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Evaluation of Chest Expansion Among Non-Specific Low Back Pain Patients

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ABSTRACT

Aim: To find out prevalence of alteration in chest expansion among non-specific low back pain patients
Background: The diaphragm is an essential muscle for breathing; however, it also has a role in preserving the segmental stability of the lumbar spine by maintaining and increasing the intra-abdominal pressure during postural tasks, diaphragm fatigue in LBP patients may compromise trunk muscle contribution to spinal control, leading to the development or recurrence of LBP or NSLBP, And these may affect chest expansion in NSLBP patients.
Method: In this study 65 patients with non specific low back pain were recruited & screened according to inclusion and exclusion criteria from Jalgaon city. The age group of study range from 18-65 yrs. The data was collected by using convenient sampling method. Chest expansion was measured using cloth tape at three levels that is 2nd Intercostal Space, 4th Intercostal Space and xiphoid process.
Result: The study showed 45 % patients with normal chest expansion values and 55 % patients with decreased chest expansion values out of 100%.
Conclusion: The study concluded that there is a significant alteration in chest expansion among non-specific low back pain patients. This shows that non specific low back pain may affect chest expansion.

Keywords: Nonspecific low back pain, Chest expansion, Cloth tape

INTRODUCTION

Low back pain is a common clinical problem and a serious significant socioeconomic problem. Although the lifetime prevalence of back pain is 60–80%.[1] Acute low back pain frequently disappears within 1 – 2 weeks. In those low back pain cases during which the origin of back pain can't be determined, the diagnosis given is nonspecific low back pain. [2]

Nonspecific low back pain is defined as low back pain undue to a recognizable, known pathology, like infection, tumour, osteoporosis, fracture, structural deformity, inflammatory disorder, radicular syndrome, or cauda equina syndrome. [2]

Some patients have pain in motion, but no pain when standing, and a some have pain after standing for so long time, but no pain in motion. O'Sullivan proposed a mechanism based organization dividing nonspecific low back pain into 3 subtypes supported pain provocative spinal postures and movement patterns.[3,4]

Non-specific low back pain (NS-LBP) could be a major unhealthiness encountered by physiotherapists and other medical professionals in daily clinical practice. Approximately 84% of individuals

encounter low back pain (LBP) in their lifetime, with a prevalence of roughly 23% [5]
The recurrence of low back pain increases as age advances, and its prevalence within the elderly population old age 40 and older is as high as 20 to 40%. On the opposite hand, the prevalence of low back pain is about 10 to 25% within the age group from the late teens to age 40, defined here as young and middle-aged people, and in this age group of people the incidence of low back pain itself is relatively low. Young and middle-aged group are highly active in daily life and are exposed to various stresses. Unlike in the elderly population, however, the aging-related changes are minimal in this age group. Due to these circumstances, therefore, low back pain in this age group is characterized by high incidence of "so-called low back pain", or nonspecific low back pain with none clear-cut diagnosis being specified.[6]
A systematic review of 18 prospective cohort studies have been reported conflicting findings between LBP and numerous factors including engaging in sports and exercise during leisure time, full body vibration during work, heavy physical work, and postures involving bending and/or twisting of the trunk while working (Bakker, et. al., 2009). [7]
Low back pain is often correlated with abnormal posture like an excessive lumbar lordosis. Excessive lumbar lordosis is also related to over lengthened and weak abdominal musculature. Poor neuromuscular control of core muscles (transverses abdominis, internal oblique, pelvic floor and diaphragm) has been described in individuals with sacroiliac joint pain and in individuals with lumbar segmental instability, potentially adversely affecting respiration.[8]
The dysfunction of motor control in the transversus abdominis muscle is related to chronic low back pain.(9,10) Shortening of the iliopsoas muscle was found to be the primary cause of lumbar hyper lordosis and excessive anterior pelvic tilt.[11] This abnormal alignment may inhibit the function of the transversus abdominis muscle [12,13]
While the role of the transversus abdominis muscle in lumbar stability is well documented, less well-known is the role of the diaphragm in lumbar stability. While the first function of the diaphragm is respiration, it also plays a role in spinal stability.[14]
The diaphragm is that the primary muscle of inspiration. The abdominal and thoracic cavities on which diaphragm muscle acts are involved in the stability of the trunk and postural control. Other respiratory muscles acting on the ribcage and abdomen are known to perform a postural function thats integrated with their respiratory role. For instance, activation of human intercostal muscles moves and stabilizes the ribcage. This activity is modulated by breathing. Contraction of the abdominal muscles contributes to trunk stability before and through movement of the limbs and this action is increased when respiratory demands increase.[14]
Co-ordination of the transversus abdominis and also the diaphragm in respiration during tasks in which stability is maintained by tonic activity of those two muscles. During inspiration, the diaphragm contracts concentrically, whereas the transversus abdominis contracts eccentrically. The muscles function in reverse during exhalation with the diaphragm contracting eccentrically while the transversus abdominis contracts concentrically.[15]
To the best of our knowledge, there are very few studies on assessment of alteration of chest expansion individuals with non specific low back pain. The purpose of this study is to see whether non specific low back pain affect the chest expansion. Objectives of this study to assess the chest expansion using cloth tape at three levels that is 2nd Intercostal Space, 4th Intercostal Space and xiphoid process following previous studies (Mohan V1, Dzulkifli NH2, et al, 2012)[17] in non specific low back pain patients.

