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# EFFECTIVENESS OF SPIROMETER EXERCISE ON CLINICAL PROFILE, QUALITY OF LIFE AMONG PATIENT WITH RELAPSE PULMONARY TUBERCULOSIS: AN EXPERIMENTAL STUDY

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**Abstract**

**Background:** The present study aims to evaluate the effectiveness of spirometer exercise on clinical profile & quality of life among patient with relapse pulmonary tuberculosis. **Method and materials** : The Quantitative research approach with quasi experimental study was conducted in the host institution of Saveetha Medical College and Hospital A Total of 60 study participants were recruited using purposive sampling technique was used in the study based on inclusion criteria the divided into 2 group ( 30 +30) 30 in used to collect the demographic data and pretest level respiratory status among the samples only experimental group exposed spirometer exercise, the posttest level of spo2 level and respiratory status were assessed using same questionnaire in both group **Results:** This infers that spirometer exercise on clinical profiles administered to the patients with relapse pulmonary tuberculosis was found to be effective in improving the level of respiratory in the post test. It Shows that in the experimental group the calculated paired 't' test value for $SPO_2$ (t=21.688, p=0.0001) was found to be statistically significant at p<0.001 level. In the experimental group the calculated paired 't' test value for dyspnea (t=18.154, p=0.0001) was found to be statistically significant at p<0.001 level. The quality of life results shows that in the experimental group the calculated paired 't' test value is (t=19.034, p=0.0001) was found to be statistically significant at p<0.001 level. This infers that spirometer exercise on clinical profiles administered to the patients with relapse pulmonary tuberculosis was found to be effective in improving the level of quality of life in the post test. **Conclusion:** This study demonstrate a positive association with posttest level of dyspnea and quality of life among patients with relapse pulmonary tuberculosis.

**Keywords:** Spirometer, Relapse Pulmonary Tuberculosis, Exercise, Respiratory Status.

## INTRODUCTION

Tuberculosis caused by tubercle bacillus which commonly affects the lung .one in three people within the world is infected with tubercle bacillus. People because ill will tuberculosis only the bacteria become active.[1] Tuberculosis is one of India's major public health problems. According to World Health Organization (WHO) estimates, India has the world's largest tuberculosis epidemic. In 2020, India accounted for 26% of the incident TB cases across the globe. India has incidence rate of 192 cases per 100,000 of population. (WHO, 2022)[2]. Common symptoms of active lung TB are cough

with sputum and blood sometimes, chest pains, weakness, weight loss, fever and night sweats. WHO recommends the utilization of rapid molecular diagnostic assays because the initial diagnostic test all together persons with signs and symptoms of TB as they need high diagnostic accuracy and can cause major improvements within the early detection of TB and drug-resistant TB.[3] Recurrent TB refers to a repeat occurrence (second, third or subsequent episode) of TB disease in a patient that occurs as a result of either relapse or re-infection. Recurrent TB occurs after the previous/initial episode has been classified as clinically cured according to WHO guidelines [smear or culture-negative sputum specimens in the last month of treatment and on at least one previous occasion, (WHO 2016)]. Relapse disease is a second (or third) episode of active TB disease due to re-emergence of the original infection, as determined by genotypic analysis of the prevailing tubercle bacilli.[4] As indicated for re-infection, substantive homogeneity in *M. tuberculosis* strains in any given setting, combined with high transmission rates, will make the classification relapse versus re-infection difficult. In these cases, whole-genome sequencing (WGS) to identify minor differences will provide the greatest insight.[5] Many adult survivors who had pulmonary TB develop chronic physical and psychosocial consequences such as persistently abnormal spirometer and reduced health-related quality of life (HRQoL). Spirometer exercise has been shown to improve symptoms, exercise tolerance and health-related quality of life (HRQL) in these patients[6]. Spirometer exercise has been found to be one of the most cost-effective treatments for tuberculosis, falling behind only influenza vaccination and pharmacotherapy for smoking cessation and faring better than all the inhaled treatments available for tuberculosis[7]. There has been a growing body of literature describing benefits of Spirometry exercise in patients[7]. We conducted our study to assess the effectiveness of spirometry exercise on clinical profile and quality of life among relapse pulmonary tuberculosis at selected hospital.

