

A 12-Week “Silver Yoga” Program Enhances Lung Function in Elderly Women Residents of a Hospice

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ABSTRACT

Introduction: “Silver Yoga” program has been devised by Centre for Yoga Therapy, Education and Research (CYTER) of Sri Balaji Vidyapeeth, Pondicherry. Participants practiced the protocol that was specially designed for senior citizens, keeping in mind their health status and physical limitations.

Aim: The present study was planned to evaluate possible changes in lung functioning assessed through Pulmonary Function Test (PFT) in senior citizens following 12 weeks of an integrated Silver Yoga programme.

Materials and Methods: In this comparative pre-post study, 40 elderly women inmates of the hospice were randomised into two groups of 20 each. Yoga group (Group A) received training in the integrated Silver Yoga programme while control group (Group B) did not receive any yoga training. Both the groups however participated in all the routine activities of the Hospice. Anthropometric data, respiratory rate and lung function parameters were recorded before and after the 12-week study period. Intra-group and inter-group comparisons of pre and post

study data were done using Student’s paired and unpaired t-test respectively. A p-value less than 0.05 was considered to indicate significant differences between means.

Results: After the 12 weeks of Silver Yoga, both weight and BMI showed significant reduction ($p < 0.05$) in Group A, whereas there was an insignificant increase in Group B. Lung function tests such as FVC, FEV1, PEFr, and FIVC increased significantly ($p < 0.05$) after yoga training, whereas FVC decreased significantly ($p < 0.05$) in the Group B. Group A showed significant decrease in both Respiratory Rate (RR) ($p < 0.01$) and Lung Age ($p < 0.001$) while FEF25-75 increased significantly in both groups.

Conclusion: Results of this pilot study give preliminary evidence that incorporation of Yoga as part of senior’s lifestyle can help in promoting health thereby, modifying age related disorders. It is however, limited by the smaller sample size, also limited to a single centre. Further multi-centric studies with larger populations can deepen understanding of intrinsic mechanisms by which these changes are occurring in Silver Yoga.

Keywords: Ageing, Lifestyle, Pulmonary function test, Respiratory parameters, Senior women

INTRODUCTION

Ageing is a progressive, generalised impairment of functions, resulting in a loss of adaptive response and is at a high risk of age-related deterioration [1]. The United Nations defines elderly as those who are older than 60 years of age, however, in many developed countries; the age of 65 is used as a reference point for older persons [2]. Ageing causes corresponding physiological modifications in the respiratory system which shows decreased static elastic recoil of the lung, respiratory muscle performance and compliance of chest wall, due to which process of breathing becomes more strained [3]. Assessment of defects and abnormalities of the respiratory system are identified and measured by PFT which provides important clinical information useful for treatment [4]. Important variable affected by Ageing is the lung functioning which varies from individual to individual [5].

Health concerns in seniors are often due to sedentary lifestyle adopted by them as a result of ageing and yoga has the potential to bring about positive changes in their lives. As part of its outreach activities for the local community, Centre for Yoga Therapy, Education and Research (CYTER) of Sri Balaji Vidyapeeth, Pondicherry has designed a “Silver Yoga” program for senior citizens keeping in mind their health status and physical limitations. This program consists of simple jathis and kriyas that are warming up practices to induce flexibility, body awareness and enhance energy (prana) circulation. Asanas, isometric passive stretching postures of yoga that are non-strenuous, non-fatiguing can be performed comfortably even at an advanced age are also included. Conscious deep breathing in pranayama is done to harmonize the cardio-respiratory function while the relaxation

component of “Silver Yoga” helps to rejuvenate body and mind and facilitate inherent healing mechanisms [6].

An earlier pilot study by the authors assessed health status of elderly women residing in a hospice in Pondicherry and reported that although the physical health status was satisfactory for their age but their psychological health status was impaired due to a life in a hospice abandoned by their families or with no family at all [7]. The present study was taken up as a follow up to that pilot study and planned to evaluate the possible changes in lung functioning as assessed through PFT of such a population following 12 weeks of an integrated Silver Yoga programme.

