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EFFECTS OF PRANAYAMA (YOGA) AND BREATHING EXERCISES ON PULMONARY FUNCTION IN SEDENTARY PEOPLE-AN EXPERIMENTAL STUDY

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ABSTRACT

Background: Pulmonary function test is the most common test to check the function of lungs in normal healthy, sedentary or diseased person. Pulmonary function testing is often considered the basis for diagnosis in many categories of pulmonary disease. Although most of the testing methodologies are well established and widely employed, there are still many questions regarding how tests should be performed, how to ensure that reliable data are produced, what reference values and rules should be used, and how pulmonary tests (PFTs) function should be interpreted to best support clinical decision making. Sedentary behaviour (SB), defined as sitting (no exercising), reclining, and lying down (posture), or by low energy expenditure, is a public health risk independent to physical activity.

Methodology: This study included 30 participants who were of the age group 18-25 and the study was conducted online through ZOOM video calls where everyone was asked to keep their camera on for monitoring them. The participants were divided in 2 groups; Pranayama (yoga) and Breathing Exercise.

Result: Statistically significant improvements were seen in FVC of group pranayama (P=0.0002), FEV1of group pranayama (P=0.0002), FVC of group breathing exercise (P=0.0001), FEV1 of group breathing exercise (P=0.0003); whereas there was no statistical significance in FEV1/FVC% of group pranayama (P=0.2655) and FEV1/FVC% of group breathing exercises (P=0.8839).

Conclusions: The current study strongly support that both pranayama (yoga) improves FEV1 (P=0.0002) whereas breathing exercises improve FVC (P=0.0001) in sedentary people.

Keywords: Pulmonary function test, sedentary people, sedentary lifestyle, pranayama, yoga, spirometry, breathing exercises, physiotherapy

INTRODUCTION

Pulmonary function measures reflect the normal and pathological state of the lungs.[1] Lung function, specifically forced vital capacity (FVC) and forced expiratory volume in 1 second (FEV1), are objectively measurable quantitative parameters of respiratory health. It is an early indicator of respiratory and systematic inflammation, and associated with cardiorespiratory morbidity and mortality. [2]

Pulmonary function test (PFT) is a useful tool for objective assessment of respiratory impairement.[3] PFT results depend on patient efforts. Normal ranges are related to patient's sex, age, race, and body size.[4] It is of great value in early diagnosis, severity classification, disease progression and evaluation of curative effect of respiratory diseases.[5] The most basic and useful PFT is spirometry.[6] Pulmonary function testing (PFT) is a complete evaluation of the respiratory system including patient history, physical examinations, and tests of pulmonary function. [7]

Spirometry includes tests of pulmonary mechanics – measurements of FVC, FEV1, FEF values, forced inspiratory flow rates (FIFs), and MVV. Measuring pulmonary mechanics assesses the ability of the lungs to move huge volumes of air quickly through the airways to identify airway obstruction.[7]

There are four lung volumes and four lung capacities. A lung's capacity consists of two or more lung volumes. The lung volumes are tidal volume (VT), inspiratory reserve volume (IRV), expiratory reserve volume (ERV), and residual volume (RV). The four lung capacities are total lung capacity (TLC), inspiratory capacity (IC), functional residual capacity (FRC) and vital capacity (VC).[8]

PFTs, measure how well the lungs work. For some of the test measurements, the client can breathe normally and quietly. Other tests require forced inhalation or exhalation after a deep breath. Sometimes, they will be asked to inhale a different gas or a medicine to see how it changes test results.[9]

Table 1.1: Pulmonary Function Test

Pulmonary function test	Instrument	Measures	Function
Spirometry	Spirometer	Forced vital capacity (FVC)	Volume of air that is exhaled after maximum inhalation
		Forced expiratory volume (FEV)	Volume of air exhaled in one breath
		Forced expiratory flow, 25–75 percent	Air flow in the middle of exhalation
		Peak expiratory flow (PEF)	Rate of exhalation
		Maximum voluntary ventilation (MVV)	Volume of air that can be inspired and expired in 1 minute
		Slow vital capacity (SVC)	Volume of air that can be slowly exhaled after inhaling past the tidal volume
		Total lung capacity (TLC)	Volume of air in the lungs after maximum inhalation
		Functional residual capacity (FRC)	Volume of air left in the lungs after normal expiration
		Residual volume (RV)	Volume of air in the lungs after maximum exhalation
		Total lung capacity (TLC)	Maximum volume of air that the lungs can hold
		Expiratory reserve volume (ERV)	The volume of air that can be exhaled beyond normal exhalation
Gas diffusion	Blood gas analyzer	Arterial blood gases	Concentration of oxygen and carbon dioxide in the blood

