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A Comparative Study on Oxygen Saturation, Breath Rate, Lung Parameters, Anxiety and Depression Level in Geriatric Population

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Ageing has been associated with multiple medical conditions mainly due to impaired immune mechanisms and deteriorating physiological reserves such as declining physical health, increased risk for mental and emotional problems, economic constraints, changing roles and changing lifestyles. Chronic psychological and physical illnesses among geriatrics were studied univocally. Hence present study aimed to compare the effect of yoga techniques and conventional exercises.
Methods: 40 subjects participated in the form of group therapy based on the selection criteria. Yoga group received yogic Relaxation and pranayama (10 min each) and exercise group received supine rest and diaphragmatic breathing (10 min each) for four days per weeks continued for three months. Outcome measures were evaluated before the intervention and after three months of participation.
Results: The Oxygen saturation in yoga group were 96.4±1.39 and 97.05±1.19, and in exercise group 96.7±1.45 and 97.7± 0.73 in pre and post assessment**.** The breath rates in yoga group were reduced to an average of 19.1 and 19.65 in exercise group after 3 months. The mean vital capacity

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(L/min), FEV1 (mL/sec), FVC (L/min) in yoga group after 3 months were 1.72 ± 0.2, 1.53 ± 0.17 and 1.47 ± 0.1 and in exercise group were 0.72 ± 0.13, 0.70 ± 0.13 and 0.69 ± 0.13 after the intervention. The mean anxiety and depression measured with HADS were 8.9 ± 0.8 & 7.45 ± 0.75 and 9.0 ± 0.72 & 7.9 ± 0.8 pre and post respectively in Yoga Group & Exercise Group.

Conclusion: Yogic relaxation and pranayama is equally effective in supine rest and diaphragmatic breathing in improving oxygen saturation, breath rate, lung parameters and anxiety and depression in geriatrics.

Keywords: Oxygen saturation; vital capacity; FEV1; FEV, Anxiety; depression; geriatrics.

1. INTRODUCTION

The age 60 years and above is defined as the geriatric population [1]. The rapid increase in number of old age people among the population raises various health, economic and social issues. Many studies all over the world have shown that one of the most important factors that causes fear in the minds of old age people is ill health [2].

The skeletal changes with ageing affect pulmonary function in geriatrics. As age advances many of the articulations of the chest wall undergo fibrosis [3]. As age is progressing, there is often decreased complains of the bony ribcage, and increased complains of the lung tissue and an overall decreased complains of the respiratory system. The decrease in effectiveness of the ventilatory muscles due to ageing makes ventilation more energy expensive than their younger age. All these physiological and musculoskeletal changes during the ageing increases ventilatory need on higher activity or illness. Research shows that there will be marked reduction in ventilatory reserve available during the times of increased ventilatory need [4].

Depression affects about one in ten people who are above 60 years in age, which makes it the most frequent among the mental health disorders of old age. Depression has been identified as one of the two most common psychological impairments of advanced age [5].

Psychological distresses like depression in elderly population can be reduced by yoga and its various techniques like pranayama. Thus, there is a high necessity to stay fit and healthy during this age. To keep elderly in good psychophysical condition training of the yoga techniques (asanas, pranayama, meditation, relaxation, and concentration) is a powerful tool. Practitioners report that the practice of Pranayama develops a steady mind, strong will-power, and sound judgment and also claim that sustained pranayama practice extends life and enhances perception [6].

Yogic exercises with abdominal stretch enhances the regeneration of pancreatic cell, which increase utilization & metabolism of glucose in muscles, liver and adipocytes through enzymatic activity. Postural exercises in yoga improve the sensitivity of B-cells of pancreas, glucose metabolism pathways and improves the sensitivity of insulin leading to changes in systemic diseases. Slow adapting receptor and hyperpolarizing currents acts as an inhibitory action on lung tissues following the activity that promotes stretching of lung tissue; Pranayama does that. Pranayama with inflatory and deflatory action of lung bring reflexes and interact with CNS to bring new homeostasis in the body [7].

Relaxation is a complete resignation of the body to the power of gravity, surrender of the mind to nature, and the whole body energy being transferred to a deep, dynamic breathing [8]. The deep relaxation technique is one of the most powerful tools in controlling a number of diseases caused by tension such as hypertension and insomnia. It is also very helpful for calming down the mind leading to meditation. Both guided relaxation and supine rest reduce physiological arousal, though the first produces changes in a larger number of autonomic measures [9].