MATERIALS AND METHODS

This comparative pre-post study of 12 weeks was done during August-November 2014 at the Hospice Convent Home for the Aged, Congregation of Saint Joseph of Cluny in Pondicherry. Ethical clearance was obtained from Institutional Human Ethics Committee (IHEC: Faculty/2014/03) of MGMCRI, Sri Balaji Vidyapeeth, Puducherry. Authorities and inmates of Hospice Convent Home for the Aged willingly volunteered to take part in this study. An orientation program was conducted for the women inmates of the hospice to explain details of tests, purpose of study and their role in this study to ensure proper understanding and effective cooperation. Those who were willing to participate in yoga therapy and who would be able to perform the techniques in the protocol were included for the study. Unwilling inmates were excluded from this study. Informed consent was obtained from the subjects and acceptance obtained from the authorities of the hospice.

Forty elderly women (68.55±7.96 years) volunteered for the present study. Eight of them reported normal health status, whereas others reported that they were on regular treatment for one or more medical conditions including hypertension (14), hypothyroidism (3), type 2 diabetes mellitus (22), knee pain (14), low back pain (3), asthma (12), dyslipidemia (7) and insomnia (5). After this assessment, they were randomised into two groups of 20 each, by random sample generator app which allows to select a sample from an ordered list. The co-morbidities of the subjects were comparable at baseline.

The yoga group (Group A) received 12 weeks of an integrated Silver Yoga programme [Table/Fig-1] developed by CYTER of Sri Balaji Vidyapeeth as part of its best practices. Group B consisted of control group who did not receive any yoga training. Both the groups however, participated in all the routine activities of the Hospice which included wake up at 5.30 am followed by prayer in the chapel and breakfast. Then they help with cooking, washing vessels, clothes followed by lunch, rest for two hours and in the evening they do some gardening, handwork, knitting etc., (according to the individual interest) followed by prayer and dinner. The age, height, weight and BMI of both groups were comparable at baseline and is given in [Table/Fig-2].

| Practices | Repetitions | Duration (min) |
|--|----------------------------|----------------|
| Jathis and Kriyas (Warming up practices) | 3 each | 12 |
| Asanas (static postures) | | |
| Tala Asana | 3 rounds | 3 |
| Ardhakaticakra Asana | 2 rounds on each side | 4 |
| Katicakra Asana | 2 rounds on each side | 4 |
| Paschimottana Asana | 3 rounds | 3 |
| Vakra Asana | 2 rounds on each side | 4 |
| Bhujanga Asana | 3 rounds | 3 |
| Pranayama (energy modulation through conscious breathing) | | |
| Chandranadi Pranayama | 9 rounds | 4 |
| Vyagraha Pranayama | 9 rounds | 3 |
| Pranava Pranayama comprising of the akara, ukara and makara components followed by omkara. | 3 rounds of each component | 10 |
| Relaxation | | |
| Shavasana | - | 10 |
| Total | | 60 |

[Table/Fig-1]: List of yogic techniques given as part of the "Silver Yoga" program for elderly women.

Silver Yoga sessions were conducted for 60 minutes, twice a week for 12 weeks. The training schedule consisted of the Silver Yoga protocol used routinely at CYTER and included simple warm-up and breath-body movement coordination practices, static stretching postures (asanas), breathing techniques (pranayamas), and relaxation [6]. The complete protocol is given in [Table/Fig-1]. There were no dropouts and all the 40 women completed the study. Those involved in the yoga programme were involved in regular discussion both individually and in groups regarding their health status and appropriate guidance given throughout training period. None of them reported any discomfort, pain or injuries during the study period or in the follow up interactions over the next 6 months. Though some mild muscle soreness and stiffness was self-reported in the initial week, this was found to subside over the next weeks with regular practice.

Data for all parameters were recorded before and after the 12 weeks study period.

