Research Article

The Effectiveness of Breathing Exercises on the Physiological and Psychological Variables of Patients with Pulmonary Tuberculosis

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Abstract

A study to evaluate the effectiveness of breathing exercises on physiological and psychological variables of patients with pulmonary tuberculosis in selected hospital at Ambala, Haryana.

TB is a 7th killer disease in the world and one of the top 10 causes of death. Pulmonary tuberculosis (PTB) is an infection, which causes widespread pulmonary fibrosis and cavitation, and often leaves the patient with a chronic respiratory deficit as a result.

Aims and Objectives: The aim of the study was to evaluate the effectiveness of breathing exercises on physiological and psychological variables of patients with pulmonary tuberculosis.

Material and Methods: A quasi experimental design using non-equivalent control group pretest- posttest design was conducted on 110 pulmonary tuberculosis patients (55 in comparison group and 55 in experimental group) in DOTS center of UPHC RavidasMajriInderpuri colonyAmbala city, UPHC Baldev NagarAmbala city, UPHC Durga Nagar Ambala city and CHC Mullana. The dependent variables were physiological variables (dyspnea, spo_2, heart rate, respiratory rate) and psychological variables (anxiety, quality of life). Pretest was taken in UPHC Durga Nagar Ambala city and CHC Mullana on day 1 and posttest was taken inUPHC RavidasMajriInderpuri colonyAmbala city and UPHC Baldev NagarAmbala cityon day 30. In experimental group, breathing exercises were administered by the researcher two times a week. Each session was of 30 minutes including 4 breathing exercises (pursed lip breathing exercise, diaphragmatic breathing exercise, deep breathing exercise and segmental breathing exercise) and each exercise was performed for 6-8 times. Other days patients were estimated to perform breathing exercises themselves at home and on day 30, posttest was taken.

Results: Both the groups were homogenous with respect to physiological and psychological variables before the administration of breathing exercises. On day 30, the mean dyspnea score and anxiety score of experimental group was significantly lower than comparison group ($p<0.05$). The quality of life of patients in experimental group was significantly better than comparison group at day 30.

Conclusion: Based on the findings of the study, it can be concluded that breathing exercises are effective in reducing the dyspnea, anxiety, HR and RR. Breathing exercises are effective in improving theO_2saturation, blood pressure and quality of life among pulmonary tuberculosis patients.

Keywords: *Breathing exercises, physiological variables, psychological variables, pulmonary tuberculosis* patients**.**

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Introduction

TB is a 7th killer disease in the all over world. Tuberculosis (TB) is one of the top ten causes of mortality and the primary cause from a single communicable agent. Globally, ten million people developed tuberculosis disease in 2017; 5.8 million men, 3.2 million women and one million children. There were cases in all countries and age groups, but overall ninety percent were adults, ten percent were people living with HIV (72% in Africa) and two third were in eight countries: India (21%), China (14%), Indonesia (6%), the Philippines (3%), Pakistan (3%), Nigeria (5%), Ethiopia (3%), Bangladesh (4%) and (5%) in South Africa (figure 1.1).[1]

India is the 2nd most populous country in the world having more new TB cases annually than any other country and accounting for 1/5th of the global incidence. About 40% of Indian populations are suffered with tuberculosis bacillus. India has been ranked 17th among 22 high burden countries in terms of tuberculosis incidence rate.[2]

Pulmonary tuberculosis (PTB) remained a main health problem worldwide, most common in developing countries.In previous times tuberculosis was known as "consumption", "Phthisis pulmonary is" and "white plaque". In 19th century, it was also known as "the captain of all men of death".[3]

Pulmonary tuberculosis is an infection, which causes widespread pulmonary fibrosis and cavitation, and often leaves the patients with a chronic respiratory deficit, which often presents as an obstructive lung dysfunction. Pulmonary fibrosis and cavitation leads to thickening of the wall, and causes decrease oxygen supply in the blood and as a consequence, patients suffer from dyspnea.[4]

Dyspnea is a complex symptom that arises from physiological impairment and alerts one to the possibility of threatened homeostasis. Dyspnea not only manifests with respiratory difficulty that embarrasses and limits the patient's activity.[5]

Only a few studies were identified on the effect of breathing exercises on physiological and psychological variables among patients with respiratory illness. Majority of studies focused only on physiological parameters of patients. The researcher did not locate any study regarding the effect of breathing exercises on physiological and psychological parameters of tuberculosis patients. Most of the previous studies have assessed the effect of single breathing exercise on physiological parameters. Considering the effect of different breathing exercises on different lung function parameters and psychological parameters, a group of breathing exercises was clustered together and their cumulative impact was tested on selected physiological and psychological parameters of tuberculosis patients.

