ISSN- O: 2458 - 868X, ISSN–P: 2458 – 8687
Index Copernicus Value: 68 . 16
PubMed - National Library of Medicine - ID: 101731606

International Journal of Medical Science and Innovative Research (IJMSIR)
IJMSIR : A Medical Publication Hub
Available Online at: www.ijmsir.com
Volume – 4, Issue – 4, August - 2019, Page No. : 147 - 153

Complimenting Tuberculosis Treatment By Yogic Exercises

Ajay Kumar Singh[1], Pramod Kumar Shridhar[2], Ravinder Kumar[3] Vandana Kumari[4], Balbir Singh[5] , Dimple Kumar Bhaglani[6]

[1]Medical Officer, District TB Centre, Department Health and Family Welfare, Solan, H.P., India.

[2]Assistant Professor, Department Chest and TB, MM Medical College and Hospital, Kumarhatti, Solan, HP, India.

[3]Medical Consultant, WHO-RNTCP Technical Support Network, Himachal Pradesh, India.

[4]Laboratory Technician, RNTCP, Department Health and Family Welfare, Solan, H.P., India.

[5]Assistant Professor, Department Chest and TB, MM Medical College and Hospital, Kumarhatti, Solan, HP, India.

[6]Senior Registrar, Department of Pulmonary Medicine, Indira Gandhi Medical College, Shimla, H.P., India.

Corresponding Author: Pramod Kumar Shridhar, Assistant Professor, Department Chest and TB, MM Medical College and Hospital, Kumarhatti, Solan, HP, India.

Type of Publication: Original Research Paper

Conflicts of Interest: Nil

Abstract

Background: Tuberculosis (TB) entails loss of lung volumes (caseous tubercles, calcification, fibrosis or cavitations), hypoxia, hypercapnoea, type II respiratory failure and poor quality life. Treatment has its own challenges like adverse drug effects, non compliance. Henceforth, complimentary approaches are need of the hour. In Yoga, an alternative Indian Medicine system, sitting positions termed Asanas promote respiratory muscle relaxation and postural alteration- improving oxygenation, strength, endurance, alleviating fatigue and breathlessness.

Methods: We assessed a cohort of 45 patients diagnosed with TB and on therapeutic treatment at a Tuberculosis centre, with informed written consent, after securing institutional Ethics Committee permission. A randomized nested case-control study with 22 cases (who performed Yoga) and 22 controls (who did not do Yoga) was formulated. Patients were trained to sit for 50 minutes in Padmasana and perform four Yogic exercises termed Pranayamas: Bhastrika- 7 minutes, Kapalbhati- 20 minutes, Ujjaee- 3 minutes, and Anulom vilom- 20 minutes. Forced vital capacity(FVC), Forced expiratory volume in 1 second (FEV1), FEV1/FVC ratio, and Peak expiratory flow rate (PEFR) were measured with Spirometry for both groups, at beginning and at the end of 8 weeks, along with administering World Health Organization- Five- Well- Being Index questionnaire.

Results: Statistically significant improvement in lung volumes i.e. FVC (*P*= 0.009), FEV1 (*P*= 0.016), FEV1/FVC (0.010) and PEFR (0.000) was observed in Yoga group. Initially, mean well being score was 9.57 and 12.43 for the Yoga and the control group respectively (non significant) and 21.57 and 17.29 (statistical significant difference, *P*= 0.04) after 8 weeks. Yoga group had significantly higher mean well being score than controls (*P*= 0.00).

Conclusion: Marked improvement in Lung volumes and well being of tubercular patients on treatment, performing Yoga substantiate its complimentary role.

Keywords: Complimentary, yoga, asanas, Lung volumes, Well Being Index questionnaire

Background

The Global Tuberculosis Report 2018 [1] elaborates that worldwide, about 6.4 million new cases of tuberculosis (TB) were notified in the year 2017 with the respective national authorities across all the regions. This accounted for about 64% of the total estimated 10.0 million new cases that occurred in 2017. Moreover, diagnosis and treatment of TB has been preventing million of deaths due to this highly communicable infectious disease (an estimated 54 millions in the year span 2000- 2017). The proportion of people who died from TB fell from 23% in the year 2000 to 16% in 2017. The report also highlighted that globally, the TB incidence rate is falling at about 2% per year. However, the treatment success rate has decreased marginally from 86% in 2013 and 83 % in 2015 to 82% in 2016, pointing out that still there are gaps in the diagnosis and treatment of the disease.