**Objectıves:**

1. To assess the effectiveness of spirometry exercise on clinical profile and quality of life among relapse pulmonary tuberculosis at selected hospital
2. To compare pretest and post-test on clinical profile and quality of life among client with relapse pulmonary tuberculosis patient in control and experimental group.

**Hypothesıs:** This is a significant difference between the pretest and posttest level of clinical profile and level quality of life among patient with relapse pulmonary tuberculosis

## METHODS AND MATERIALS

**Study design:** The quantitative research approach with quasi experimental research design was adopted for the present study aims to evaluate the effectiveness of spirometry exercise on clinical profile & quality of life among patient with relapse pulmonary tuberculosis **Study setting:** the study was conducted for the duration of 8$^{th}$ month from 20$^{th}$ December 2021 till 30 July 2022 in chest medicine ward of host institution **Ethical Approval :** After obtaining ethical clearance from an Institutional Ethical Committee (IEC) of Saveetha Medical College and hospital formal permission from the Department of Chest Medicine, the study was conducted. **Study participant** total 60 sample are selected by purposive sample technique which 30 in experimental group and 30 in control group, who met the inclusion criteria samples were selecte**d. Informed consent:** The purpose of the study was explained by the investigator to

each of the study participant and a written informed consent was taken. A pretest was conducted by using questionnaires interview schedule that consists of Part I- Demographic variables, Part II- Clinical variable, Part III- MRC Dyspnea Scale questionnaire, WHOQOL BREF questionnaires to relapse tuberculosis patient. After the pretest they were gathered or gave the instruction initially followed by a the patient is instructed to be hold your breath for 3 to 5 second then slowly exhale take 10 to 15 breath with your spirometer daily every 2 hours once for 6 week of the session patient clearly the doubts. The tuberculosis patient participated with full attention and a great interest post test was conducted using the same questionnaires. The collected data were tabulated and analyzed by using descriptive and inferential statistics.

## RESULT

Frequency and percentage distribution of demographic variables of patients with relapse pulmonary tuberculosis out of 60 samples, majority of sample 14(46.7%) were aged between 41 – 60 years, in experimental group, whereas 12(40.0%) were aged in 61 -80 years in control group. Regarding gender, 17 (30%) male were in experimental group whereas 15(50%) were male in control group. Regarding Habits of Smoking, 10(33.3%) had occasionally in experimental group, whereas 09(30.0%) had frequent smoking habits in control group. Consumed alcohol, 16(53.4%) in experimental group, whereas 11(36.7%) had occasionally consumed alcohol, in control group. 12(40.0%) had faced adverse effects while taking TB drugs and in experimental group, whereas 10(33.3%) had faced adverse effects while taking TB drugs in control group. Regarding duration of illness 11(36.7) had suffered 1-5 year in experimental group, whereas 13(43.3%) had the illness of below one year. Regarding Period of illness 11(36.7%) had the illness for 1 – 5 years in experimental group, whereas 3(43.3%) had the illness for below 1 year.

**Table 1: Assessment of clinical profile among patients with relapse pulmonary tuberculosis in the experimental and control group. N = 60(30+30)**

| Clinical Profiles | Experimental Group | | Control Group | |
|---|---|---|---|---|
| | Mean | S.D | Mean | S.D |
| Temperature | 97.05 | 1.68 | 96.99 | 1.86 |
| $SPO_2$ | 87.70 | 5.66 | 93.73 | 2.13 |
| Heart rate | 68.53 | 7.18 | 53.30 | 7.09 |
| Respiratory rate | 22.33 | 3.33 | 25.23 | 2.34 |
| Systolic BP | 120.0 | 8.30 | 132.67 | 12.29 |
| Diastolic BP | 83.33 | 4.79 | 82.33 | 6.26 |

Assessment of clinical profile among patients with relapse pulmonary tuberculosis out of 30 sample in the experimental group, the mean score of temperature was 97.05±1.68, $SPO_2$ (87.70±5.66), heart rate (68.53±7.18), respiratory rate (22.33±3.33), systolic BP (120.0±8.30), diastolic BP (83.33±4.79) and pulse rate (69.17±5.89). Whereas control group, the mean score of temperature was 96.99±1.86, $SPO_2$ (93.73±2.13), heart rate (53.30±7.09), respiratory rate (25.23±2.34), systolic BP (132.67±12.29), diastolic BP (82.33±6.26) and pulse rate (80.77±14.87). Shows that in the experimental group the calculated paired 't' test value for $SPO_2$ ($t=21.688$, $p=0.0001$) was found to be statistically significant at $p<0.001$ level. This infers that spirometry exercise on clinical profiles administered to the patients with relapse pulmonary tuberculosis was found to be effective in improving the level of $SPO_2$ in the post test. (Table 1).

