide optimal control of segmental motion, several compensatory mechanisms may occur. First, uncontrolled movement of the lumbar spine and/or pelvis may occur. Second, global muscles such as external obliques or rectus abdominis may be recruited to provide global control of the lumbopelvic region. Also, the diaphragm may be used to enhance spinal stability, therefore causing disadvantage in respiration. When acute low back pain progresses into chronic low back pain, the thoraco-lumbar fascia is taut. This alters the lumbar curve angle and puts the diaphragm in active insufficiency position. And thus, the expansion of thorax is limited. Chest expansion can correlate with many other parameters such as age, sex, built, posture, lung volume and capacity.

Conclusion

A correlation study was conducted to investigate the relationship between chronic low back pain and chest expansion in 35 to 45 years adult male patients. Pain values and chest expansion were measured by visual analog scale and inch tape respectively. The study concluded that there is moderate negative correlation between pain and chest expansion, that is as pain increases, the chest expansion decreases.

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