Materials and Methods

We enrolled inpatients of Pulmonary Tuberculosis (PTB) having dyspnea, willing to participate, able to understand Hindi or English and available during the period of data collection.

The present study was a quasi-experimental study using non-equivalent control group pretest-posttest design conducted at DOTS center of UPHC Ravidas Majri Inderpuri colony Ambala city, UPHC Baldev Nagar Ambala city, UPHC Durga Nagar Ambala city and CHC Mullana over the period of one monthJuly 2020

Total of 110 PTB patients were selected for the study and non-randomly divided into comparison group (55) and experimental (55) group.Convenience sampling technique was used to select PTB patients in the study who were come in DOTS center of UPHC Ravidas Majri Inderpuri colony Ambala city, UPHC Baldev Nagar Ambala city, UPHC Durga Nagar Ambala city and CHC Mullana. The dependent variables were physiological variables (dyspnea, spo_2, heart rate, respiratory rate) and psychological variables (anxiety, quality of life). Pretest was taken in UPHC Durga Nagar Ambala city and CHC Mullana on day 1 and posttest was taken in UPHC Ravidas Majri Inderpuri colony Ambala city and UPHC Baldev Nagar Ambala city on day 30. In experimental group, breathing exercises were administered by the researcher two times a week. Each session was of 30 minutes including 4 breathing exercises (pursed lip breathing exercise, diaphragmatic breathing exercise, deep breathing exercise and segmental breathing exercise) and each exercise was performed for 6-8 times. Other days patients were estimated to perform breathing exercises themselves at home and on day 30, posttest was taken.

Formal ethical permission was obtained from the Institutional Ethical Committee of Maharishi Markandeshwar (Deemed to be) University, Mullana, Ambala, Haryana**.** Informed consent was obtained from the pulmonary tuberculosis patients who werecome in DOTS center of UPHC Ravidas Majri Inderpuri colony Ambala city, UPHC Baldev Nagar Ambala city, UPHC Durga Nagar Ambala city and CHC Mullana.

Different tools like sample characteristics Performa, Modified Medical Research Council dyspnea scale (MMRC), physiological variables recording sheet, anxiety scale, respiratory disease quality of life (RD-QOL) and semantic differential scale were used to collect data.

Interview technique and bio-physiological measurement were used to collect data from pulmonary tuberculosis patients.

MMRC Scale [6] is a standardized tool developed for assessing the dyspnea level (0-4). Lower score 0 indicates mild dyspnea and higher score 4 indicates the severe level of dyspnea. Content validity of the MMRC dyspnea scale was 1 and test-retest reliability of the MMRC dyspnea scale was 1.Physiological variable recording sheet consisted of a recording of physiological variables like SPO_2, BP, heart rate and respiratory rate.

Anxiety scale is a ten items tool (I feel tense, I feel upset, I feel restless as I have to be on the move, Worrying thoughts go through my mind, I get sudden feelings of panic, I can sit at ease and feel relaxed, I feel confused, I feel fear of dying, I feel frightened, I get sudden feeling of heart pounding/ racing) developed by the researcher to determine the levels of anxiety among tuberculosis patients. It has been developed after reviewing hospital anxiety and depression scale (HAD) [7]. Only ten items pertaining to assess anxiety were included. The maximum score was 30 and the minimum score was zero. A higher score indicates an increased level of anxiety and a lower score indicates a lower level of anxiety. Content validity of the anxiety scale was 1 and the internal consistency of the anxiety scale was assessed using Cronbach's Alpha and found to be 0.81.