The physiology of the disease meets attention in this regard. TB presents with obstructive, restrictive and mixed pattern of lung disease as a squeal despite the treatment [2]. A great proportion of treated patients also show signs of marked airflow obstruction or restrictive impairment [3-6]. The disease also significantly affects the quality of the life of the treated person [7, 8]. There are various overlooked process and phenomenon which later on contribute to such a varied disease sequel.

One such aspect is the understanding of the physiology of the disease. The rationale of the human respiratory physiology is the incorporation of the oxygen present in the environment for the utilization of energy from the organic compounds and in turn releasing carbon dioxide into the environment. The anatomical built of the human body involving the rib cage bones, diaphragm, inter coastal muscles and the spine stature affect the lung compliance and the elastance, which eventually control the inspiration and expiration of air by the lungs [9]. It is the alveoli of the lungs where the exchange of gases takes place. Restrictive lung diseases such as tuberculosis tend to lead to difficulty in expanding and deflating the lungs. The ability of the lungs and the pleural cavity to expand and contract, commonly referred to as the lung compliance, is dependent on the changes in the lung pressure. The lung compliance is known to decrease because of thickening of the lung tissue which may occur due to fibrosis of lungs which can be a sequel of pulmonary tuberculosis.

Progression of tuberculosis (caseous tubercles, calcification, fibrosis or cavitations) also leads to loss of lung volumes causing hypoxia and hypercapnoea and eventually to type II respiratory failure. Quality of life gets deteriorated with the disease progression [10]. Moreover, the treatment has its own challenges [11, 12]. Frequent adverse effects of drugs and treatment non compliance worsen the scenario further. Henceforth, complimentary approaches in the management of TB are need of the hour.

In the west Yoga has been classified by the National Institute of Health as a complementary and alternative medicine (CAM) [13]. However, in India, Yoga, a part of the mainstream Medicine has been practiced for ages in the treatment of many acute and chronic, infectious and non-infectious, communicable and non communicable diseases [14, 15, 16]. This stream of medicine finds a wide acknowledgement now days as it has been acknowledged internationally by United Nations General Assembly and 21 June has been endorsed to be celebrated as International Day of Yoga or Yoga Day [17]. Yoga is a holistic health approach. This science involves sitting

position termed Asana which promote relaxation and postural alteration of muscles which aid in breathing, thereby, improving oxygenation [18]. Strength and endurance building by aerobic Yogic exercises alleviates fatigue, shortness of breath and improves general well being [19]. The intervention of Yoga as a complementary tool along with anti- tubercular drug regimes was assumed to benefit the tubercular patients. Henceforth, the study was proposed with the objectives of assessment of Yoga in affecting lung functions and in the overall well being of the tubercular patients.

Methods

A prospective cohort study was formulated by enrolling 45 tubercular patients who had volunteered after informed consent. These patients had been initiated on anti tubercular treatment at a Directly Observed Treatment Short course (DOTS) centre at a tertiary hospital in Solan, a mountainous region in northern state of India. The ethical clearance for the study was secured from the Institutional ethics committee of a Medical College of the region.

Study Design: A randomized matched controlled clinical study was formulated. Yoga, involving the sitting postures (asanas) and the breathing exercises (pranayama) was explored on 22 patients, who were on therapeutic treatment. These were the cases of the study. Informed written consent was obtained from the participants.