MATERIALS & METHODS

- **Study Design** – Cross-sectional study
- **Study setting** – Jalgaon, Maharashtra
- **Sample size-** 65
- **Sampling Method –** Simple random sampling method
- **Study population –** Patients with non specific low back pain
- **Study duration-** 6 months
- **Selection criteria:**
  - **Inclusion criteria**:

I. Patients who were willing to participate.
II. Patients of 18-65 years of age.
III. Both male and female patients.
IV. Patients having non specific low back pain.

- **Exclusion criteria**:

I. Any history of trauma of lumbar region. History of lumbar spine pathology such as infection, tumour
II. Postural abnormalities like scoliosis.
III. Spine and upper limb fracture
IV. Known medical problems like osteoporosis and Tuberculosis of spine, bones or joints.
V. History of radicular syndrome or cauda equina syndrome.
VI. Any abnormal structural deformity
VII. Obese or overweight individual
VIII. Congenital deformity of spine & upper limb
IX. Any Respiratory problem

- **Materials**

I. Pen
II. Paper
III. Pencil
IV. Cloth tape (Measuring tape)

- **Outcome Measures:**
- **Chest Expansion Measurement**– chest expansion was measured using cloth tape at three levels that is 2nd Intercostal Space, 4th Intercostal Space and xiphoid process. Patient was asked to stand erect and hands on side, exhale the air as much as possible and then take a maximal deep inspiration. The difference between the full expiration and full inspiration was noted. Three trails were given at each level and average of three readings was noted. (ICCs for the fourth intercostals measurement ranged from 0.90 to 0.95 across occasions with P <0.001. and axillary level, the ICCs ranged from 0.90 to 0.95 across occasions with P <0.001. Similarly, the ICCs for the xiphoid level chest expansion measurement ranged from 0.95 to 0.97 across occasions with P <0.001.) [17]

Below table shows normal values of chest expansion[18] -

Sr. No.	Level Of Expansion	Age Group (in Years)	Values (in inches)	
			Male	Female
1	2nd ICS	18-24	3.18	2.72
		25-34	2.98	2.38
		35-44	2.9	1.95
		45-54	2.68	2.01
		55-64	2.19	1.75
		65 and above	2.13	1.69
2	4th ICS	18-24	3.12	2.61
		25-34	2.93	2.32
		35-44	3.01	1.93
		45-54	2.51	1.95
		55-64	2.2	1.88
		65 and above	2.09	2.13
3	Xiphoid Process	18-24	3.15	2.41
		25-34	3.23	2.46
		35-44	3.33	2.27
		45-54	2.86	2.17
		55-64	2.63	2.05
		65 and above	2.59	2.01

Procedure: -

To conduct the following study permission was taken from the principal of Dr. Ulhas Patil College of Physiotherapy, Jalgaon. Ethical clearance was obtained from institutional ethical committee. Patients were screened as per the inclusion and exclusion criteria and the procedure was explained. A written consent was obtained from the patients. Initially the demographic data that is Name, age, gender were assessed. Study procedure for chest expansion was carried out with study patients in standing position, elbows slightly flexed so that the hands rested on hips. With the help of non stretchable inch tape the chest expansion was measured at three levels that is 2nd Intercostal Space, 4th Intercostal Space and Xiphoid process. Patient was asked to exhale the air as much as possible and then take a maximal deep inspiration. The difference between the full expiration and full inspiration was noted. Three trials were given at each level and average of three readings was noted.