Anthropometric data: Individual height was measured to the nearest mm by a wall mounted stadiometer and weight measured with a weighing scale (Krup's scale). BMI was calculated by Quetelet's index quantified as weight (kg)/height² (m).

Respiratory Rate (RR) in breaths/minute: The subjects were instructed to relax in the supine position for three minutes after which the investigator held the wrist of the subject as if taking the pulse and at the same time observed the rising and falling of the chest wall for 60 seconds. The number of breaths per minute was counted manually and noted down.

PFT: Lung function parameters selected for study were: Forced Vital Capacity (FVC) in Litres (L), Forced Expiratory Volume in the 1st second (FEV1) in Litres (L), FEV1/FVC, Peak Expiratory Flow Rate (PEFR) in Litres per second (L/s), Forced Inspiratory Vital Capacity (FIVC) in Litres (L), Forced Expiratory Flow between 25 and 75% (FEF 25-75) in Litres per second (L/s) and Lung age in years.

RMS Helios 401 Spirometer, version 1.0, (EN ISO 13485: 2003) manufactured by Recorders and Medicare Systems Pvt. Ltd., Haryana was used having a turbine sensor working on infrared interruption principle. All measurements in Spirometry were done by chief clinical lab technician of an ISO 9001-2008 certified laboratory, and assisted by the investigator. Relevant data such as name, age, sex, height, weight, occupation, lab temperature were entered into the computer and subjects were made familiar with the instrument and procedure for performing PFT. Tests were done on the subjects who were seated comfortably in an upright position with an erect spine, without bending forward. The subjects were instructed to take the disposable mouthpiece inside their mouth with lips closed

| Parameter | Group A (n=20) | | Group B (n=20) | | Comparison (p-values) | |
|--------------------------|----------------|----------------|----------------|--------------|-----------------------|--------|
| | Before | After | Before | After | Before | After |
| Age (y) | 68.90±7.55 | | 68.20±8.54 | | 0.78 | |
| Height (m) | 1.49±0.07 | | 1.47±0.07 | | 0.36 | |
| Weight (Kg) | 58.15±10.27 | 57.01±10.30* | 59.80±14.45 | 60.50±13.50 | 0.68 | 0.36 |
| BMI (Kg/m ²) | 26.31±4.87 | 25.78±4.79* | 27.62±6.42 | 27.98±5.99 | 0.47 | 0.21 |
| RR (bpm) | 22.75±4.67 | 19.85±4.02** | 23.20±4.44 | 24.00±2.60 | 0.76 | <0.001 |
| FVC (L) | 1.44±0.53 | 1.91±0.35*** | 1.42±0.44 | 1.31±0.45* | 0.88 | <0.001 |
| FEV1 (L) | 1.32±0.46 | 1.82±0.30*** | 1.34±0.42 | 1.29±0.42 | 0.92 | <0.001 |
| FEV1/FVC | 92.50±6.31 | 95.77±5.96 | 95.82±4.81 | 99.14±2.65** | 0.06 | 0.02 |
| PEFR (L/s) | 3.00±1.28 | 3.76±1.15** | 3.52±1.30 | 3.65±1.82 | 0.21 | 0.82 |
| FEF 25-75% (L/s) | 1.89±0.61 | 2.55±0.72*** | 2.16±0.81 | 2.51±0.90** | 0.24 | 0.90 |
| FIVC (L) | 1.44±0.53 | 1.78±0.33* | 1.29±0.60 | 1.16±0.31 | 0.29 | <0.001 |
| Lung age (y) | 59.60±23.71 | 28.75±33.40*** | 59.20±20.87 | 62.10±20.40 | 0.96 | <0.001 |

[Table/Fig-2]: Effect of 12 Weeks of Silver Yoga programme on Body Mass Index (BMI), Respiratory Rate (RR), Forced Vital Capacity (FVC), Forced Expiratory Volume in the 1st Sec (FEV1), FEV1/FVC, Peak Expiratory Flow Rate (PEFR), Forced Expiratory Flow (FEF) 25-75%, Forced Inspiratory Vital Capacity (FIVC), and Lung Age in 20 elderly women (Group A) and 20 matched controls (Group B) before and after study period.

