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"To compare the therapeutic effects of yoga and pranayama versus conventional training on chest expansion in post COVID-19 patients."-PILOT STUDY

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ABSTRACT:
Background: Coronavirus disease-19 (COVID-19), caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has become a global pandemic, posing a serious health risk worldwide. It is believed that yoga and pranayama have a more profound and powerful effect on the respiratory system than any other organ in the body.
AIM: To determine whether the therapeutic effects of yoga and pranayama is successful in restoring post-COVID 19 patients' optimum respiratory performance.
Material and method:In this study volunteers who met inclusion and exclusion criteria were selected for the study. In this study 12 subjects have enrolled in each Group-A (Intervention) and Group-B (Control). Volunteers in Group A (Intervention group) were taught yoga and pranayama in addition to conventional cardio lab training. In Group B (Control), volunteers received standard cardio lab training. Treatment is given twice a week for 12 weeks. Thoracic expansion was measured using metric tape.
Result: In both groups, 12 subjects participated in the study. Data analysis was carried out using IBM SPSS software. The Mann-Whitney U test

within-group analysis yielded a $p>0.05$ for both the conventional and interventional groups, indicating no significant difference. In the between-group analysis, the Wilcoxon rank test showed a significant difference and improvement in the intervention group ($p < 0.05$).

Conclusion: Based on the findings of this study, we can conclude that the using yoga and pranyama will be efficient in promoting an increasethoracic expansion.

Key words: Post Covid-19 patients, chest expansion, yoga and pranayama, SARS-Cov-2

INTRODUCTION

Coronavirus disease-19 (COVID-19), produced by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has become a global pandemic, giving rise to a serious health threat globally. Several countries have seen a two-wave pattern of reported cases, with a first wave in spring and a second in late summer and autumn.

The main concern in COVID-19 is the involvement of the lungs and respiratory system which may result in dyspnea, low blood oxygen saturation, and respiratory failure, thereby, requiring mechanical ventilation, mostly in those havingcomorbid conditions such as diabetes mellitus, obesity, ischemic heart disease, cancer, post-surgery, and chronic obstructive pulmonary disease (COPD).

Different types of functional respiratory evaluations can be carried out objectively, the most commonly used are pulmonary function tests (PFTs), such as spirometry, diffusion capacity and lung volumes, and chest expansion.

However, other tests that complement lung function tests, such as the evaluation of respiratory muscles or airway resistance, can help to improve the study of the properties of the lung and allow us to determine the consequences of acute or chronic respiratory disease objectively. These findings generate concerns regarding the assessment of lung injury for discharged patients.

Yoga originated in India more than 5,000 years ago and is a means of balancing and harmonizing the body, mind, and emotions. The health and fitness fields are paying much attention towards yoga, an ancient Indian exercise.

It is believed that both yoga and pranayama exhibits a profound and powerful effect on the respiratory system than on any other organ in the body. Many of the studies clearly showed the positive impact of yoga in improving the pulmonary function. Several studies reported the improvement in vital capacity and PEFR (Peak Expiratory Flow Rate) with yoga training. Of the several exercise regimens, yoga is found to be superior and effective.

The effects of an illness typically extend beyond clinical outcomes such as mortality and morbidity and include subjective measures such as HRQoL. HRQoL is a multidimensional concept that encompasses physical, mental, social, and emotional functioning. There are several HRQoL measurement tools available, some of which are generic and some of which are disease specific. Generic HRQoL tools (for example, the SF-36 (36-item Short-Form Health Survey), SF-6D (Short-Form 6 Dimension) derived from the SF-36, and EQ-5D (Euro-Qol- 5 Dimension)) are widely used to assess multidimensional domains of health and well-being in various populations. St. George Respiratory Questionnaire (SGRQ) and Clinical COPD Questionnaire (CCQ) are two disease-specific quality of life assessment instruments used in the HRQoL assessment of Covid-19 patients.

METHODOLOGY:

Data for this observational cross-sectional study was gathered from various colleges, OPD, and locations in and around the Surat area. Participants in our study were post-covid patients, and 50 samples were collected conveniently. The following inclusion criteria were used to include

