## CONCLUSIONS

### INDEX

<table>
<thead>
<tr>
<th>Chapter Index</th>
<th>Particulars</th>
<th>Page no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapter 6</td>
<td>CONCLUSIONS:</td>
<td>159 – 164</td>
</tr>
<tr>
<td>6.1</td>
<td>Conclusions</td>
<td>160</td>
</tr>
<tr>
<td>6.2</td>
<td>Limitations</td>
<td>161</td>
</tr>
<tr>
<td>6.3</td>
<td>Future Scope</td>
<td>162</td>
</tr>
<tr>
<td>6.4</td>
<td>Contribution to the Medical &amp; Physiotherapy Profession</td>
<td>163 – 164</td>
</tr>
</tbody>
</table>
CHAPTER – 6: CONCLUSIONS:

6.1: CONCLUSIONS:

Thus the present study concludes;

1. Among 216 chronic low back pain patients studied, significant reduction in the pulmonary function [FEV1 & PEFR]

2. Pulmonary function such as FEV1 and PEFR has moderate negative correlation with the pain and disability in patients with chronic low back pain patients.

3. Both core stabilization exercises and Yoga exercises [Asanas] significantly improves the FEV1 and PEFR value, significantly reduces pain and disability in chronic low back pain patients.

4. Among the 2 groups, core stabilisation exercises is statistically significant than the yoga in improving the FEV1 and PEFR and also in reducing the pain and disability in chronic low back pain patients.
6.2: LIMITATIONS:

- The limitation of this study includes those common with any other non-pharmacological trails for cLBP such as inability to blind the participants about their interventions and the self-report measures [VAS for pain and Rolland Morris Disability questionnaire for function].
- Wide range of age is considered to be the other limitations of this study.
- Though the subjects were advised to quit smoking, the follow up and the impact on the results were not monitored later.
- Accurate assessment of home practice and its dosimetry is limited due to the patients’ self-report bias.
- This study measured only the short term effect of the intervention [3 weeks, 6 weeks and 9 weeks].
- Though comorbidity like presence of hypertension, diabetes, asthma, etc., were documented its effect is not analysed.
- Among the core muscles, this study emphasise more on the effect of transverse abdominis muscle’s recruitment and strength in pulmonary function.
- Though this study assumes that the improvement in pulmonary function is due to the increase in TrA muscle strength, its recruitment and gain in LM muscle strength to maintain the low back stiff during forced expiration, the evaluation of these parameters is not done.
- Thus further study to thoroughly examine the relationship between the exercise program and the pulmonary function is necessary.
6.3: FUTURE SCOPE:

- This present study can be performed with a large sample size. Similarly the range of the age can be reduced to small interval instead the wide range [20-50 years] placed in this study.
- Interventions can be done in the supervised training program like group exercise program / in the laboratory / outpatient clinic, instead of home exercise program inorder to avoid self-report bias of the patients.
- Long term effect of the intervention can be studied instead of the short term effect studied in this present research.
- Though we assume that the increase in TrA muscle strength, its recruitment and gain in LM muscle strength to maintain the low back stiff during forced expiration is the reason for the improvement in pulmonary function we didn’t evaluate these parameters, so we suggest that direct measurement of the parameters will give accurate effect of the intervention.
- Thus further study to thoroughly examine the relationship between the exercise program and the pulmonary function is warranted.
- This study can be done with different type of exercise program, breathing technique, postural control etc., and find the effect of these interventions in pulmonary function.
- From this research, we learned that pulmonary function can be altered in the patients having low back pain.
- Core stabilization exercise besides reduces pain intensity and disability in cLBP, it also improves the selected pulmonary function [FEV1 & PEFR].
- Core muscle strength [Transverse Abdominis and Lumbar Multifidus] can be directly measured with Pressure biofeedback unit and their difference before and after intervention with reference to the pulmonary function can be analyzed.
6.4: CONTRIBUTION TO THE MEDICAL & PHYSIOTHERAPY PROFESSION:

- This is the first kind of study which explained the direct relationship of altered pulmonary function in the patients suffering from chronic low back pain.
- The present study shows that patients with chronic low back pain has reduced FEV₁ and this reduction may be due to the weakness in the back flexor as well as extensor muscles, intensity of the pain and the fear of movement Kinesiophobia.
- Pulmonary dysfunction in cLBP patients should be considered with clinical importance.
- Though this reduction is not sufficient to label the patients as having respiratory dysfunction, neuromuscular weakness shows the pattern of restrictive diseases on spirometric analysis.
- De Troyer A et al 2004 in their study about the analysis of lung volume restriction in patients with respiratory muscle weakness concluded that long term decrease in the lung flow and volumes may result in lung tissue pathology, pathomechanical changes in the vertebras and stiffness of the rib cage, which may end with the development of restrictive lung disease pattern.
- Correct breathing pattern gained by the co-contraction of the abdominal muscle clinically termed as the bracing technique in CSE, which in turn produces the trunk stiffness and stability of the spine [Thurlbeck WM 1970 & Perrin C 2004].
- Biomechanically, the expiration phase promotes active recruitment of the abdominal muscle which increases the intra-abdominal pressure and thereby stabilises the lumbar spine to re-establish the correct pattern of respiration [LoRusso TJ 1993, Kim 2005 & Feldman JL 2006] and we assume that this mechanism results in the improvement of the FEV₁ and PEFR value.
- According to Barr et al when there is a demand in external and internal force of the spine, the neuromuscular system alters stiffness of the spine and also produces the movement.
- When a normal subject moves in any direction, TrA is the first muscle to be activated but in the patient with LBP there is changes in the automatic control
of it as well as a significant delay in its activation which lead to the poor stabilization of the lumbar spine and pelvis [White A 1990].

- Enhanced pulmonary function achieved via core strengthening exercises not only increased respiratory volume but also played a role in stabilizing the lumbar spine through the co-contraction of flexor and extensor muscles.
- Thus, this method can be reduce lower back pain and enhance respiration and trunk stability when lumbar stabilization exercises are clinically administered for patients with a low level of stability. Furthermore, this method needs to be compared with other methods in future studies.