Statistical Analysis

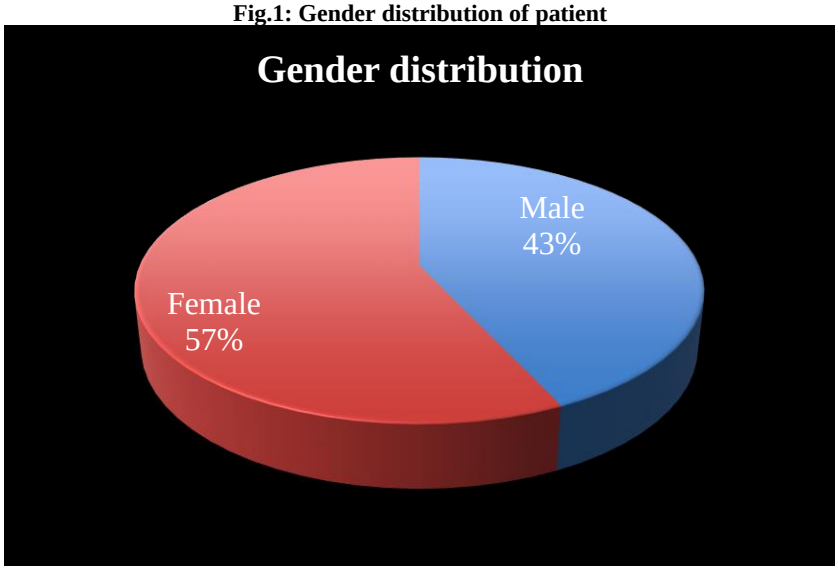
The entire data of the study was entered and cleaned in MS excel before it was the entire data of the study was entered and cleaned in MS excel before it was statistically analyzed in GraphPad InStat. All the results are shown in graphical format to visualize the statistically significant difference more clearly. The descriptive statistic was done for gender and age groups.

Descriptive Statics of Study Variables

Table 1: Gender distribution

Male	Female
(28) 43%	(37) 57%

Fig.1: Gender distribution of patient

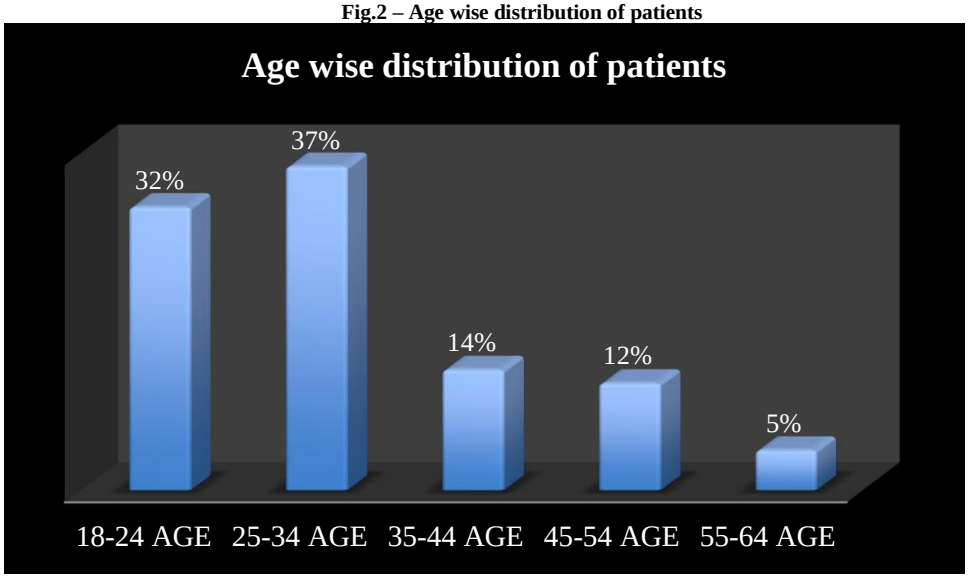


Interpretation - In this the table no.1 and Fig.1 shows gender distribution. In that total no. of male patients were (28) 43% and Female are (37) 57%.