Yoga training was imparted to the cases to sit for a total time span of 50 minutes in a posture referred to as Padmasana, the lotus pose Yoga in Yoga science (Figure 1) [22] and perform four aerobic Yogic exercises termed as Pranayamas (Table 1). These exercises along with their respective time duration of performance were namely, the Bhastrika: 7 minutes, Kapalbhati: 20 minutes, Ujjaee: 3 minutes and Anulom vilom: 20 minutes. A video film depicting the methodology of these Yogic practices was shared with the participants. Thus the randomized nested case- control study from among the cohort of 45 tubercular patients on anti- tubercular treatment was designed with 22 cases (the interventional group who completely practiced Yoga) and 22 controls (the control group who did not perform Yoga). One patient had died in the first month of the treatment and henceforth was excluded from the study. Interventional and the control group was observed and studied for a time span of 8 weeks. The Spirometry test was employed for measuring the lung volumes such as the Forced vital capacity (FVC), Forced expiratory volume in 1 second (FEV1), FEV1/FVC ratio, and Peak expiratory flow rate (PEFR). These lung volumes were measured for both the groups at the beginning of the therapeutic anti tubercular treatment and at end of 8 weeks. A standardized World Health Organization (WHO) well being questionnaire was concordantly administered by the interviewer to these patients during the same time period.

Table 1: List of Yogic practices

Practice	Duration
Sitting posture (Asana)	
Padmaasana	50 minutes
Breathing yogic exercises	
Bhastrika	7 minutes
Kapalbhati	20 minutes
Ujjaee	7 times in 3 minutes
Anulom vilom	20 minutes

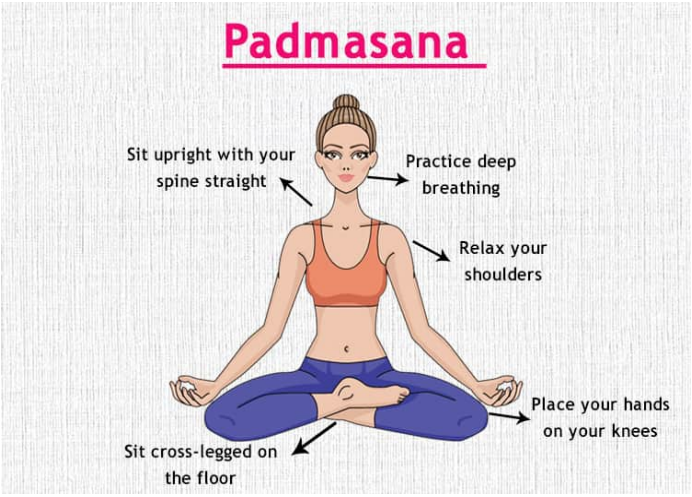

Figure 1: Padmasana (Lotus pose Yoga) [22]

Data statistics and analysis: The data was collected regarding the various lung volumes and the well being aspects perceived by the patients. The outcome measure were recorded at the beginning of the antitubercular treatment and then at the end of 8 weeks. The data was analyzed in IBM SPSS Statistics version 21 and Microsoft Excel 2010 software. Paired *t*-test statistics were employed for the analysis. The *p* values of lesser than 0.05 were considered significant.

Results: The data inferred from table 2 reflects the demographic profile of the study cohort of 45 patients comprising of 23 males (51.1%) and 22 females (48.9%) with median age of 27 ±16.28 years and median weight of 54.3±16.22 kg.

22 cases with the median age of 27.5±17.59 years and median weight of 52.2±16.00 kgs showed significant improvement in their lung functions as compared to the control group of patients having the median age of 28.00±15.59 years with a median weight of 52.4±15.87years.

Table 2. Demographic profile of the study participants

Group	Male	Female	Median age (years) ±SD	Weight (kg) ±SD
Cohort	23(53.1 %)	22(48.9 %)	27 ±16.28	54.3±16.22
Cases	12(54.5 %)	10(45.5 %)	27.5±17.59	52.2±16.00
Controls	10(45.5 %)	12(54.5 %)	28.00±15.29	52.4±15.87

It is evinced from table 3 that statistical significant positive correlation existed between the initial and post yogic exercises lung volumes with correlation coefficient (r) ranging from 0.008 to 0.608. The correlation observed in the lung volumes measured FVC, FEV1 AND PEFR was found to be statistically significant (*p* value< 0.05). Whereas, the correlation observed in the ratio of FEV1/FVC, was found to be statistically non significant.

The data formulated in table 3 enumerates the statistically significant improvement observed in the lung volumes of the cases i.e. the interventional group of patients who had performed the yogic practices. FVC (*p*= 0.009), FEV1 (*p*= 0.016), FEV1/FVC (0.010) and PEFR (0.000) improved significantly when measured at the follow up examination of the cases at the end of eight weeks as compared with group at the beginning of the study.