participants in the study: There are both male and female included. never smoked, Ability to provide informed consent, knowledge of the local language, and a patient with a COVID-19 history dating back more than a year. 25 to 40 years of age, both men and women are included., History of COVID-19 within two years (with proof) According to the WHO classification, the patient's symptoms ranged from mild to severe during COVID 19. During the covid19 pandemic, both hospitalized and non-hospitalized people were affected. The following exclusion criteria were used to include participants in the study: Myocardial infarction within the last month. A history of unstable angina. Recent thoracic and abdominal surgeries, ophthalmic surgery on the brain, middle ear, sinuses, eyes, chest, or abdomen. History of abdominal, thoracic, and cerebral aneurysms. Recentconcussion. History of pulmonary hypertension, pulmonary embolism, and pneumothorax. History of late-term pregnancy. History of Musculoskeletal Disorders person who regularly practices yoga and breathing exercises. Patients who agreed to participate in the study and who have not received PT management for their functional capacity were included. (The confirmation of COVID-19 will be validated using RTPCR report.) Using these standards, the participants were disqualified. recent abdominal and thoracic surgeries, having ophthalmic surgery on the chest, abdomen, middle ear, sinuses, eyes, or brain, recently suffered a myocardial infarction, history of thoracic, cerebral, and abdominal aneurysms history of pneumothorax, pulmonary embolism, and pulmonary hypertension Experience with late-term pregnancies. Outcome measures used for the study were Thoracic expansion and functional capacity outcome measures: Metric tape is used to measure thoracic expansion. We first obtained approval from the principal, director, or HOD of each college. The subject was informed of the study's goal. Using inclusion and exclusion criteria, a sample of 24 people was chosen; they were willing to participate, and their informed consent was also obtained. In a sitting position, the chest expansion was measured. The chest expansion was measured using an inch tape at two levels, the second and sixth ICSs. The subject was instructed to take the deepest possible breaths while exhaling as much air as they could. There was a distinction between inspiration and full expiration. Each level received three trials, and the average of the three readings was recorded. On the day of the test, the subjects received an orientation. According to the American Thoracic Society, the course was designated by two traffic cones, and the lab floor was marked every three meters. Up until the subject excursion, encouragement was given every minute. The following data were collected: pulse, SPO2, and blood pressure before and after the walk test. Dataanalysis wasdonebySPSS softwareandexcel database2007. The result is presented as mean and standard deviation using narrative text, graph and table.

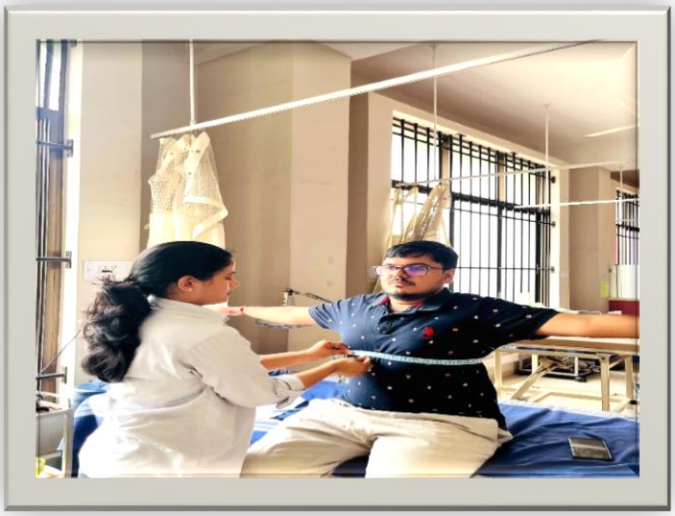
OUTCOME MEASURES/TOOL

1. Thoracic expansion is measured by Metric tape

Thoracic expansion (Chest expansion):

- In the evaluation of thoracic expansion, a metric tape will be used in order to measure the thoracic (axillary and xiphoid) circumferences. (Figure 1)
- Therapist will be show how to blow into the spirometer before starting. A volunteer has to blow 3 or more times into the spirometer, to check the readings are similar each time.

Figure 1: Evaluation of thoracic expansion



DATA COLLECTION PROCEDURE:

First, we obtained ethical clearance from the institutional committee for the study. I visited Uka Tarsadia university Bardoli Surat district informed about the research programme meeting done with HOD department and research approval letter received.The faculties with post Covid-19 history were informed and given brief introduction of the study.The other day, they were gathered in the physiotherapy department of the cardio lab, where all devices were available for measuring the outcome measure.

The screening procedure began with an explanation of the study, followed by the completion of an assessment form that included inclusion and exclusion criteria, and the selection of an appropriate study sample. Twenty faculty members expressed interest and attended the screening; ten were chosen, while the remaining did not meet the inclusion criteria. The consent form was then given, and the remainder of the procedure was completed the following day.

The following day, the study and protocol were thoroughly explained, including the duration. Then chits were prepared and placed in a bowl. The group name was mentioned in the chit, and each subject picked the chit to reveal it. After that, using this technique, they were divided into GROUP A or GROUP B, as stated in the chit.

Clothing instructions (comfortable wear) are provided so that they can complete the protocol without restriction. YOGA should be done properly, so all indications were explained before beginning the procedure. One schedule was provided, with timing and location specified.