Table no.2: Age wise distribution of patients

Age group	Frequency	Percentage
18-24	21	32%
25- 34	24	37%
35- 44	9	14%
45-54	8	12%
55-64	3	5%

Fig.2 – Age wise distribution of patients

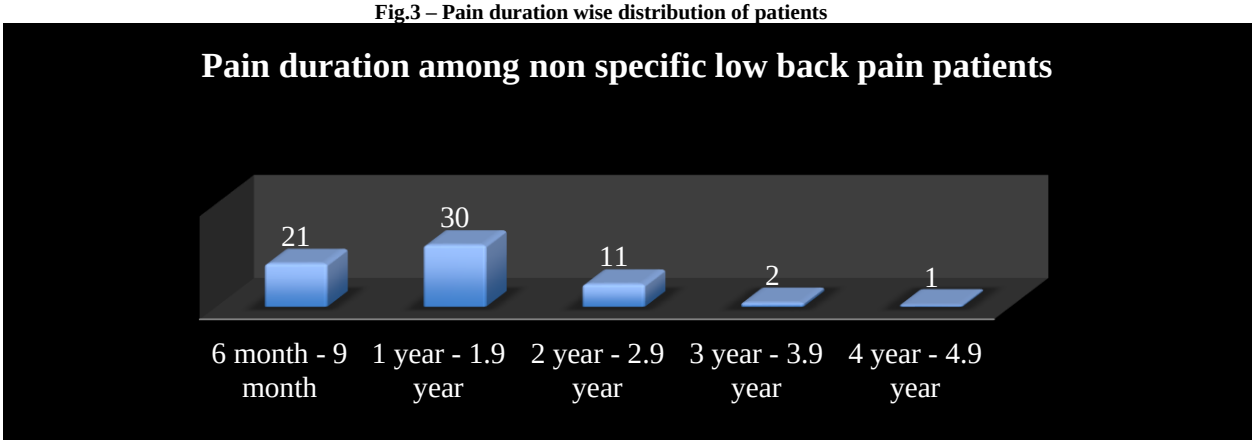


Interpretation - Table and Fig.3.2 shows age wise distribution of male and female of which 21 patients were in 18-24 age group, 24 patients were in 25-34 age group, 9 patients were in 35-44 age group, 8 patients were in 45-54 age group, 3 patients were in 55-64 age group.

Table no.3 – Distribution of patients per pain duration

Pain Duration	No. Of Patients
6 Months- 9 Months	21
1 Year - 1.9 Year	30
2 Year - 2.9 Year	11
3 Year - 3.9 Year	2
4 Year - 4.9 Year	1