**Frequency and percentage distribution of pretest and posttest level of dyspnea among in the experimental and control group.** It results shows that in the pretest of experimental group, 20(66.7%) had Grade 3 perceived respiratory difficulty, where as In the pretest of control group, 25(83.3%) had Grade 3 perceived respiratory difficulty, 7(23.3%) had Grade 2 perceived respiratory difficulty in experimental group. 2(6.7%) had perceived respiratory difficulty in control group . and 3(10%) had Grade 4 perceived respiratory difficulty in experimental group. 3(10%) had Grade 4 perceived respiratory difficulty in control group. In the post test, 26(86.7%) had Grade 1 perceived respiratory difficulty, in experimental group.3(10%) had Grade 0 perceived respiratory difficulty and 1(3.3%) had Grade 2 perceived difficulty. In the post test, 24(80%) had Grade 3 perceived respiratory difficulty, 4(13.3%) had perceived respiratory difficulty and 2(6.7%) had Grade 4 perceived respiratory difficulty.

**Effectiveness of spirometry exercise on clinical profile and quality of life among patients with relapse pulmonary tuberculosis.** Results shows that in the pretest, the calculated student independent 't' test value for $SPO_2$ (t=0.071, p=0.944) was not found to be statistically significant which clearly shows that there was no significant difference in the pretest level of $SPO_2$ between the groups shows that in the post test, the calculated student independent 't' test value for $SPO_2$ (t=24.90, p=0.0001) was found to be statistically significant at p<0.001 level which clearly shows that there was significant difference in the post test level of $SPO_2$ between the groups. It shows that in the experimental group the calculated paired 't' test value for respiratory rate (t=3.309, p=0.003) was found to be statistically significant at p<0.01 level. This infers that spirometry exercise on clinical profiles administered to the patients with relapse pulmonary tuberculosis was found to be effective in improving the level of respiratory in the post test. The table 7 shows that in the control group the calculated paired't'test value for respiratory rate (t=1.439, p=0.161) was not found to be statistically significant. This infers that there was no significant difference in the level of respiratory rate between the pretest and post test.

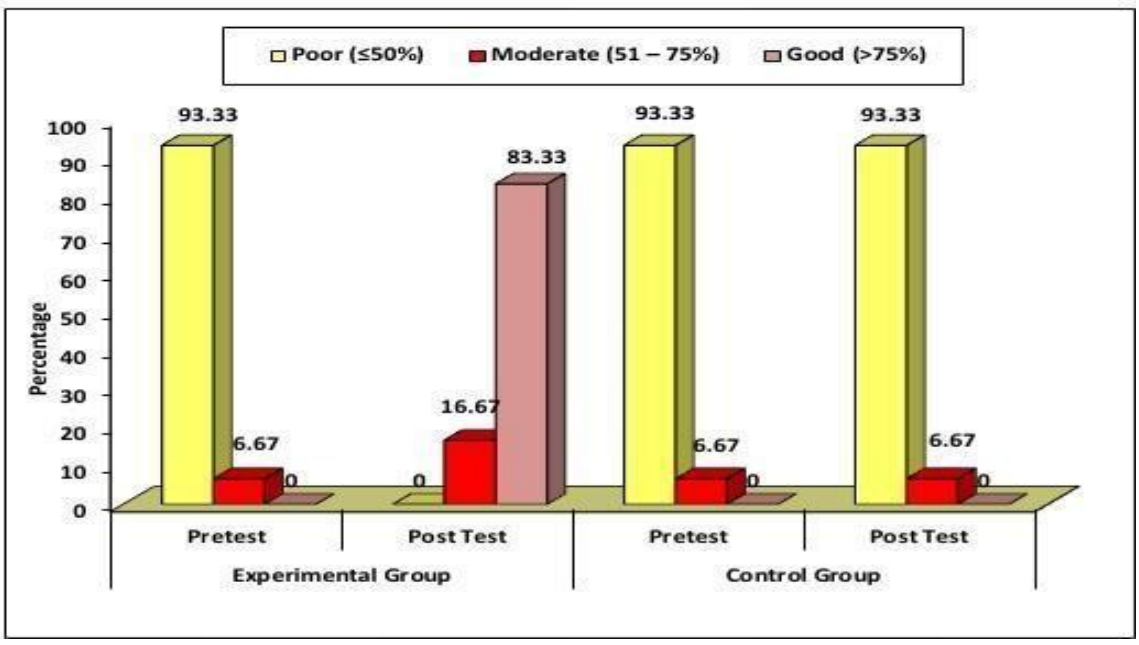


**Figure 1: Frequency and percentage distribution of pretest and post test level of quality of life among in the experimental and control group.**