The next day, all pre-measurements were taken, such as pre-chest expansion with tape. Pre-pulmonary functions were measured with a spirometer, and pre-health quality of life was assessed using the SF-36 questionnaire. And as of the other day, the protocol for both groups began, with training time allocated separately in the cardio lab.

The intervention group was first shown the YOGA postures and how to maintain them, and the dosage was explained to them in the cardio lab. The volunteers were given preliminary warm-up sessions before participating in the study. Because YOGA cannot be done at random, we must first

prepare the body and then perform the exercises properly. Treatment is given twice a week for 12 weeks, up to 24 sessions. The protocol has been set for three months.
The volunteers were not regular due to their busy schedules, and one person dropped out of the interventional group for personal reasons. After completing the 3-month protocol, the volunteerpost-outcome measures were reviewed, as each volunteer's protocol completion dates differed due to their schedule. Before beginning the protocol, they have given the instructions on what should be avoided so that they can fit in the entire research

TREATMENT:

Figure 2: Conventional Training:

Pulmonary rehabilitation includes breathing techniques, Thoracic mobility exercises. [17]

Intervention training:

Yoga and pranayama technique:

Yoga asana for improving respiratory pressure and pulmonary function

The yoga poses that improves respiratory pressure and pulmonary function include 49: (i) Vrikshasana, the tree pose; (ii) Padahastasana, hand to feet pose; (iii) Trikonasana, the triangle pose; (iv) Chakrasana, the wheel pose; (v) Natarajasana, Lord of the dance pose; (vi) Vakrasana, the spine twist pose; (vii) Bhujangasana, the cobra pose; (viii) Paschimottasana, seated forward bend; (ix) Katuspadasana, the cat pose; (x) Kurmasana, the turtle pose, (xi) Salabhasana, the locust pose; (xii) Dhanurasana, the bow pose; (xiii) Janusirshasana, head to knee forward bend; (xiv) Viparitakarani, Legs-Up-The-Wall pose; (xv) Sarvangasana, shoulder stand pose. (Figure 2)

Pranayama for improving respiratory pressure and pulmonary function

The various pranayama techniques like (i) Adhama Pranayama, a deep breathing technique with or without air retention; (ii) Kapalabhati, also known as the forehead shining breathing technique, a breathing technique in which air is exhaled with vigour through the nostrils; (iii) Nadi Sodhana, also known as Anuloma Viloma Pranayama or the alternate nostril breathing technique; (iv) Bhastrika, a breathing technique that produces a loud noise as loud as the sound from a sickle due to fast and strong inhalation and exhalations. These respiratory exercises are coupled with exercises that strengthen abdominal muscles like Uddiyana Bandha (Uddiyana means upward, Bandha means to lock) also known as upward abdominal lock involves contraction of the abdominal region while breathing normally or after a forced exhalation and Jalandhar Bandha also known as throat lock involves contraction of larynx muscles after an inhalation.

Each volunteer from each group expressed an interest in following the protocol. After each subject session, post-outcome measures were taken. Post-chest expansion using inch tape, post-pulmonary function test with spirometry, and post-health-related quality of life using the SF-36 questionnaire.There were three dropouts in the intervention group., due to some personal reasons.
Some data were collected from Surat city and nearby societies; first, they were informed about the study via WhatsApp group, and the time and date were mentioned to meet at one club house where I had set up; they were given permission to collect because it would benefit society; I convinced the people, and they were willing to do so; then they could come to the set up and provide the details.
In society, there was a health club where an area was set aside for the plinth, and I had a portable spirometer with me so that all preliminary measurements could be taken easily. In addition, instruction on the procedure was given in a single session. And demonstrated some protocols to the appropriate group so that they could prepare themselves. Comfortable clothing was advised so that the protocol could be carried out without restriction. The interventional group was given the demonstration, and according to theta, they had to do with correct dosage, which was previously explained to volunteers under my supervision. Both groups of volunteers were following the protocol.
First, I explained the study in a brief introduction to the participants, and then I began to assess the people who had a history of Covid-19. Depending on the assessment form, some samples were collected, and a consent form was signed. The selected samples were given a detailed explanation of the screening procedure and protocol. Twenty samples that met the criteria were collected and then randomly divided into two groups using chit picking.
The premeasures were recorded. The timing for each group was provided, and the people were cooperative and participated fully in the study. There were two dropouts in the conventional group; one was hospitalized and the other was transferred from the city. Warm up sessions were organized, and everyone was very attentive and interested in the sessions. The protocol was completed successfully. Following the conclusion of the protocol, post-measures were taken. After gathering a small amount of data, it was entered into an excel worksheet. (Figure 3)
Figure 3: Pranayama for improving respiratory pressure and pulmonary function