Fig.3 – Pain duration wise distribution of patients

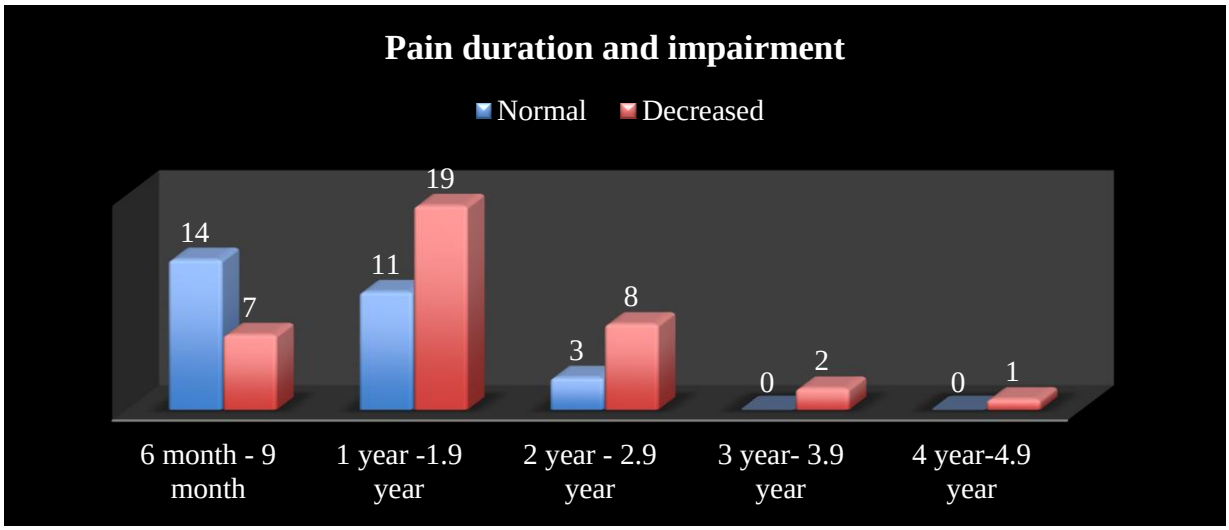


Interpretation - Table and Fig.3 shows pain duration wise distribution of patient which of 21 were in 6 months – 9 months, 30 were in 1 year -1.9 year, 11 were in 2 year – 2.9 year, 2 were in 3 year -3.9 year and 1 was in 4 year – 4.9 year.

Table 4: Variations of chest expansion values with the year of pain duration

Year of pain duration	Patients with normal chest expansion values	Patients with decreased chest expansion values	Total no. Of patient
6 months- 9 months	14	7	21
1 year - 1.9 year	11	19	30
2 year - 2.9 year	3	8	11
3 year - 3.9 year	-	2	2
4 year - 4.9 year	-	1	1

Fig.4: Variations of chest expansion values with the year of pain duration

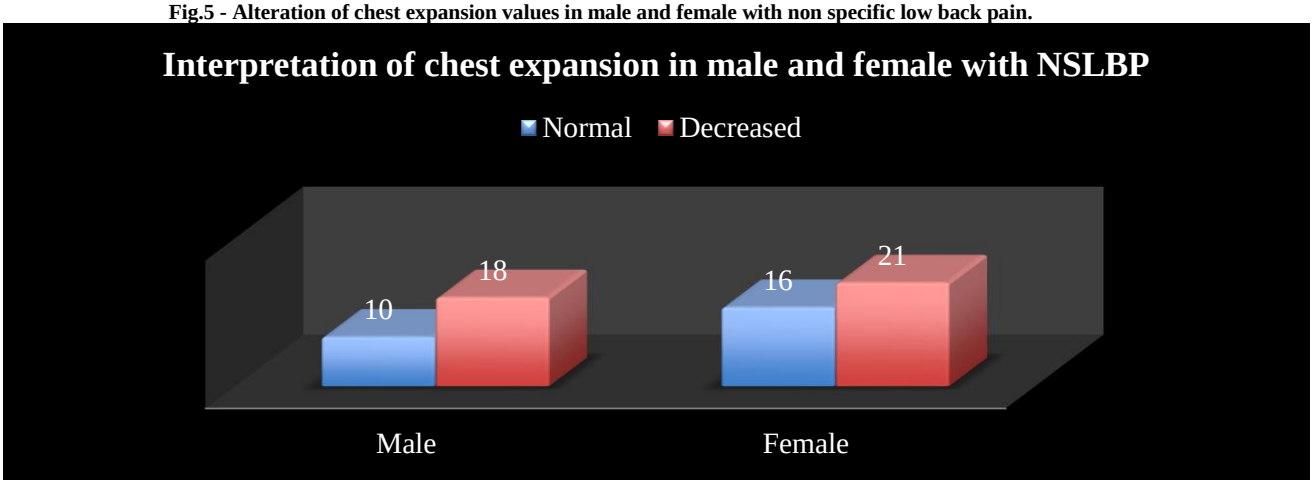


Interpretation - Table and Fig.4 shows the chest expansion values showed variations with the year of pain duration with lowest chest expansion values for 1 year and more than 1 year. As 14 patients were normal and 7 patients were found decreased chest expansion values out of 21 in 6 months -9 month , 11 patients are normal and 19 patients were found decreased chest expansion values out of 30 in 1 year – 1.9 year, 3 patients were normal and 8 patients were found decreased chest expansion values out of 11 in 2 year – 2.9 year, 2 patients were found decreased chest expansion values out of 2 in 3 year – 3.9 year, 1patient was found decreased chest expansion values out of 1 in 4 year – 4.9 year of pain duration of non specific low back pain.

Table no.5 - Alteration of chest expansion values in male and female with nonspecific low back pain.

Gender	Patients with normal chest expansion values	Patients with decreased chest expansion values	Total no. Patients
Male	10	18	28
Female	16	21	37

Fig.5 - Alteration of chest expansion values in male and female with non specific low back pain.