Breathing is the process that moves air in and out of the lungs. Breathing is also called ventilation, which includes both inhalation and exhalation. Proper breathing when done helps in easy recovery from the illnesses and also towards well- being [10]. Diaphragmatic breathing helps to breathe more easily and less energy is been used. Diaphragmatic breathing helps to get the trapped air out of the lungs. The diaphragm is a large curved muscle separating the lungs from

abdomen. It does about 80% of the work of breathing.

Studies have been done on the effect of yogic relaxation and pranayama and supine rest and breathing exercises but there are limited studies on comparison of all the components and limited studies have been done on geriatric population. Implementation of cultural asanas and exercise are very difficult to execute on geriatric population. So here, less intense activities are used as a tool of the study on geriatric groups which may have beneficial effect. The present resent study aimed to determine the efficacy of yoga techniques and conventional exercises in geriatrics.

2. METHODOLOGY

Study Design & Methods: The study was conducted at 2 different sites of Abhaya Ashraya (Old Age Homes) at Assaigoli and Kodialbail, Mangalore after getting the institution ethical clearance from Nitte University (NIPT/IEC/Min/2015-16). With purposive sampling and pre-post test design 40 subjects were participated in this study. The study subjects were divided into 2 groups; Yoga Group and Exercise Group. Subjects aged between 60-80 years of both the genders without the presence of comprehension and language pathology were included and subjects who are not willing to give the consents, with the severe musculoskeletal, cardio respiratory and neurological problems were excluded.

Procedure: After dividing the subjects into two groups based on purposive sampling group therapy initiated. The subjects were given 20 min of free exercises before every session as a warm up and a general measure to promote health hygiene. The procedures were explained to the subjects before the commencement of the yoga and exercise sessions. Baseline values of oxygen saturation, Breath Rate, PFT (Vital Capacity, Forced Vital Capacity & Forced Expiratory Volume), Anxiety and Depression Levels were taken before the intervention to both groups and post interventional values were taken after the end of three months sessions.

Interventions: A) Yoga Group: Yogic Relaxation (Deep relaxation technique) subjects were made to lie in Savasana position and they were instructed to close their eyes, while breathing deeply in 5, slowly practiced relaxation phases. Subjects were instructed to relax each specific part of the body from the tip of the toes to the waist, followed by chanting 'A'. Relax each body part from the waist to the neck, followed by chanting 'U'. Relax head and neck, followed by chanting 'M', the last half of' A-U-M'. They were told that let the body collapse on the ground with a feeling of 'letting go', chanting the whole word, 'AUM'. Subjects were instructed that one should feel apart from the physical body, aware of expansion, and merge with a limitless space like the sky. Treatment duration was 10 min. Pranayama (Anuloma Viloma) subjects were instructed to sit in a comfortable balanced meditative pose. And they were instructed to use their right thumb to close their right nostril and were told to inhale through their left nostril. They were instructed to close their left nostril with their right index and middle finger and were told to exhale through their right nostril and again inhale through the right nostril while keeping the right nostril closed with the right thumb and exhale through the left nostril. This was one round or cycle of anuloma-viloma pranayama. A ratio of 1:2 is for inhalation and exhalation. If subject inhales for 4 seconds through one nostril, then the exhalation from the other nostril is 8 seconds. In Kumbhaka (retention of the breath), the ratio is 1:4:2. If subject inhales for 4 seconds, 16 seconds of retention and 8 seconds of exhalation. This session was for 10 minutes. B) Exercise Group: Supine Rest subjects were made to lie supine with their legs apart, arms away from the side of their body, and eyes closed. This session lasts for 10 minutes. Diaphragmatic breathing/abdominal breathing subjects were instructed to sit comfortably, with their knees bent and their shoulders, head, and neck relaxed. The subjects were told to place one hand over their upper chest and the other just below their rib cage. They were told to feel their diaphragm move as they breathe. Subjects were instructed to breathe in slowly and deeply through their nose so that their abdomen moves out against their hand. They were told that hand on their chest should remain as still as possible. They were instructed to tighten their abdominal muscles, letting them fall inward as they exhale through pursed lips. This session was for 10 minutes.