Spirometry Measures the rate of air flow and estimates lung size. For this test, client will breathe multiple times, with regular and maximal effort, through a tube that is connected to a computer. Some people feel lightheaded or tired from the required breathing effort.[10]

If breathing is taken seriously and done with utter care and consciousness it can benefit the body and can increase the efficiency of everyday life and process. Breathing is a workout in itself for the body.[11]

Human life relies on the process of breathing. Breathing is the basic living process on which life depends. It is important to understand the significance of the process of breathing. With breathing, we inhale air and that is circulated throughout the body so it matters, what are we breathing and how are we breathing. Yet with time and lifestyle, people have forgotten how to breathe properly.[12]

When you have healthy lungs, breathing is natural and easy. You breathe in and out with your diaphragm doing about 80 percent of the work to fill your lungs with a mixture of oxygen and other gases, and then to send the waste gas out. Lung Helpline respiratory therapist Mark Courtney compares the process to a screen door with a spring, opening and shutting on its own. "Our lungs are springy, like the door.[13]

Over time, stale air builds up, leaving less room for the diaphragm to contract and bring in fresh oxygen.[14] With the diaphragm not working to full capacity, the body starts to use other muscles in the neck, back and chest for breathing. This translates into lower oxygen levels, and less reserve for exercise and activity. If practiced regularly, breathing exercises can help rid the lungs of accumulated stale air, increase oxygen levels and get the diaphragm to return to its job of helping you breathe.[15]

Breathing exercise (BE) has been an essential part of a comprehensive pulmonary rehabilitation program. Many types of BE such as slow and deep breathing, active expiration, pursed-lip breathing (PLB), relaxation breathing, diaphragmatic breathing (DBE), and ventilatory feedback (VF) training, have been prescribed to decrease lung hyperventilation, enhance respiratory muscle function, exercise tolerance, and QoL.[16] These BEs have been used individually, or in combination of different types of BE.[16]

A person may not be able to change how much oxygen their lungs can hold. However, breathing exercises can help reduce shortness of breath caused by limited lung function.[17]

Some people find it especially beneficial to focus on time, for example by breathing in for 5 seconds and breathing out for 10 seconds. It can help to keep a clock that shows the second's nearby.[18] For people who are not very physically active and may not be exercising their breathing muscles frequently, pursed lip breathing may have particular benefits. Deep breathing exercises may help increase lung capacity. For instance, the British Lung Foundation say that deep breathing can help clear mucus from the lungs after pneumonia, allowing more air to circulate.[17]

Other exercises, such as pursed lip breathing, can help manage breathlessness during respiratory illness. According to the National Institute for Health and Care Excellence, this may help with breathlessness caused by COVID-19.[19]

Although the terms breathing control and diaphragmatic breathing are often used synonymously, unlike breathing control, diaphragmatic breathing exercises encourage abdominal movement and contraction. Levensen (1992) describes diaphragmatic breathing as a breathing exercise which improves diaphragmatic recruitment. Excursion during inspiration and expiration. Although no studies to date have investigated the effect of breathing control on ventilation, it may be appropriate to extrapolate from the findings of research based on diaphragmatic breathing exercises.[20]

Pranayama is the yogic practice of focusing on breath. In Sanskrit, prana means "vital life force", and yama means to gain control.[21] In yoga, breath is associated with the prana, thus, pranayama is a means to elevate the prana shakti, or life energies. Pranayama is described in Hindu texts like the Bhagavad Gita and the Yoga Sutras of Patanjali. Later in Hatha yoga texts, it meant the complete suspension of breathing.[22]

Pranayama, the practice of controlled breathing, can be found as a part of many types of yoga's. This practice is believed to help encourage relaxation and improve breathing.[22, 23, 24] Although limited in nature, research studies on a small group of subjects indicate pranayama to have a positive impact on lung function and lung parameter as an adjunctive treatment. Long term and large-scale studies would be needed in order to validate the research and confirm the effects of pranayama and reach global acceptance pranayama.[24]