Respiratory Disease quality of life (RD-QOL) is 28 items developed by the researcher to assess QOL in PTB patients. Items of airway questionnaire 20 (AQ20) [8] were referred for developing the RD-QOL. The maximum score was 56 and the minimum score was zero. A higher score indicated the poor QOL and lower score indicated the good QOL. Content of the RD-QOL questionnaire was 0.9 and the Test-retest reliability RD-QOL questionnaire was assessed and found to be 0.8.The semantic differential scale was developed to assess the acceptability of breathing exercises among PTB patients. Content validity of the semantic differential scale was 0.9. All the tools translated into the Hindi language and then back-translated into English for semantic equivalence

The dependent variables were physiological variables (dyspnea, SpO_2, BP, heart rate, respiratory rate) and psychological variables (anxiety, quality of life).

Results

The results shows that both the groups were homogenous and comparable in terms of age in year, gender, marital status, type of family, previous history of pulmonary tuberculosis in family, socio-economic status, BMI, duration of TB in months, any comorbid disease, tubercular infection, treatment category of tuberculosis, performing any respiratory exercises, performing any physical exercises, smoking status, history of alcoholism, tobacco use and exposure to passive smoking before the administration of breathing exercises.

Therefore, it can be inferred that the comparison and experimental group were homogenous and comparable in terms of physiological and psychological before administration of breathing exercises**. [TABLE 1]**

Results of independent 't'-test revealed that breathing exercises are effective in reducing dyspnea, anxiety, HR and RR and improving SpO_2 , blood pressure and QOL. On day 30, the mean dyspnea score, anxiety score, heart rate and respiratoryrate of the experimental group were significantly lower than the comparison group ($p<0.05$). The quality of life of patients, blood pressure andSpO_2 in the experimental group was significantly better than the comparison group on day 30.**[TABLE 2]**

Majority of PTB patients in the experimental group were highly satisfied with the breathing exercises at day 30 (97.14%) respectively which shows acceptability of the intervention among patients.

Discussion

In the current study, the breathing exercises

administered for four weeks were effective in reducing dyspnea among PTB patients. A significant difference was found in dyspnea score of PTB patients in the comparison group and in the experimental group after administration of breathing exercises at day 30. These findings are in line with the study done by Brenda Morrow et.al (2016)[9]to determine the "effect of positioning and diaphragmatic breathing on respiratory muscle activity in people with a chronic obstructive pulmonary disease" which showed a significant decrease of dyspnea score in the experimental group than in comparison group respectively. The diaphragm helps to inflate the lungs, increase in vital capacity, functional residual capacity and oxygen consumption, which may result in a concomitant decrease in dyspnea.[10]

The breathing exercises were effective in improving oxygen saturation level score. The patients in the experimental group had higher oxygen SpO_2 level score than the comparison group on day 30. These findings are consistent with a study conducted by S.K. Sharma and GautamAhluwalia (2006) [11] who reported that mean oxygen saturation (SpO_2) improved after exercises in the experimental group. Purse lip breathing exercise improves the lungs' ability to get O_2 in and CO_2 out.

The breathing exercises were effective in reducing heart rate score. There was a significant difference found in heart rate of PTB patients in the comparison group and in the experimental group afterthe administration of breathing exercises at day 30. These findings are similar with the study done by Dr. Labiba Aba El-Kader Mohamed et.al (2013)[12] to examine the "effect of slow deep breathing exercise (DBE) on blood pressure and heart rate"on 120 newly diagnosed patients with hypertension in which heart rate score of patients before intervention was 97.06±10.65 and after intervention heart rate score of patients was 92.01±7.70. A deep breathing exercise improves vagal tone and decreases sympathetic discharge, by decreasing sympathetic discharge it helps to decrease heart rate.[13]

The breathing exercises were effective in reducing respiratory rate score. There was a significant difference found in respiratory rate score in the comparison group and in the experimental group after administration of breathing exercises at day 30. The patients in comparison and experimental group had a lower respiratory rate than the comparison group. These findings are similar with the study conducted by Ritu Adhana et.al. (2016) [14] to check the "effect of slow breathing training on spontaneous respiratory rate, heart rate and pattern of breathing" among 60 volunteers in which respiratory rate of patients before training was 20.0±2.0 and after training respiratory rate was 17.0±2.0. Diaphragmatic breathing exercise helps to inflate the lungs, increase in vital capacity and decrease in respiratory rate (RR).[15]

In the current study, the breathing exercises were effective in reducing anxiety. There was a significant difference found in anxiety score of PTB patients in the comparison group and in the experimental group after administration of breathing exercises at day 30. The patients in comparison and experimental group had lower anxiety score than the comparison group. These findings were similar with a study conducted by Li- Chi Chiang et.al (2009)[16] to evaluate the "effectiveness of relaxation breathing training on anxiety among moderate to severe asthmatic patients" in which after intervention anxiety score in the experimental group was 26.11±11.41 and the comparison group was 32.21±17.76.