Outcome Measures: A) Pulse Oximetry: A non invasive easy and reliable method to measure the Oxygen Saturation of hemoglobin for arterial blood (capillary) and is expressed in percentage. **B)** Breath Rate: Respiration for a minute was counted and the pattern, degree of respiratory effort was also observed. **C)** Pulmonary Function

Test: The procedures were done according to the method recommended by the European Respiratory Society. Measurements were taken by using the handheld spirometer which has shown good reliability and validity when compared to the gold standard pulmonary function in laboratory tests. At the outset, the vital capacity (VC) was measured using an inspiratory manoeuvre. After that the forced vital capacity (FVC) and forced FEV_1 are measured.

Recording Vital Capacity: The subjects were instructed to keep the disposable mouthpiece attached to the transducer halfway in the mouth above the tongue. The nose clip attached and the subjects were asked to look away from the monitor and also instructed to breathe normally. After a minimum of 3 quiet breaths, asked to take a deep inspiration followed by expiration and then breathe normally.

Recording FVC and FEV1: The subjects were instructed to take a deep inspiration and then blow hard in the transducer for 6 seconds followed by a deep inspiration. D) Hospital Anxiety and Depression Scale (HADS): It was originally developed by Zigmond and Snaith (1983) and is commonly used by doctors to determine the levels of anxiety and depression that the patient is experiencing. The HADS is a fourteen-item scale that generates ordinal data. Seven of the items narrate to anxiety and seven narrate to depression. Subjects were asked to choose one response from the four given for each interview. Also instructed to give a quick response and persuade them from not thinking too long about their answers.

Statistical Analysis: All the data were analysed by using SPSS 21.0. The collected data were summarized by using frequency, percentage, mean and standard deviation. For pre-post comparison of the breath rate, oxygen saturation, vital capacity, FEV1 and FVC, paired't' test and for Hospital Anxiety and Depression Scale Wilcoxon sign rank test were used. For the between group comparison of breath rate, oxygen saturation, vital capacity, FEV1 and FVC, independent sample't' test and for Anxiety and Depression Scale Mann Whitney U test were used. The p value <0.05 were considered as significant for this study.

3. RESULTS

40 subjects of both the genders were randomly assigned into Yoga Group and Exercise Group. Table 1 summarized the baseline features. After the intervention the yoga group shows an average reduction in Breath Rate of 2 bpm and in exercise group 1.35 bpm. Oxygen saturation shows an average increase of 0.75% in yoga group and 1.05% in exercise group. This study also had shown differences in the lung parameters after the intervention which includes vital capacity, FEV1 and FVC. The vital capacity in yoga group shows an average increase of 0.95 L/min and 0.15 L/min in exercise group. The forced expiratory volume after 1 second shows an average improvement of 0.95 mL/sec in yoga group and 0.14 mL/sec in exercise group. The forced vital capacity in yoga group demonstrated an average improvement of 0.94 L/min and 0.19 L/min in exercise group. The anxiety and depression level showed an average significant difference in yoga group (1.45) and exercise group (1.10) in HADS (Table 2).

Within the group comparison: Breath Rate, Oxygen Saturation and Lung Parameter's significant level was analyzed by using Paired sample t- test which shows there is statistically significant difference in each variable within the group (Table 3). Wilcoxon Signed Ranks test was used to compare the difference within the group for finding the statistically significant difference in anxiety and depression by using HADS (Table 4).

Table 1. Baseline characters

Variables	All Participants (N=40)	Yoga Group (N=20)	Exercise Group (N=20)
	Mean ± SD		
Age	69.05 ± 0.50	69.85 ± 5.44	68.25 ± 6.94
Gender	M = 15, F = 25	M = 7, F = 13	M = 08, F = 12
Diabetes Mellitus	M=10, F=18	M=04, F=08	M=06, F=10
Hypertension	M=11, F=12	M=06, F=06	M=05, F=06
M-Male, F-Female			

Between the group comparison: Breath Rate, Oxygen Saturation, and Lung Parameter's significant level was analyzed by using independent sample t- test which shows there is statistically significant difference in Vital Capacity, FEV1, FVC (Table 5). Mann Whitney test was used to compare the difference between the group in Anxiety and Depression, and shows no statistical difference (Table 6).