Pranayama improves overall performance of the body.[25] The regular practice of pranayama increases chest wall expansion and almost all lung functions. The beneficial effect of different pranayama is well reported and has sound scientific basis. Pranayama makes efficient use of abdominal and diaphragmatic muscles and improves the respiratory apparatus. Yoga strengthens the respiratory musculature due to which chest and lungs inflate and deflate to fullest possible extent and muscles are made to work to maximal extent .[25, 26]

Yoga originated in ancient India and denotes union between the individual self and the transcendental self. Pranayama is an important aspect of yoga that mainly deals with the relationship between breathing pattern and emotional states.[26] It can assume more complex forms of breathing, but the essence of its practice remains slow and fast breathing. Regular practice of pranayama improves cardiovascular and respiratory functions, improves cognitive function, decreases the effect of stress and strain on the body and hence improves the physical and mental health of an individual. The Bhramari Pranayama (Bhr.P), in specific, is one such ancient yogic breathing practice that not only includes a unique breathing technique but also is associated with concurrent generation of a constant humming sound during the phase of expiration thus placing the body in the state of relaxation. Studies done by Jain et al. and Rampalliwar et al. have concluded that regular practice of Bhr.P reduces the cardiovascular reactivity to stress (cold pressor test) by inducing parasympathetic predominance and cortico-hypothalamo medullary inhibition. Immediately after the practice of Bhr.P, there is a reduction in heart rate, blood pressure and improvement in the cognition in healthy subjects.[27]

Pranayama is an ancient yoga technique. The regular practice of Pranayama integrates the mind and the body. It differs from other forms of exercises as it mainly focuses on the sensations in the body.[28] Pranayama thus acts directly on the various functions of the body and affords benefits in a positive way. The following may be the reasons for this:

- Regular, slow and forceful inspiration and expiration for a longer duration during the pranayama practice, leading to strengthening of the respiratory muscles.[28]
- Pranayama training causes improvement in the expiratory power and decreases the resistance to the air flow in the lungs. [28]
- Pranayama training causes an increase in the voluntary breath holding time. This may be due to acclimatization of the chemoreceptors to hypercapnoea. [28]

Pranayama breathing may prevent serious cardio-respiratory complications by emphasizing optimal physical and mental conditioning. It also helps in tranquilizing the mind and as a result patient feel.[29]

REVIEW OF LITERATURE

1. **Breathing exercises and pranayama to decrease perceived exertion during breath-holding while locked-down due to COVID19 online randomized study. Mayank Shukla, et al. (2020)**30

Aim of the study was to compare the anulom vilom pranayama (AVP), kapal bhati pranayama (KBP), diaphragmatic breathing exercise (DBE), and pursed lip breathing (PLB), for breath holding time (BHT) and rate of perceived exertion (RPE). It was concluded that KBP and PLB did not decreased RPE as compared to AVP and DBE (p.0.05). DBE increased BHT more than KBP and PLB interventions (p 0.05). Study concluded that AVP is best among studied interventions for increasing relaxation during breath holding and DBE increases breathe holding time maximally.

2. **Pulmonary function tests. Harpreet Ranu, et al. (2011)**31

The study concluded that pulmonary function tests are an important tool in the assessment of patients with suspected or known respiratory disease. They are also important in the evaluation of patients prior to major surgery. Interpretation of the tests, which requires knowledge of normal values and appearance of flow volume curves, must be combined with the patient's clinical history and presentation.

3. **Pulmonary function tests for the generalist: A brief review. Timothy M. Dempsey, et al. (2018)**32

The study concluded that PFT's are essential to the diagnosis of many lung conditions and help to identify numerous non pulmonary disease processes. Understanding the basic interpretation of the components of this valuable test is crucial for primary care physicians to aid in the diagnosis of patients with respiratory symptoms.

4. **Lung function in obese children and adolescents without respiratory disease: a systematic review. Mariana Simoes Ferreira, et al. (2020)**33

The objective of the study was to perform a systematic review to assess lung function in children and adolescents affected by obesity and to verify the presence of pulmonary changes due to obesity in individuals without previous or current respiratory diseases. Articles from 18 countries were included. Spirometry was the most widely used tool to assess lung function. There was a high variability in lung function values with a trend towards reduced lung function markers (FEV1/FVC, FRC, ERV and RV) in obese children and adolescents.