Result shows that in the pretest of experimental group, 28(93.33%) had poor quality of life and 2(6.67%) had moderate quality of life. In the post test, 25(83.33%) had Good quality of life and 5(16.67%) had moderate quality of life. In the pretest of control group, 28(93.33%) had poor quality of life in the pretest and post and 2(6.67%) had moderate quality of life in both pretest and posttest. (Figure: 1)

**Table 1: Comparison of clinical profiles among patients with relapse pulmonary tuberculosis between the experimental and control group. N = 60(30+30)**

| Clinical Profiles | Experimental Group | | Control Group | |
|---|---|---|---|---|
| | Mean | S.D | Mean | S.D |
| Temperature | 97.05 | 1.68 | 96.99 | 1.86 |
| $SPO_2$ | 87.70 | 5.66 | 93.73 | 2.13 |
| Heart rate | 68.53 | 7.18 | 53.30 | 7.09 |
| Respiratory rate | 22.33 | 3.33 | 25.23 | 2.34 |
| Systolic BP | 120.0 | 8.30 | 132.67 | 12.29 |
| Diastolic BP | 83.33 | 4.79 | 82.33 | 6.26 |

The table 1 shows that the calculated student independent't' test value for temperature (t=0.131, p=0.896) and diastolic BP (t=0.695, p = 0.490) was not found to be statistically significant. This infers that there was no significant difference in the level of temperature and diastolic BP among the patients in the both the groups. The table 5 shows that the calculated student independent 't' test value for $SPO_2$ (t=5.465, p=0.0001), heart rate (t=8.265, p = 0.0001), respiratory rate (t=3.904, p=0.0001), systolic BP (t=4.675, p=0.0001) and pulse rate (t=3.982, p=0.0001) was found to be statistically significant at p<0.001 level. This infers that there was significant difference in the level of SPO2, heart rate, respiratory rate, systolic BP and pulse rate among the patients in the both the groups.

**Table 2: Comparison of posttest level of dyspnea among patients with relapse pulmonary tuberculosis between the experimental and control group. N= 60(30+30)**

| Test | Pretest | | Post Test | | Mean Difference Score | Paired 't' test & p-value |
|---|---|---|---|---|---|---|
| | Mean | S.D | Mean | S.D | | |
| Experimental | 2.87 | 0.57 | 0.93 | 0.37 | 1.94 | **t=18.154 p=0.0001 S*** ** |
| Control | 3.03 | 0.41 | 2.93 | 0.45 | 0.10 | t=1.795 p=0.083 N.S |
| Mean difference Score | 0.16 | | 2.0 | | ***p≤0.001<br>S – Significant<br>N.S – Not Significant | |
| Student Independent 't' test & p-value | t=1.294 p=0.201 N.S | | **t=18.909 p=0.0001 S*** ** | | | |

The table 2 shows that in the experimental group the calculated paired 't' test value for dyspnea (t=18.154, p=0.0001) was found to be statistically significant at p<0.001 level. This infers that spirometery exercise on clinical profiles administered to the patients with relapse pulmonary tuberculosis was found to be effective in improving the level of dyspnea in the post test. The table 8 shows that in the control group the calculated paired 't' test value for dyspnea (t=1.795, p=0.083) was not found to be statistically significant. This infers that there was no significant difference in the level of dyspnea between the pretest and post test. The table 4 also shows that in the

pretest, the calculated student independent 't' test value for dyspnea (t=1.294, p=0.201) was not found to be statistically significant which clearly shows that there was no significant difference in the pretest level of dyspnea between the groups. The table 8 also shows that in the post test, the calculated student independent 't' test value for dyspnea (t=18.909, p=0.0001) was found to be statistically significant at p<0.001 level which clearly shows that there was significant difference in the post test level of dyspnea between the groups.