Limitations

The limitations of the study is that the potential for comparison and experimental group patients to seek out DOTS or alternative treatment was not assessed which may be affecting physiological and psychological variables. The study did not use masking/blinding which might have increased risk of assessment biases.

Conclusion

Breathing exercises are effective in reducing dyspnea, heart rate, breathing rate, and anxiety and increasing the SpO_2 level and improving the QOL among PTB patients. These findings recommend that nurses should routinely provide breathing exercises to the pulmonary tuberculosis patients and must monitor the after the use of breathing exercises.Nurses should provide ongoing education to the tuberculosis patients regarding breathing exercises so that they are able to performand continue these exercises at home setting also.

Table 1: Mean, Mean Difference, Standard Deviation, Standard Error of Mean Difference and 't' value of Physiological and Psychological Variables in Comparison and Experimental group before administration of Breathing Exercises

N=110

Sr. No	Variables	Comparison Group (n=55) Mean ± SD	Experimental Group (n=55) Mean ± SD	M_D	SE_{MD}	t value	df	p Value
Physiological variables								
1.	Dyspnea	2.80 ± 0.80	1.02±0.30	1.78	0.05	0.15	108	0.87^{NS}
2.	SpO_2	94.18±2.10	94.02±3.97	0.16	-0.87	0.66	108	0.51^{NS}
3.	Systolic blood pressure	119.05 ±8.39	121.82±10.30	- 2.77	-1.91	0.96	108	0.34^{NS}
	Diastolic blood pressure	83.40±8.39	82.53±8.57	0.87	-0.18	0.33	108	0.74^{NS}
4.	Heart Rate	101.27±11.09	99.64±12.37	1.63	-1.28	0.31	108	0.75^{NS}
5.	Respiratory Rate	20.47±1.84	20.91±1.95	-0.44	-0.01	1.11	108	0.27^{NS}
Psychological variables								
6.	Anxiety	22.93±4.68	23.42±3.99	- 1.29	0.69	1.03	108	0.30^{NS}
7.	Quality of Life	48.44±3.63	47.55±2.69	0.89	0.94	1.64	108	0.10^{NS}

***-Significant (p ≤0.05)** **^{NS}- Not Significant (p >0.05)**

TABLE 2: Mean, Mean Difference, Standard Deviation, Standard error of Mean Difference and 't' value of Physiological and Psychological Variables among Pulmonary Tuberculosis patients in Comparison and Experimental group after administration of Breathing Exercises at day 6.

N= 110

Variables	Comparison Group (n=55) Mean ± SD	Experimental Group (n=55) Mean ± SD	MD	SEMD	t value	df	p Value
Physiological variables							
Dyspnea	1.51±0.54	1.02±0.30	0.49	0.24	2.8	108	0.01*
SpO2	95.37±1.89	96.60±1.24	-1.23	0.69	3.20	108	0.01*
S.B.P	118.47±7.30	116.24±8.50	2.23	1.20	1.56	108	0.03*
D.B.P	80.87±8.39	77.82±6.30	3.07	2.09	1.71	108	0.04*
Heart Rate	98.80±4.92	90.15±8.68	8.65	-3.76	2.16	108	0.01*
Respiratory Rate	20.20±1.78	19.13±1.62	1.07	0.16	2.80	108	0.01*
Psychological variables							
Anxiety	16.58±1.99	11.78±1.93	4.8	0.06	3.37	108	0.01*
Quality Of Life	42.91±1.78	38.82±2.43	4.09	-0.45	3.64	108	0.01*

***-Significant (p ≤0.05)** **^{NS}-Not Significant (p >0.05)**

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