5. **Effects of Diaphragmatic breathing on health: A narrative review. Hidetaka Hamasaki. (2020)**34

This review consists of a total of 10 systemic reviews and 15 random controlled trials. DB appears to be effective for improving the exercise capacity and respiratory function in patients with chronic obstructive pulmonary disease. Based on this narrative review the exact usefulness of diaphragmatic breathing in clinical practice is unclear due to poor quality of studies. However, it may be feasible and practical treatment method of various disorders.

6. **The short-term effect of pranayama on the lung parameters. Shankarappa V., et al. (2020)**35

An evaluation of a non-controlled study with 50 adult subjects was undertaken to study the effect of 6 weeks of pranayama on the lung parameters. After 6 weeks of pranayama it was noted that pulmonary function parameters FVC, FEV1, PEFR, FEF 25-75% and breath holding time (BHT) increased significantly.

7. **Effect of bhramari pranayama practice on pulmonary function in healthy adolescents: a randomized controlled study. Maheshkumar Kuppusamy, et al. (2017)**36

The study was conducted to find the effects of bhramari pranayama practice on pulmonary function in healthy adolescents. A significant ($P<0.05$) improvement in all pulmonary function parameters; FVC, FEV1, FEV1/FVC ratio, FEF 25% - 75% and PEFR was seen in the bhramari group then the control group adolescents. Slow vital capacity (SVC) and maximum voluntary volume (MVV) also showed significant improvement in the pranayama group.

8. **Exploring the therapeutic benefits of pranayama (yogic breathing): a systematic review. Ranil Jayawardena, et al. (2020)**37

The aim of the study was to perform a systematic review about the beneficial health effects of pranayama. Available evidence on pranayama indicates physiological benefits. Beneficial effects were mostly observed in patients with respiratory diseases such as bronchial asthma. It also helped those with cancer and cardiovascular disease.

9. **The comparison of the pulmonary functions of the individuals having regular exercises and sedentary individuals. Irfan Marangoz, et al. (2016)**38

The objective of the study was to determine the differences between the pulmonary functions of individuals having regular exercises and long-term exercises, and sedentary individuals. When the results of the study were evaluated, it was found out that no difference is present between FEV1 and PEF ($p>0.05$) values of individuals having long term and regular exercises, and sedentary individuals; however, there is a significant difference among MVV, FVC and VC values ($p<0.05$). Therefore, it has been found out that the pulmonary capacities (MVV, FVC, and VC) of individuals having regular exercises have improved better than that of sedentary individuals.

10. **Pulmonary functions in yogic and sedentary population. Shobha Rani Vedala, et al. (2014)**39

Pulmonary functions were compared between the yoga practitioners and sedentary group. Yoga exercise significantly increased chest wall expansion as observed by higher values of pulmonary functions compared with sedentary controls. Regular yoga practice increases the vital capacity, timed vital capacity, maximum voluntary ventilation, breath holding time and maximal inspiratory and expiratory pressures.

11. **A comparative study of the effects of yoga and swimming on pulmonary functions in sedentary subjects. Shilpa S Gupta, et al. (2012)** [40]

The aim of the study was, designed to assess and compare the effects of yogic training and swimming on pulmonary functions in normal healthy young volunteers.100 volunteers were inducted into the study and randomly divided into two groups: One group underwent 12 weeks training for yogic exercises and other for swimming. The training and data acquisition was done in small cohorts of 10 subjects each. The subjects were assessed by studying their anthropometric parameters and pulmonary function parameters (FVC, FEV1/FVC ratio, PEFR, FEF25-75%, FEF 0.2-1.2 l and MVV) both before and after training. All parameters showed statistically significant improvements after both yoga and swimming. Comparison of these improvements for different

parameters statistically analysed by unpaired t test or Mann Whitney U test depicted a statistically better improvement in FVC, FEF25-75% and MVV with swimming as compared to yogic exercises.