**Table 3: Comparison of post test level of quality of life among patients with relapse pulmonary tuberculosis between the experimental and control group. N = 60(30+30)**

| Test | Pretest | | Post Test | | Mean Difference Score | Paired 't' test & p-value |
|---|---|---|---|---|---|---|
| | Mean | S.D | Mean | S.D | | |
| Experimental | 14.60 | 4.71 | 32.63 | 2.47 | 18.03 | **t=19.034 p=0.0001 S*** ** |
| Control | 14.77 | 4.34 | 15.0 | 4.06 | 0.23 | t=1.882 p=0.070 N.S |
| Mean difference Score | 0.17 | | 17.63 | | ***p≤0.001<br>S – Significant<br>N.S – Not Significant | |
| Student Independent 't' test & p-value | t=0.143 p=0.887 N.S | | **t=20.323 p=0.0001 S*** ** | | | |

The table 3 shows that in the experimental group the calculated paired 't' test value for quality of life (t=19.034, p=0.0001) was found to be statistically significant at p<0.001 level. This infers that spirometry exercise on clinical profiles administered to the patients with relapse pulmonary tuberculosis was found to be effective in improving the level of quality of life in the post test. The table 9 shows that in the control group the calculated paired 't' test value for quality of life (t=1.882, p=0.070) was not found to be statistically significant. This infers that there was no significant difference in the level of quality of life between the pretest and posttest. The table 3 also shows that in the pretest, the calculated student independent 't' test value for quality of life (t=0.143, p=0.887) was not found to be statistically significant which clearly shows that there was no significant difference in the pretest level of quality of life between the groups. The table 9 also shows that in the post test, the calculated student independent 't' test value for quality of life (t=20.323, p=0.0001) was found to be statistically significant at p<0.001 level which clearly shows that there was significant difference in the post test level of quality of life between the groups.

## DISCUSSION

Tuberculosis (TB) continues to be a major global health problem despite the efforts of the World Health Organization (WHO) and governments of all countries to unite and end TB by 2035. Pulmonary impairment after tuberculosis (PIAT) may be obstructive, restrictive, or mixed pattern, ranging from normal to severe impairment contributing to increased morbidity, The American Thoracic Society/European Respiratory Society have recently defined pulmonary rehabilitation as "a comprehensive intervention based on a thorough patient assessment followed by patient-tailored therapies, which include, but are not limited to, exercise training, education and behaviour change, designed to improve the clinical profile of people with tuberculosis and to promote the long-term adherence to health-enhancing behaviours" (Spruit MA et al., ) An incentive spirometer is a device that measures the volume of the air inhaled into the lungs during