Table 3: Paired Samples t- test findings of the cases

		Paired Differences					T	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	*I-FVC - **FFVC	-24.773	40.205	8.572	-42.599	-6.947	-2.890	21	.009
Pair 2	I-FEV1 - FFEVI	-9.0909	16.2361	3.4615	-16.2896	-1.8922	-2.626	21	.016
Pair 3	I-RATIO – FRATIO	16.182	26.862	5.727	4.272	28.092	2.825	21	.010
Pair 4	I-PEFR – FPEFR	-12.909	9.611	2.049	-17.170	-8.648	-6.300	21	.000

*Initial, **Follow up at eight weeks

The WHO Mean well being score recorded for the cases at the beginning of was 9.57 and the score at the end of eight weeks was 21.57 with statistical significant difference between them (p= 0.04) as compared to the intital and follow up scores of 12.43 and 17.29 with no significant difference observed amongst these.

The controls were not subjected to the yogic practices and did not show any significant improvement in their respective lung volumes (Table 4) when these were measured at the beginning and then at the end of the eight weeks of the study.

Table 4: Paired Samples *t*- test findings of the controls

N=22		Paired Differences					T	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	*I-FVC - **FFVC	-.174	10.012	2.088	-4.503	4.156	-.083	22	.934
Pair 2	I-FEV1 - FFEVI	-9.609	33.435	6.972	-24.067	4.850	-1.378	22	.182
Pair 3	I-RATIO – FRATIO	5.348	51.691	10.778	-17.005	27.701	.496	22	.625
Pair 4	I-PEFR – FPEFR	-3.348	14.031	2.926	-9.415	2.720	-1.144	22	.265

*Initial, **Follow up at eight weeks

Discussion

The present study has documented significant improvement in the lung volumes of the subjects who had practiced and followed yogic exercises. The sitting posture termed asana and the breathing exercises known as the Pranayamas had improved the lung health of the tubercular patients performing these exercise. Similarly, Yadav *et al.* (2015)[20] had observed in their study that a yoga regime of three months had shown significant improvement in the lung volumes of the persons who followed yogic postures and pranayama breathing

exercises. Spirometrically documented evaluation of lung functions in the present study also empirically established the improvement found in the lung functions of the patients who had followed the yogic exercises. In a similar interventional study Hakked *et al*. (2017) had spirometrically documented significant improvement in the lung volumes such as FVC and FEV1 in the persons who had performed the yogic pranayama exercises [21]. The present study was formulated with the purpose to assess the role of yogic exercises on lung health. The exercises comprising the voluntary breath cessation and slowing down of breathing aiding the practitioner to gain control over the pneumotaxic centre and influencing the pontine areas on the brain stem, had shown positive results with significant improvement as depicted by the mean WHO well being score. Similar observations have also been studies in studies incorporating yogic exercises for improving lung health (Kesavchandran *et al*., 2001; Smith *et al*., 2006 and Chaya *et al*., 2006).

Conclusion

Tuberculosis is a highly communicable disease associated with the challenges of its treatment like compliance, adverse drug reactions, breathing difficulties and generalized weakness of the body. Yogic exercises increase the breathing capacity and lung health. It eventually improves the well being in tubercular patients on treatment. Hence, the yogic exercises if advocated for the tubercular patients, can prove to be a complimentary tool in tuberculosis treatment.

Acknowledgement

We highly acknowledge the continuous support of the Chief Medical Officer, district Solan for the successful completion of the study. We also thank the team of Apex Diagnostics, Solan for extending aid in spirometric evaluation of the patients.

References

1. WHO. Global Tuberculosis report 2018. Geneva, World Health Organization. Licence: CCBY- NC- SA 3.0 IGO.

2. Manji M, Shayo G, Mamuya S, Mpembeni R, Jusabani A, Mugusi F. Lung functions among patients with pulmonary tuberculosis in Dar es Salaam – a cross-sectional study. BMC Pulmonay Medicine 2016;16:58.