12. Effect of short-term yoga practice on pulmonary function tests. Vinayak P Doijad, et al. 2012[41]

This work was done to find effects of short-term Yoga practice on pulmonary function tests. The study was conducted on 60subjects, (40males and 20females) who came voluntarily as subjects for the project with written consent. It was a cohort study on I MBBS students, 60 in number (40 boys and 20 girls). Their age ranged between 18 to 20 years. Various Pulmonary function tests were measured. The instrument used was Medspiror Pneumotachometer (manufactured by MED SYSTEMS PVT. LTD. CHANDIGARH). FVC, FEV 1%, MVV and PEFR were found to be increased in both male and female subjects in result of the study. From this study we conclude that yoga practice can be advocated to improve respiratory efficiency for healthy individuals as well as an alternative therapy or as adjunct to conventional therapy in respiratory diseases.

13. **Effects of slow breathing exercise on cardiovascular functions, pulmonary functions & galvanic skin resistance in healthy human volunteers-a pilot study. AV Turankar, et al. 2013.**42

In this study eleven normal healthy volunteers were randomized into Pranayama group (n= 6) and a non-Pranayama control group (n= 5); the pranayama volunteers were trained in pranayama, the technique being Anuloma-Viloma pranayama with Kumbhak. Pulse, GSR, blood pressure (BP) and pulmonary function tests (PFT) were measured before and after the 7-day programme in all the volunteers.

While no significant changes were observed in BP and PFT, an overall reduction in pulse rate was observed in all the eleven volunteers; this reduction might have resulted from the relaxation and the environment. Statistically significant changes were observed in the Pranayama group volunteers in the GSR values during standing phases indicating that regular practice of Pranayama causes a reduction in the sympathetic tone within a period as short as 7 days. On the basis of results the study concluded that beneficial effects of pranayama started appearing within a week of regular practice, and the first change appeared to be a reduction in sympathetic tone.

14. An Approach to Interpreting Spirometry. Timothy J. Barreiro, et al. 2004.[43]

According to this study spirometry is a powerful tool that can be used to detect, follow, and manage patients with lung disorders. Technology advancements have made spirometry much more reliable and relatively simple to incorporate into a routine office visit. However, interpreting spirometry results can be challenging because the quality of the test is largely dependent on patient effort and cooperation, and the interpreter's knowledge of appropriate reference values. A simplified and stepwise method is key to interpreting spirometry. The first step is determining the validity of the test. Next, the determination of an obstructive or restrictive ventilatory pattern is made. If a ventilatory pattern is identified, its severity is graded.

15. Spirometry in the lung health study. Paul L Enright, et al.1991[44]

In this study Data were obtained from four surveys and included 3,598 subjects aged 4–80 years. The original analyses were sex specific and limited to non-Hispanic white subjects. An extension of the LMS (lambda, mu, and sigma) method, widely used to construct growth reference charts, was applied. The study concluded that the modelling technique provides an elegant solution to a complex and longstanding problem. Furthermore, it provides a biologically plausible and statistically robust means of developing continuous reference ranges from early childhood to old age. These dynamic models provide a platform from which future studies can be developed to continue to improve the accuracy of reference data for pulmonary function tests.

NEED OF STUDY

This study is required to determine the significance of pranayama (yoga) and breathing exercise in increasing or changing the lung volume or its capacity in sedentary people. With increasing popularity and demand of yoga it is important to have the knowledge about its effect on pulmonary function in comparison to breathing exercise, to determine if they both have same effect or if one type is superior to other.

AIM AND OBJECTIVES OF THE STUDY

AIM OF THE RESEARCH:

To see the difference in effects of pranayama (yoga) and breathing exercise on vital capacity in sedentary people.

OBJECTIVE OF THE RESEARCH:

To assess the effectiveness of pranayama (yoga) and breathing exercise on vital capacity in sedentary people.

HYPOTHESIS

NULL HYPOTHESIS:

There will be no significant difference in effects of pranayama (yoga) or breathing exercises on vital capacity in subjects with sedentary lifestyle.

ALTERNATE HYPOTHESIS:

There will be significant difference in effects of pranayama (yoga) or breathing exercises on vital capacity in subjects with sedentary lifestyle.