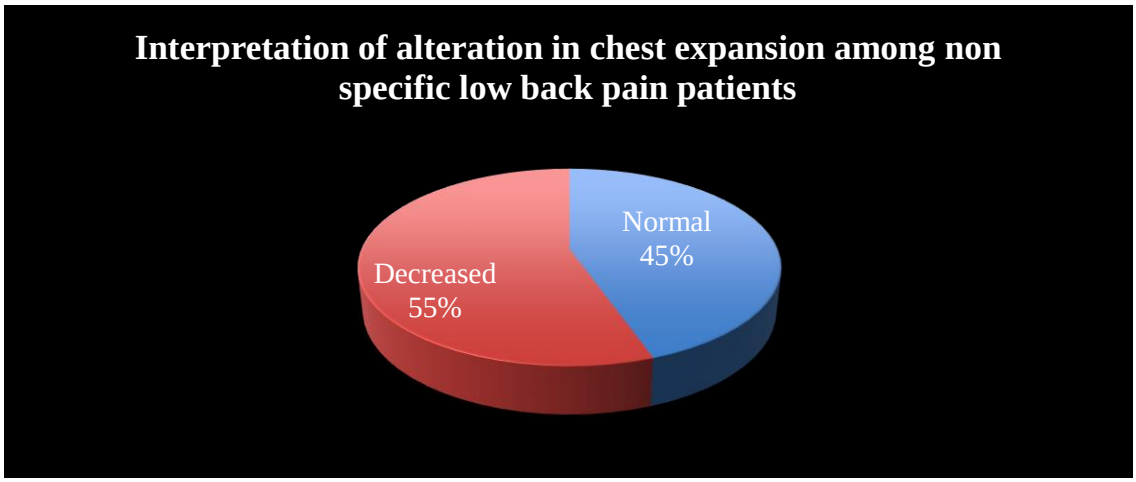


Interpretation - Table and Fig..5 shows the alteration of chest expansion values in male and female with non specific low back pain. in which out of 28 male patients, 10 patients were found with normal values and 18 patients were found with decreased values of chest expansion and out of 37 female patients, 16 patients were found with normal values and 21 patients were found with decreased values of chest expansion.

Table no.6: Interpretation of alteration in chest expansion among non specific low back pain patients

Evaluation	Patients with normal chest expansion values	Patients with decreased chest expansion values	Total no. of patients
Chest expansion values	(29) 45%	(36) 55%	65

Fig.6: Interpretation of alteration in chest expansion among non specific low back pain patients



Interpretation -Table and Fig.6 shows interpretation of alteration in chest expansion among non specific low back pain patients in which out of 65 patients we found (29) 45% patients with normal chest expansion values and (36) 55% patients with decreased chest expansion values.

RESULT

Present study was conducted to see the alteration of chest expansion in non specific low back pain patients. A total 65patients with non specific low back pain participated in the study (28 male and 37 females), with a mean age of mean 31.3076 years, SD 10.250 respectively. For the prevalence of alteration in chest expansion among non specific low back pain, cloth tape were used which showed 36 patients found decreased in values of chest expansion out of 65 patients i.e. out of 100%, 55% patient found decreased values and 45 % patient found normal values (Table no.6). Out of 28 male patients, 18 patients found decreased value of chest expansion and out of 37 female patients, 21 patients found decreased value of chest expansion (Table no. 5).

DISCUSSION

The study was survey based study for evaluation of alteration in chest expansion among non specific low back pain (NSLBP) patients were unaware about non specific low back pain can cause alteration in chest expansion. It had been found that decrease chest expansion in who has pain duration 1 year and more than 1 year.