3. Hnizdo E, Singh T, Churchyard G. Chronic pulmonary function impairment caused by initial and recurrent pulmonary tuberculosis following treatment. Thorax 2000;55:32-38.

4. Willcox PA, Ferguson AD. Chronic obstructive airways disease following treated pulmonary tuberculosis. Respiratory Medicine 1989;83:195-198.

5. Krishna K, Bond S, Artvinli M, Reid KDG, McHardy GJR, Crofton JW. Pulmonary function in treated tuberculosis; a long term follow-up. The American Review of Respiratory disease 1977;115:402-404.

6. Vargha G. Fifteen year follow-up of lung function in obstructive and non-obstructive pulmonary tuberculosis. Acta Medica Hungarica 1983;40:271-276.

7. Miller TL, McNabb SJ, Hilsenrath P, Pasipanodya J, Weis SE. Personal and societal health quality lost to tuberculosis. PLoS One 2009;4(4):e5080.

8. Pasipanodya JG, McNabb SJ, Hilsenrath P, Bae S, Lykens K, Vecino E *et al*. Pulmonary impairment after tuberculosis and its contribution to TB burden. BMC Public Health 2010;10:259.

9. Hall, JE, Guyton, A. C. (2011). *Guyton and Hall textbook of medical physiology*. Philadelphia, PA: Saunders Elsevier.

10.Kasper, D. L., & Harrison, T. R. (2005). *Harrison's principles of internal medicine*. New York: McGraw-Hill, Medical Pub. Division

11.Laurenzi M, Ginsberg A, Spigelman M. Challenges associated with current and future TB treatment. Infectious Disorders- drug targets 2007;7(2):105-119.

12.Gebreegziabher SB, Yimer SA, Bjune GA. Qualitative assessment of challenges in tuberculosis control in West Gojjam Zone, Northwest Ethiopia: Health Workers' and tuberculosis control program Coordinators' perspective. Tuberculosis Research and Treatment 2016;2016:2036234.

13.NCCAM. Mind-body intervention. 20 Sep 2003. Available at http://nccam.nih.gov/health/whatiscam/

14.Woodyard C. Exploring the therapeutic effects of yoga and its ability to increase quality of life. International Journal of Yoga 2011;4(2):49-54.

15.Atkinson NL, Permuth-Levine R. Benefits, barriers, and cues to action of yoga practice: A focus group approach. American Journal of Health Behavior 2009;33:3-14.

16.Arora S, Bhattacharjee J. Modulation of immune response in stress by yoga. International Journal of Yoga 2008;1:45-55

17.United Nations Information Centre for India and Bhutan. UNIC/PRESS RELEASE/233-2014. 12 December 2014. From the UN General Assembly. United Nation declares 21 June as International Day of Yoga.

18.Birkel DA, Edgren L. Hatha yoga: Improved vital capacity of college students. Alternate therapies in health and medicine 2000;6(6):55-63.

19.Harinath K, Malhotra AS, Pal K, Prasad R, Kumar R, Kain TC et al. Effects of hatha yoga and omkar meditation on cardiorespiratory performance, psychologic profile, and melatonin secretion. Journal of alternative and complementary medicine 2004;10(2):261-268.

20.Yadav A, Singh S, Singh K, Pai P. Effect of yoga regime on lung functions including diffusion capacity in coronary artery disease patients: A randomized controlled study. International Journal of Yoga 2015;8(1):62-67.

21.Hakked CS, Balakrishnan R, Krishnamurthy MN. Yogic breathing practices improve lung functions of competitive young swimmers. Journal of Ayurveda and Integrative medicine 2017;8(2):99-104.

22.Kesavachandran C, Nair HR, Shashidhar S. Lung volumes in swimmers performing different styles of swimming. Indian Journal of Medical Science 2001;55:669–676.

23.Smith RE, Smoll FL, Cumming SP, Grossbard JR. Measurement of multidimensional sport performance anxiety in children and adults: the sport anxiety scale-2. Journal of Sport and Exercise Psychology 2006;28:479–501.

24.Chaya MS, Kurpad AV, Nagendra HR, Nagarathna R. The effect of long term combined yoga practice on the basal metabolic rate of healthy adults. BMC Complementary and Alternative Medicine. 2006;6:28.