METHODOLOGY

Study design: Experimental

Study setting: Community

Sampling method: Purposive

Sample size: 30

Inclusion criteria:

a) Age group – 18 to 25 years

b) Subjects with sedentary lifestyle

Exclusion criteria:

a) Age group that does not match the inclusive criteria

b) Subjects who are physically active and not sedentary

c) Subjects having allergic disorders or respiratory disorders

d) Systemic diseases like hypertension, diabetes

Data collection tool:

a) International Physical Activity Questionnaire

b) Pulmonary Function Test

Procedure:

Identification of subjects were done according to the inclusion criteria. Each of them was explained about the study and its benefits and written consent form was obtained from each subject.

Subjects who fulfilled the inclusion and exclusion criteria along with MET scoring were recruited and assigned into one of the two groups: Pranayama (yoga) and Breathing exercise.

Each individual's height, weight and spirometry score were recorded before and after the intervention procedure.

GROUP 1: Pranayama (yoga) group

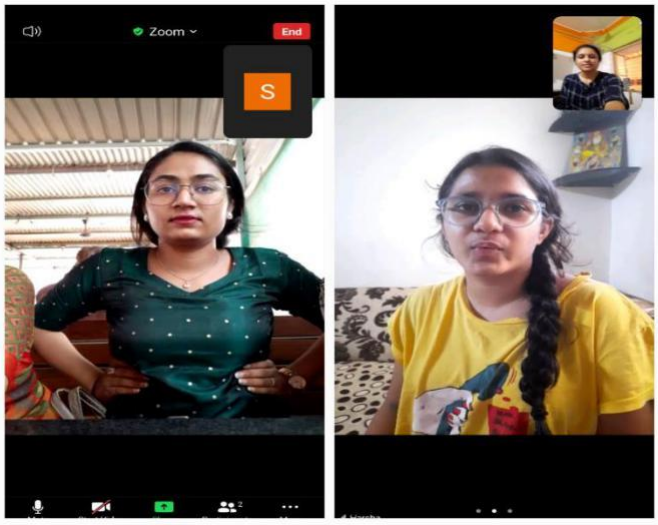
15 subjects were taken in the group who were treated with pranayama (yoga) which included anuloma viloma, kapal bhati, Bhramari.

10 repetition of each exercise was done for 5 sessions per week for 4 weeks.

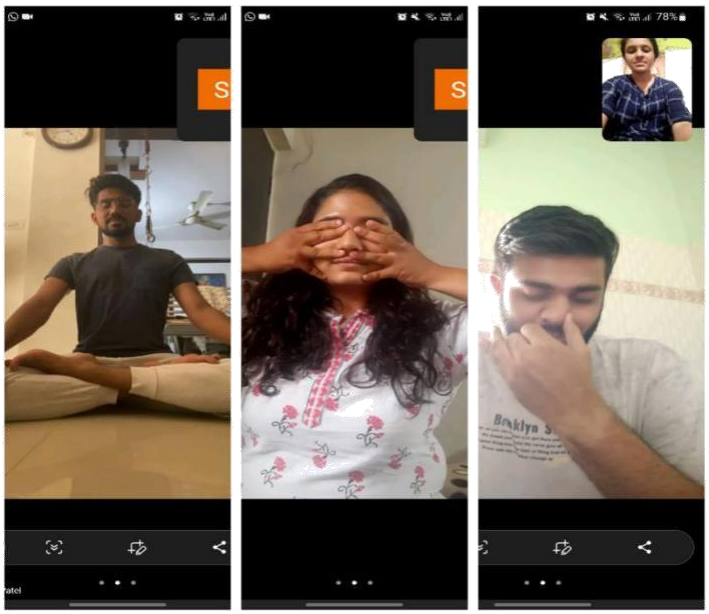
GROUP 2: Breathing exercise group

15 subjects were taken in the group who were treated with breathing exercises which included diaphragmatic breathing, pursed lip breathing, segmental breathing.

10 repetition of each exercise was done for 5 sessions per week for 4 weeks.