Values are given as Mean±SD. *p<0.05, **p<0.01 and ***p<0.001 by paired t-test for intra group comparisons and actual p-values given for unpaired t-test between groups.

over it to avoid the leakage of air while blowing. Nose clip was applied during the entire manoeuvre. Test manoeuvre was repeated for three times with gap of 3-5 minutes between each manoeuvre and the subjects were adequately encouraged to perform at their optimum level applying maximal effort and the best manoeuvre was considered for analysis.

STATISTICAL ANALYSIS

All data passed normality testing by Kolmogorov-Smirnov (KS) test and hence, intra-group comparisons of pre and post study data was done using Student's paired t-test while intergroup comparisons between groups was done using Student's unpaired t-test. A p-value less than 0.05 were considered to indicate significant differences between the means.

RESULTS

The results are given in [Table/Fig-2]. At baseline all values were comparable between groups A and B. After the 12 weeks of Silver Yoga, both weight and BMI showed significant reduction ($p < 0.05$) in Group A, whereas there was an insignificant increase in Group B.

Lung function tests such as FVC ($p < 0.001$), FEV1 ($p < 0.001$), PEFR ($p < 0.01$), FEF25-75% ($p < 0.001$), and FIVC ($p < 0.05$) increased significantly in Group A after yoga training. FEV1/FVC increased in Group A but it was not statistically significant. There was a significant decrease in both RR ($p < 0.01$) and Lung Age ($p < 0.001$) in Group A. FEV1 and PEFR increased slightly and FIVC decreased in Group B. FVC decreased significantly ($p < 0.05$) because of which there was a statistically significant increase of FEV1/FVC in Group B ($p < 0.01$). There was an insignificant increase in both RR and Lung Age in Group B.

DISCUSSION

The present study provides evidence of improvements in PFT of geriatric hospice women population after 12 weeks of a Silver Yoga program. There were significant differences between groups for parameters such as FVC, FEV1, FIVC and lung age and these were significantly greater in Group A than in Group B. The seemingly positive change seen in FEV1/FVC in Group B can however be neglected as an artefact as it can be attributed to an unequal reduction in FVC as compared to FEV1. Reduced FVC suggests a restrictive abnormality and small airway closure and gas trapping and the negative changes in control group and positive changes in Group A provide evidence of the benefits of yoga in such a population [8-11].

The positive and significant changes seen in Group A clearly indicate improvements in lung function in our subjects and these findings are consistent with previous studies [12-15].

These findings are important considering the age group of our subjects as Knudson RT et al., reported that ageing results in changes in pulmonary mechanics, respiratory muscle strength, gas exchange and ventilatory control with increased rigidity of chest wall and decrease of respiratory muscle strength evidenced by reduction in FVC and FEV1 [16]. Others including Woo J et al., have shown that FVC declined by 28.61%, FEV1 by 28.54% and PEFR by 24.86% with advancement of age and that women showed greater age related decline in FVC than men [17].

Improvement in vital capacity may be attributed to the strengthening of respiratory musculature associated with regular practice of yoga as reported by Bhole MV [18]. It was also suggested that the respiratory apparatus is emptied completely after prolonged exhalation and thus the subsequent inhalation is more complete and efficient, which then reflects in terms of increased FVC [18]. Joshi LN et al., reported significant increase in FVC and PEFR following six weeks of pranayama practice [13] while Makwana K et al., showed increased FEV1 after 10 weeks of yogic practice

and concluded that the increase was due to significant increase in vital capacity [19].