RESULT

In both groups, 12 subjects participated in the study. Data analysis was carried out using IBM SPSS software. The Mann-Whitney U test within-group analysis yielded a $p>0.05$ for both the conventional and interventional groups, indicating no significant difference. In the between-group analysis, the Wilcoxon rank test showed a significant difference and improvement in the intervention group ($p < 0.05$). (Table 1 and 2)

Table 1 and 2: Test Statistics

Test Statistics[a]

	G1_2nd_IC	G1_4th_IC	G1_Xihoid
Mann-Whitney U	42.000	24.000	34.000
Wilcoxon W	120.000	102.000	112.000
Z	-2.460	-3.391	-2.383
Asymp. Sig. (2-tailed)	.014	.001	.017
Exact Sig. [2*(1-tailed Sig.)]	.089[b]	.005[b]	.028[b]

Test Statistics[a]

	G2_2nd_IC	G2_4th_IC	G2_xiphoid
Mann-Whitney U	48.000	54.000	47.500
Wilcoxon W	126.000	132.000	125.500
Z	-1.621	-1.319	-1.552
Asymp. Sig. (2-tailed)	.105	.187	.121
Exact Sig. [2*(1-tailed Sig.)]	.178[b]	.319[b]	.160[b]

DISCUSSION

- The present study was conducted in different areas of Surat dedicated for COVID-19 patients with a reasonable (24) sample size. To the best of our knowledge, this is the first study to assess the effect of Yoga and Pranayama in preventing to restore pulmonary functions.
- The biological processes underlying the protective effects of Yoga and Pranayama remain to be fully investigated. Each component of the Pranayama module would have played a role in

preventing COVID-19 infection. Vaata-neti helps to clean the nasal passages and maintain the sinuses and helps to get rid of pathogens. Kapalabhati kriya is a process of forceful exhalation and normal inhalation which help to improve pulmonary function and clean the frontal sinuses, removing congestion in nasal and respiratory tract [2] and easing movement of the diaphragm [3]. These two are very useful preparatory practices for Pranayama. Deep breathing helps to improve lung's vital capacity.

- Remarkable change in lung functions can be achieved by practicing yoga even for short duration. The effect of slow and fast pranayama in strengthening the respiratory muscles was studied by Madan Mohan et al. Several factors such as chest expansion, respiratory muscle strength, lung dimensions, alveolar surface area and air way resistance effect respiratory function. In the Asthanga yoga, pranayama is one of the limb which includes various kinds of breathing patterns that have profound effects on the pulmonary function than any other part of the human system. These breathing patterns include alternate nostril breathing, Kapalabhati, Mukha bhasthrika pranayama, Bhrahmari pranayama etc. The positive effects of pranayama on lung function have been well documented. Significant improvement in the pulmonary parameters was observed in hypothyroid patients after yoga and pranayama training.
- Practice of thoracic breathing immediately after performing abdominal breathing helps the practitioner to adapt to more chest expansion, before doing the clavicular breathing. Thus, in the next step, i.e., the practice of deep breathing, the subject naturally and effectively expands thorax for effective ventilation. The selected combination of Pranayama modules makes it a comprehensive intervention for the purpose of reducing the possibility of contracting post COVID-19 infection symptoms and to recover pulmonary functioning.
- In post COVID-19 patients, this study would investigate the impact of Yoga and pranayama on respiratory muscle strength, chest expansion, pulmonary functioning and health-related quality of life.

CONCLUSION

- Based on the findings of this study, we can conclude that the using yoga and pranyama will be efficient in promoting an increase thoracic expansion. The study will encourage physiotherapists to raise awareness about the post-COVID-19 patient pulmonary rehabilitation and the ease with which the Yoga and pranayama may be included into daily practice to recover pulmonary functioning.

Limitation of the study:

One of the study's limitations was that it did not compare spirometry results between COVID-19 patients and healthy individuals. Furthermore, due to the coronavirus pandemic, obtaining a sufficient number of patients proved difficult.

The absence of a follow-up procedure was another limitation in estimating the exercise program's long-term effects on patients. Furthermore, as with any other human research, the current study's results can be influenced by an individual's family environment and social and economic conditions. As a result, caution should be exercised when extrapolating current findings to a larger population.

Future recommendation:

As a result, we recommend conducting a multi-centric study with a larger sample size
and a longer duration/period to further test our Pranayama Protocol. The pranayama protocol can also be compared to and combined with other yoga/pranayama programmes. Given the study's implications for health care professionals and the general public living in fear of COVID-19, larger

studies with diverse geographical, ethnic, and cultural backgrounds are required to confirm its generalizability.

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Conflicts of Interest: The authors declare no conflict of interest.

Informed Consent Statement: All subjects who took part in the study provided informed consent.
Data Availability Statement: The data that support the presented result can be received directly from the correspondent author who is in charge of deals with data storage.

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