Photograph 6.1: Subjects performing Breathing exercises



Photograph 6.2: Subjects performing pranayama (yoga)

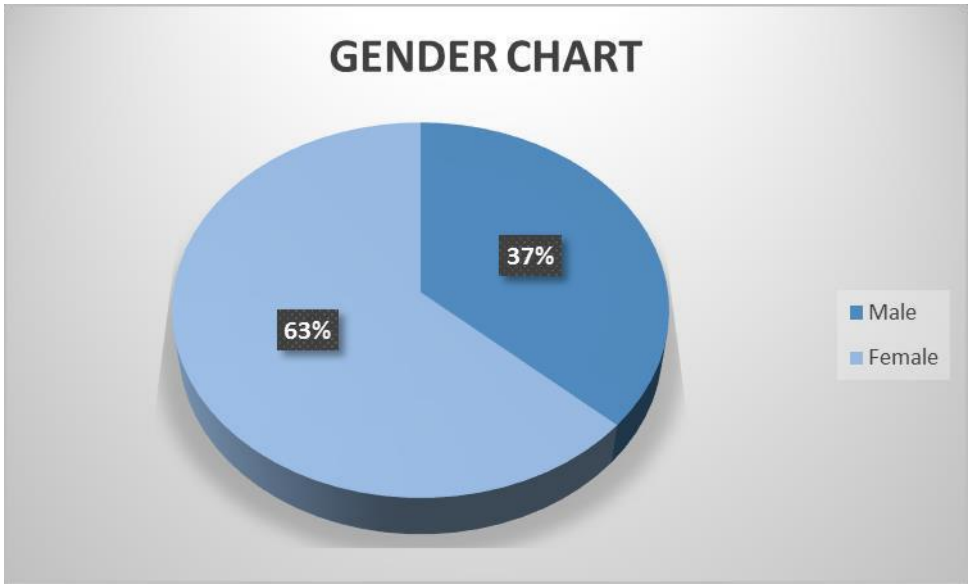
Photograph 6.3: Subjects performing Spirometry

RESULT

Demographic Profile:

1. GENDER DISTRIBUTION:

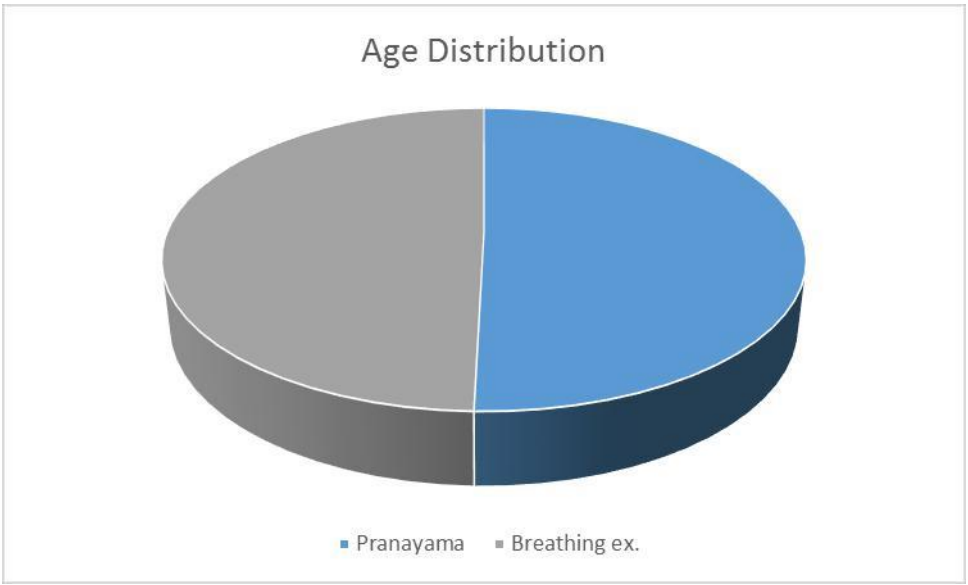
There were total 30 participant taken after matching the inclusion and exclusion criteria in which 19 were Females and 11 were Males.



Graph 7.1: Gender Distribution

2. AGE DISTRIBUTION

The mean age of participants of both groups are 20.8 and 20.46 respectively for group Pranayama (yoga) and Breathing exercise.



Graph 7.2: Age Distribution

Table 7.1: Mean Of Age Distribution

MEASURES	MEAN
PRANAYAMA (YOGA)	20.8
BREATHING EXERCISE	20.46

Clinical Parameters:

The participants in both groups shows significant result in increasing FVC and FEV1 whereas there were no significant changes in FEV1/FVC Ratio.

3. PULMONARY FUNCTION TEST

PFT recordings were done in both groups pre and post intervention for FVC, FEV1 and FEV1/FVC Ratio.