In another report by Nayar HS et al., it was suggested that increased FEV1 in yogic practitioners may be because of improved potency of airways [20]. Buffalo health study revealed FEV1 as an independent predictor of overall long term survival rates and suggested that it could be used as a tool in general health assessment [21]. They also recommended that yoga could help in enhancing efficiency of lung function especially with respect to FEV1 as part of an essential preventive strategy [21]. Yoga asanas involve isometric contraction that contributes to enhanced skeletal muscle strength and this in turn improves lung function parameters [14,15]. Such practices also enable lungs to inflate and deflate to fullest possible extent leading to maximum efficiency of respiratory apparatus [13].

The measurement of PEFR helps assess degree of opening of small airway passages and previous studies have shown improvements due to enhanced respiratory muscle conditioning that are also evidenced in Group A [22,23]. There were some insignificant improvements in PEFR of Group B, however the inter group comparisons resulted in no significant statistical differences.

Improvement in FVC, FEV1 and PEFR may be due to regular slow and forceful inspiration and expiration during yoga practice, leading to strengthening of respiratory muscles and increased release of surfactant [24]. Yoga with its calming effect on the mind can reduce and release emotional stresses, thereby withdrawing broncho-constrictor effect [19]. Relaxation is an integral part of any yoga training and was part of our Silver Yoga program as it de-stresses and enhances self-healing in the practitioner as reported earlier [25].

In this protocol, brief periods of relaxation were given between practice of different techniques and also during shavasana with breath awareness. This may be contributing to enhanced autonomic balance by increasing parasympathetic activity and simultaneously decreasing sympatho-adrenal over activity. The resultant calming effect on the stress response system enables to bring down the levels of anxiety and depression [7].

RR decreased significantly in Group A and this is similar to previous reports by Upadhyay K et al., who reported decreased respiratory rate after four weeks of alternate nostril breathing as well as Doijad VP et al., who found significant decreases after 12 weeks of yoga [26,27]. Yogic practices especially pranayama provides focus, helps internalisation by withdrawing attention from worldly worries and hence de-stresses the practitioner, decreasing sympathetic activity, leading to a corresponding decrease in heart rate, blood pressure, RR etc., [28,29]. Joshi LN et al., has hypothesised that during pranayama the basic activity of medullar and pontine respiratory centres is slowed down, prolonging phases of inspiration and expiration by stretching and utilising to the fullest extent the efficiency of lungs [13]. Others have also postulated that while practicing pranayama, reflex mechanisms that control respiratory centre may be modified by conscious use of the higher cortical centres thereby, increasing breath holding time and decreasing RR [20,30]. Our findings are consistent with earlier reports that asanas and pranayama reduce resting RR, while increasing vital capacity, breath holding time, as well as the maximum inspiratory and expiratory pressures [31].

LIMITATION

The present study is limited by the smaller sample size and the fact that the protocol was not validated by external experts though it is being routinely used at CYTER. It was also limited to a single centre. Further, multi-centric studies that explore functional changes with correlations between such changes, psychological variables, and other biochemical markers may deepen the understanding of intrinsic mechanisms by which these changes are occurring in yoga therapy programs.

CONCLUSION

Silver Yoga training programme can be advocated to improve pulmonary function in elderly individuals thereby preventing respiratory problems in future. The results of this pilot study would justify the incorporation of yoga as part of seniors' lifestyle in promoting health and thereby preventing age related systemic disorders.

This study offers preliminary evidence of yoga's potential as a complementary and adjunct therapy in the integrative, holistic management of elderly who live in a hospice. It is an attractive option because it is non-pharmacological, has minimal adverse effects, and also enhances other aspects of physiological and psychological functioning in a positive manner. Considering all these positive changes after yoga training, it can be recommended as an important lifestyle intervention and physical activity for the elderly in the prevention of many diseases as prescribed by the WHO especially where rigorous physical exercise is not advisable. It is recommended that yoga should be a part of health-care facilities for elderly as it can enhance quality of life by improving their overall health status. It can provide a healthy and positive alternative and give them a sense of purpose and hope in the sunset years of life.

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