A total no. of 65 patients were taken for the study. The data was analyzed by cloth tape (measuring tape). Among 65 NPLBP patients 57% were female and 43% were male. Age 18-65 (Mean age was ± 31.30) were taken. We found pain duration of NSLBP between 6 month to 4 year, 32% of patients were between 6 months to 9months , 45% of patients were between 1 year to 1.9 year, 17% of patients were between 2 year to 2.9 year, 3% of patients were between 3 year to 3.9 year, 2% of patients were between 4 year to 4.9 year, 55% of NSLBP patients observed chest expansion values lesser than expected , remaining 45% of NSLBP patients chest expansion was normal. The Chest expansion values showed variations with the year of pain duration with lowest chest expansion values for 1 year and more than 1 year. In 6 month – 9 month there were total 21 patients among that 14 patients were with decreased value

of chest expansion and 7 were normal , In 1 year – 1.9 year there were total 30 patient among that 19 patients were with decreased value of chest expansion and 11 were normal , in 2 year – 2.9 year there were total 11 patient among that 8 patients were with decreased value of chest expansion and 3 were normal, in 3 year – 3.9 year total 2 patients were there among that patients were with decreased value of chest expansion and in 4 year- 4.9 year there were total 1 patient among that 1 patients was with decreased value of chest expansion.

The diaphragm is an important muscle for breathing; however, it also has a role in preserving the segmental stability of the lumbar spine by maintaining and increasing the intra-abdominal pressure during postural tasks. [19] Individuals with low back pain have a disturbed proprioceptive input from the low back area; hence they achieve worse results in the stability limit tests (such as functional and lateral reach tests) than healthy Individuals. [20] The function of the diaphragm muscle deteriorates if non-specific low back pain occurs.[21] In these cases, the diaphragm has a higher position, decreased mobility, and greater fatigability. [21]

Evidence suggests that an absence of active spinal control may contribute to LBP, since the spine becomes more susceptible to loading during conditions like lifting and balancing. [22] The diaphragm fatigability in LBP patients may contribute to a decreased spinal control in this population via a number of potential mechanisms. First, its known that a rise in intra abdominal pressure provides 'relative stiffness' and thus control of the spine, which is required during loading tasks. [23]

Increasing intra-abdominal pressure has been suggested to unload the spine by activation of the trunk muscles.[24] Interestingly, isolated diaphragm contraction (by phrenic nerve stimulation), even in the absence of abdominal and back muscles activity, has been shown to contribute to spinal control by the increasing intra-abdominal pressure. [23] Moreover, the diaphragm has a direct anatomical connection to the spine via its crural fibers.[25]

Lotte Janssensa, Simon Brumagnea, et al conducted study on Greater diaphragm fatigability in individuals with recurrent low back pain, in balgium 2013, there result showed greater fatigability of the diaphragm in individuals with LBP. A mechanism by which greater diaphragm fatigability in LBP patients may contribute to a decreased spinal control in this population, is via the responses evoked by activation of the inspiratory muscle metaboreflex.[21] When the work of breathing is increased above a critical threshold, a reflex increase in sympathetic outflow is triggered. In turn, this induces a peripheral vasoconstriction, including in exercising muscles.[26] Thus, activation of the inspiratory muscle metaboreflex may impair muscle function, including muscles involved in spinal control.[27,28] According to various studies, it is reasonable to speculate that diaphragm fatigue in LBP patients may compromise trunk muscle contribution to spinal control, leading to the development or recurrence of LBP. The primary function of the diaphragm is respiration; it also plays a role in spinal stability.

Richardson et al.[29] describe coordination of the Transverses abdominis and the diaphragm in respiration during tasks in which stability is maintained by tonic activity of these muscles. During inspiration, the diaphragm contracts concentrically, whereas the transverses abdominis contracts eccentrically. The muscles function in reverse during exhalation with the diaphragm contracting eccentrically while the transverses abdominis contracts concentrically. Hodges et al. noted that during respiratory disease the coordinating function between the transverses abdominis and diaphragm was reduced.[30] O'Sullivan et al.[31] studied patients with LBP attributed to the sacroiliac joints and compared them to control patients without pain. O'Sullivan et al. compared respiratory rate and diaphragm and pelvic

floor movement using real time ultrasound during a task that required load transfer through the lumbo pelvic region (the active straight leg raise test). Patients with pain had an increase in respiratory rate, descent of their pelvic floor and a decrease in diaphragm excursion as compared to the control patients, who had normal respiratory rates, less pelvic floor descent, and optimal diaphragm excursion.

CONCLUSION

Our study shows prevalence of alteration in chest expansion among non specific low back pain patients so the study concluded that there is a alteration of chest expansion values in the patient with non specific low back pain patient and The Chest expansion values decreases with increased year of pain duration. Non specific low back pain can affect chest expansion.

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Ethical Approval: Approved

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