3.1 FVC in Pranayama (yoga) Group and Breathing exercise Group

In Pranayama (yoga) group, the treatment was given for 4 weeks and its pre and post treatment difference is -0.8500.

In Breathing exercise group, the treatment was given for 4 weeks and its pre and post treatment difference is -0.8353.

Table 7.2: FVC Pre And Post

MEASURES	FVC		DIFFERENCE	T VALUE	P VALUE
	PRE	POST			
PRANAYAMA	2.29±0.128	3.14±0.147	-0.85	4.3447	0.0002
BREATHING EX.	2.38±0.116	3.22±0.136	-0.835	4.6424	<0.0001

3.2 FEV1 in Pranayama (yoga) group and Breathing exercise Group

In Pranayama (yoga) group, the treatment was given for 4 weeks and its pre and post treatment difference is -0.7573.
In Breathing exercise group, the treatment was given for 4 weeks and its pre and post treatment difference is -0.7000.

Table 7.3: FEV1 Pre And Post

MEASURES	FEV1		DIFFERENCE	T VALUE	P VALUE
	PRE	POST			
PRANAYAMA	1.948±0.120	2.706±0.128	-0.7573	4.312	0.0002
BREATHING EX.	2.046±0.113	2..746±0.125	-0.7	4.137	0.0003

3.3 FEV1/FVC in Pranayama (yoga) group and Breathing exercise Group

In Pranayama (yoga) group, the treatment was given for 4 weeks and its pre and post treatment difference is -1.4467.

In Breathing exercise group, the treatment was given for 4 weeks and its pre and post treatment difference is 0.2160.

Table 7.4: FEV1/FVC Pre And Post

MEASURES	FEV1/FVC		DIFFERENCE	T VALUE	P VALUE
	PRE	POST			
PRANAYAMA	84.58±0.88	86.03±0.91	-1.446	1.136	0.265
BREATHING EX.	85.43±0.91	85.215±1.14	0.216	0.147	0.8839

DISCUSSION

It is seen in many studies done in past that sedentary lifestyle is one of the causes of reduced lung capacity and volume. It is known that sedentary lifestyle is a risk factor for reduced lung volumes and lung capacity. Reduction in these can cause many obstructive or restrictive lung diseases in healthy as well as sedentary population. Also, current study found out that participant's with lower MET showed comparatively lower lung volume and capacity this indicates that sedentary lifestyle and reduced lung volume are correlated and directly proportional. Many researches have also shown improvement in lung volumes and capacity through pranayama or breathing exercise in diseased individuals but the intervention procedure might take longer duration to show significant results. This research presents an experimental study of Pranayama (yoga) and Breathing exercise in sedentary people.

A study done by Irfan Marangoz, et al. (2016) to determine the differences between the pulmonary functions of individuals having regular exercises and long-term exercises, and sedentary individuals showed that there was a significant difference among MVV, FVC and VC values ($p<0.05$) in individuals doing regular exercise, and sedentary individual. Therefore, it has been found out that the pulmonary capacities (MVV, FVC, and VC) of individuals having regular exercises have improved better than that of sedentary individuals. Similarly, although our study didn't find any statistically significant change in FEV1/FVC but there was statistically significant improvement seen in both FVC and FEV1.

Current findings suggest that participants who were having high more sedentary lifestyle i.e. lower MET value were having comparatively lower lung volume and capacity, this indicates that sedentary lifestyle and reduced lung volume are correlated and directly proportional. We collected 30 samples from which females were 19 and males were 11.

CONCLUSION & SUMMARY

Conclusion

The current study strongly supports that both pranayama (yoga) and breathing exercises improve FVC and FEV1 in sedentary people.

Summary

This study is comparing the effects of pranayama (yoga) and breathing exercise on sedentary people, 30 participants were taken and their MET was calculated using IPAQ. Spirometry was done before and post the intervention procedure. It is seen that both pranayama (yoga) and breathing exercises help increase FVC and FEV1 in sedentary people.

LIMITATIONS

Limitations

Limitations of the study included the conduction of the study which was done online on zoom call because of outrage of cases of COVID-19.
Small sample size (30 participants).
Limited age group of 18-25 years.

Future recommendation

Offline study conduction can help monitor the participants well rather than contacting them online.
Increasing sample size can help in making sure that data obtained is statistically correct.
Increasing age group range.

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