inspiration. When breathing in through an incentive spirometer, a piston rises inside the device and measures the volume of the inspired air. The incentive spirometry device is widely used in physical, speech, and respiratory therapy as it encourages the patient to perform a slow and deep inspiration through visual feedback. Breathing in slowly is important with spirometer use as it allows the lungs to stretch and opens the airways. Dyspnoea is the most disabling symptom for people with tuberculosis and is often the reason that medical attention is sought. (Vestbo J, et al 2013). The current study results revealed that pulmonary tuberculosis out of 60 samples, majority of sample 14(46.7%) were aged between 41 – 60 years, in experimental group, whereas 12(40.0%) were aged in 61 -80 years in control group. Regarding gender, 17 (30%) male were in experimental group whereas 15(50%) were male in control group. Regarding Habits of Smoking, 10(33.3%) had occasionally in experimental group, whereas 09(30.0%) had frequent smoking habits in control group. The similar study was conducted to assess clinical variables on patient with tuberculosis. The results reveal that the mean age of the 29 participants was 45 years, and 52% were female. Improvements were seen in measures of chest pain; 13/29 (45%) participants reported chest pain at baseline but only 7/29 (24%) at the end of PR, and in those with persistent pain, the mean pain scores decreased. Mild hemoptysis was reported in 4/29 (17%) participants at baseline and in 2/29 (7%) at the end of PR With the rising global burden of CRD, further studies are needed to assess the value of PR in p-TBLD and other prevalent forms of CRD (Rupert Jones1 et al., 2016). The present study mean score of temperature was 97.05±1.68, $SPO_2$ (87.70±5.66), heart rate (68.53±7.18), respiratory rate (22.33±3.33), systolic BP (120.0±8.30), diastolic BP (83.33±4.79) and pulse rate (69.17±5.89). whereas control group, the mean score of temperature was 96.99±1.86, $SPO_2$ (93.73±2.13), heart rate (53.30±7.09), respiratory rate (25.23±2.34), systolic BP (132.67±12.29), diastolic BP (82.33±6.26) and pulse rate (80.77±14.87).shows that in the experimental group the calculated paired‘t’ test value for $SPO_2$ (t=21.688, p=0.0001) was found to be statistically significant at p<0.001 level. This infers that spirometry exercise on clinical profiles administered to the patients with relapse pulmonary tuberculosis was found to be effective in improving the level of $SPO_2$ in the post test. It shows that in the experimental group the calculated paired ‘t’ test value for respiratory rate (t=3.309, p=0.003) was found to be statistically significant at p<0.01 level. This infers that spirometry exercise on clinical profiles administered to the patients with relapse pulmonary tuberculosis was found to be effective in improving the level of respiratory in the post test. The table 7 shows that in the control group the calculated paired ‘t’test value for respiratory rate (t=1.439, p=0.161) was not found to be statistically significant. This infers that there was no significant difference in the level of respiratory rate between the pretest and posttest. Similar study was conducted by Dian Arif Wahyud et al (2020) to determine the effect of an active circle of breathing on pulmonary tuberculosis patients’ respiratory rate. Quasi-experimental design. The results showed the mean score of respiration rate before Active Circle of Breathing was 27.2 and after 23.2. The mean respiration rate scores before deep breathing exercises were 27.3 and after 26.1. There is an effect of an active circle of breathing on the respiratory rate of pulmonary TB patients (p-value 0.001). The another similar study was conducted by Niraj Kumar et al., (2019) study to compare the effectiveness of Incentive Spirometer and Inspiratory muscles trainer on ventilator muscle strength on patients with COPD this study, efforts were made to compare the effects of Incentive Spirometer and Inspiratory muscles trainer devices as a treatment for improving ventilator muscle strength in patients with mild to

severe dyspnea in COPD. The study was done on randomized 30 COPD patients with mild to moderate dyspnea diagnosed by physician. The patients were randomly divided into 2 groups consisting of 15 subjects each. Group A was treated with Inspiratory muscles trainer and Group B with Incentive spirometer for a duration of 4 weeks. The results demonstrated that the patients treated with both the intervention were highly significant in improving ventilatory muscle strength and hence decreasing the exertion dyspnea. However statistically there was significant difference between two groups. Our study results shows that in the experimental group the calculated paired 't' test value for quality of life (t=19.034, p=0.0001) was found to be statistically significant at p<0.001 level. This infers that spirometry exercise on clinical profiles administered to the patients with relapse pulmonary tuberculosis was found to be effective in improving the level of quality of life in the post test. The table 9 shows that in the control group the calculated paired't' test value for quality of life (t=1.882, p=0.070) was not found to be statistically significant. This infers that there was no significant difference in the level of quality of life between the pretest and post test. The current study results were supported by Kurt.J (2018) had conducted study on pulmonary tuberculosis health related quality of life lung function and exercise. PTB continues to negatively affect patients' health-related quality of life (HRQoL) and functioning even after cure to describe the demographics, respiratory symptoms, pulmonary airflow patterns, HRQoL and exercise capacity of cured PTB patients, in the Specific challenges resulted in 45 patients being included (male n = 25 [56%]; mean population age 39.9 [± 10.2]). HRQoL was assessed using the short-form 12v2, part of the burden of lung disease core questionnaire. In summary score = 45) were higher than mental scores (mental health component summary score= 39). The mean 6MWD was 294.5 m (± 122.7) m (range 110 m – 600 m), which is well below normal reference values. The combination of spirometry and HRQoL measures as tools to assess health and well-being after TB treatment represents strength of this study, as this further highlights the association between previous TB and long-term physical and psychosocial well-being. Hence above results revealed that the more effects were shows the after spirometry exercise on clinical profile and health quality of life was improved. Hence the hypothesis was accepted.

## CONCLUSION

The results of present clinical studies results show that spirometry exercise are an effective and economical way to relieve symptoms such clinical profile. It can improve respiratory health when used as an adjunct to standard therapy.

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**Conflict of interest:** Authors declare no conflict of interest.

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