Table 2. Changes in outcome measures following intervention

Variables		All Participants (N=40)	Yoga Group (N=20)	Exercise Group (N=20)
		Mean ± SD		
Breath Rate (bpm)	Pre	21.05 ± 2.33	21.10 ± 2.31	21.00 ± 2.41
	Post	19.37 ± 2.10	19.10 ± 1.86	19.65 ± 2.36
Oxygen Saturation (%)	Pre	96.5 ± 1.43	96.30 ± 1.41	96.70 ± 1.45
	Post	97.4 ± 1.03	97.05 ± 1.19	97.75 ± 0.72
Vital Capacity (L/Min)	Pre	0.67 ± 0.18	0.77 ± 0.18	0.57 ± 0.08
	Post	1.22 ± 0.53	1.72 ± 0.20	0.72 ± 0.13
FEV1(ml/sec)	Pre	0.57 ± 0.10	0.59 ± 0.12	0.56 ± 0.08
	Post	1.12 ± 0.45	1.54 ± 0.17	0.70 ± 0.14
FVC (L/Min)	Pre	0.55 ± 0.08	0.54 ± 0.09	0.55 ± 0.81
	Post	1.08 ± 0.41	1.48 ± 0.11	0.69 ± 0.13
HADS	Pre	8.95 ± 0.78	8.90 ± 0.85	9.00 ± 0.73
	Post	7.68 ± 0.78	7.45 ± 0.76	7.90 ± 0.78

Table 3. Within the group comparison (paired sample t test)

Group	Variables	Mean ± SD	Sig. (2-tailed)
Yoga	BR_Pre - BP_Post	2.00 ± 1.29	.000*
	O2_Pre - O2_post	0.75 ± 1.61	.008*
	VC_Pre - VC_Post	0.94 ± 0.27	.000*
	FEV1_Pre - FEV1_Post	0.95 ± 0.21	.000*
	FVC_Pre - FVC_Post	0.93 ± 0.12	.000*
Exercise	BR_Pre - BP_Post	1.35 ± 1.30	.000*
	O2_Pre - O2_post	1.05 ± 1.50	.006*
	VC_Pre - VC_Post	015 ± 0.13	.000*
	FEV1_Pre - FEV1_Post	0.14 ± 0.13	.000*
	FVC_Pre - FVC_Post	0.14 ± 0.13	.000*

**p<0.05, statistically significant*

Table 4. Wilcoxon signed ranks test for HADS

Group	Mean Rank	Sig. (2-tailed)
Yoga	10.50	0.000*
Exercise	9.68	0.000*

**p<0.05, statistically significant*

Table 5. Between the group comparison (independent samples t test)

Variables	Group	Mean ± SD	Mean Difference	Sig. (2-tailed)
Breath Rate	Yoga	19.10 ± 1.86	0.55	.417
	Exercise	19.65 ± 2.36		
Oxygen Saturation	Yoga	97.05 ± 1.19	0.70	.030
	Exercise	97.75 ± 0.72		
Vital Capacity	Yoga	1.72 ± 0.20	1.00	.000*
	Exercise	0.72 ± 0.13		
FEV1	Yoga	1.54 ± 0.17	0.84	.000*
	Exercise	0.70 ± 0.14		
FVC	Yoga	1.48 ± 0.11	0.79	.000*
	Exercise	0.69 ± 0.13		

**p<0.05, statistically significant*

Table 6. Mann-whitney test for HADS

Group	Mean Rank	Sig. (2-tailed)
Yoga	17.48	0.078*
Exercise	23.53	0.102*

**p>0.05, not statistically significant*

4. DISCUSSION

The study purpose was to determine the efficacy of yogic relaxation with pranayama and supine rest with breathing exercise in geriatric population. The results of the present study proved that yoga group and exercise group had a significant improvement in Breath Rate, Oxygen Saturation, Lung Parameters, Anxiety and Depression Levels.

Studies have been done on the effect of yogic relaxation, pranayama, supine rest and breathing exercises, but there are limited studies on comparison of all the components and limited studies have been done on geriatric population. Hence, this study was undertaken. Klainin-Yobas et al. [11] stated in a review on yoga's effectiveness of depression and anxiety with older adults (60 years and above) determined yoga to be a treatment that may counteract the negative effects of aging by improving physical functioning and stimulating the mind and increasing the hope and by reducing the risk of anxiety and depression. Vempati and Shirley Telles [12] in a study on yoga based isometric relaxation versus supine rest: a study of oxygen consumption, breath rate and volume and autonomic measures concluded that yoga based IRT produced better physiological rest than SR, supporting the idea that a combination of stimulation (through isometric contractions) and relaxation may reduce arousal; better than relaxation alone [13] Klainin-Yobas et.al (2014) in an systematic review on effects of relaxation interventions on depression and anxiety among older adults concluded that there is a positive effects of relaxation interventions on anxiety and depression among older adults [14].

This study shows that both yogic relaxation exercise and supine rest have significant influence in reducing the anxiety and depression levels, physical functioning, and improvement in lung vital parameters. So yogic relaxation and supine rest can be used as effective intervention in managing the overall functions and anxiety and depression levels in an individual. There are few studies which provide relevant information adding to the validity of the study findings stating that it is feasible to train the elderly to perform (pranayama) practices.

Hence, in this present study yogic relaxation was combined with pranayama to find the better effect then yogic relaxation alone. Baljinder Singh Bal (2010) in his study on effect of anulomaviloma and bhastrika pranayama on the vital capacity and maximal ventilatory volume concluded that pranayama training programme had significant effect on vital capacity and maximal ventilatory volume [15] Thus, such training may be recommended to improve physical fitness-based performance. Patil et al (2007) on effect of two relaxation technique on sustained attention found significant improvement in sustained attention after practice of cyclic meditation and supine rest [16]. He found change in sustained attention 24.9% and13.6% respectively ($p < .001$) and concluded that DRT is equally good as of cyclic meditation.

The present study result shows there is no significant differences between the groups in breath rate, Oxygen saturation and anxiety level ($P>0.05$), but the yoga group significant ($P<0.05$) improvement in pulmonary function test values than the exercise group. This might be the inhibitory effects of yoga stretches done on the lung parenchyma.

In psychological state the rate of respiration is highly sensitive to phasic changes stated in the study by Lorig & Schwartz, 1990 [17]. The increase in breath rate has been correlated with evoked anxiety and fear .The reduction in breath rate after yoga based relaxation is consistent with other reports of reduced breath rate related to the practice of yoga, both as an immediate effect [18] and after three months [19].

Meditation acts as a holistic, or whole, treatment for disease. Meditation is a most powerful way of controlling physiological processes and of controlling physiological reaction to psychological events. As we go on chanting OM mantra, our mind becomes calm. When our mind becomes calm, the body relaxes and the breath becomes even smoother and slower. OM mantra which is being repeated naturally slows down as the rate

of the speed decreases. This slowing is a natural process and not by forcing the mantra to be slowed down. Mind is allowed to stay wide-awake and alert, as the OM mantra and breath becomes slower and slower naturally. Within minutes the body and mind relaxes, thoughts are dramatically swept away so as to release the internal life force which heals the self on a cellular level, with more strength, energy and focus.

Thus in the present study there was improvement in both the groups in terms of breath rate, lung volumes (vital capacity, FEV1, FVC), anxiety and depression level (HAD'S) but while the result of yoga group was compared with the exercise group, Yoga group showed significant improvement in lung volumes when compared with exercise group. And breath rate, oxygen saturation, and anxiety and depression level both the groups were equally good in case of improvement.

We also recommend a study with larger sample size and with more quantitative outcome measures to derive and compare the long term effect of Yogic Relaxation and Supine Rest.

5. CONCLUSION

Yogic relaxation with pranayama and supine rest with breathing exercise are equally effective in improving oxygen saturation, breath rate, pulmonary function test and anxiety and depression in geriatrics. While comparing yogic relaxation with pranayama and supine rest with breathing exercise, yogic relaxation with pranayama was seen to be more effective than supine rest with breathing exercise to improve the pulmonary function test values (VC, FEV1, and FVC). Breath rate, oxygen saturation, depression and anxiety level in both the groups showed the similar improvement.

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the authors.

CONSENT

As per international standard or university standard, Participants' written consent has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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