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Immediate Effect of Anulom - Vilom Pranayama on Selected Cardiovascular and Pulmonary Parameters in Post COVID-19 Individuals - An Experimental Study

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Abstract: ***Background: Coronavirus disease 2019 (COVID-19) is caused by novel coronavirus, known as severe acute respiratory syndrome coronavirus 2 (SARS-COV-2) Since December 2019. Practice of pranayama has been known to modulate cardiac autonomic status with an improvement in cardiorespiratory functions. The present study is designed to determine whether ANULOM VILOM pranayama practice for 20 minutes will have on immediate effect on HR, SBP and DBP, peak expiratory flow rate or not. Aim: The aim of study is to examine the immediate effect of ANULOM VILOM pranayama on selected of cardiovascular, pulmonary parameters in post COVID-19 individuals. Method: Bachelor of Physiotherapy students aged 17-20 years who had suffered from COVID-19 were included. They were screened by an average body mass index. There were two GROUP A & B. In group A, a recording was done before and immediately after performing 20 minutes ANULOM VILOM pranayama and 10 minutes quiet breathing. In group B, a recording was done before performing quiet breathing in any comfortable sitting posture and immediately after 20 minutes quiet breathing with closed eyes. Results: The baseline heart rates, blood pressure, peak expiratory flow rate, were compared. In GROUP A, changes were seen in cardiovascular parameters in that significant decline in heart rate (P< 0.0001) and peak expiratory flow rate improved significantly (P< 0.01) was observed. In contrast, both groups displayed no significant changes were seen in heart rate, SBP & DBP and peak expiratory flow rate. Conclusion: The present study concluded that there is immediate effect of anulom vilom pranayama on selected cardiovascular and pulmonary parameters in post COVID- 19 individuals. Result suggested decrease in heart rate and improved peak expiratory flow rate after 20 min of anulom vilom pranayama. Limitation: Due to time limitations, we could not include a greater number of the students in this study.***

Keywords: ANULOM VILOM pranayama, coronavirus disease 2019, COVID-19, heart rate, blood pressure, Peak expiratory flow rate

1. Introduction

The first cases of coronavirus disease 2019 (COVID-19) were reported in December 2019, originating in Wuhan, China,[1] with rapid spread worldwide, and COVID-19 became a public health emergency of international concern[2]. The pathogen has been identified as a novel enveloped RNA beta-coronavirus and has been named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)[3]. The clinical course of SARS-CoV-2 infection is mostly characterized by respiratory tract symptoms, including fever, cough, pharyngodynia, fatigue, and complications related to pneumonia and acute respiratory distress syndrome[4]. Despite the tropism for the lungs where it causes interstitial pneumonitis, in the most severe cases multiorgan failure develops. The cardiovascular (CV) system appears to have complex interactions with COVID-19[5]. The increased incidence of these illnesses could be due to the imbalance between sympathetic and parasympathetic stimulation[6]. Heart rate variability is an index of beat-to-beat changes in the heart rate and is a non-invasive assessment of autonomic control of cardiac functions. Persistently elevated blood pressure has been linked to the dysregulation of the autonomic nervous system or increased sympathetic activity[7].

Yoga breathing, or pranayama, is the science of breath control. Pranayama is derived from Sanskrit word 'prana' means breathe and 'ayama' means development or control[8]. The breath holding is a voluntary act. A longer breath holding time indicates good concentration of oxygen in blood and a lesser concentration of carbon dioxide in blood Breath holding time can be increased by the regular practice o Pranayama[9].Yogasana and pranayama are claimed to have beneficial effects on the body such as improving the functions of different systems of the body including the performance of the central nervous system (CNS).[6]Practice of pranayama has been known to modulate cardiac autonomic status with an improvement in cardiorespiratory functions[10].

During breathing for Pranayama inhalation (puraka) stimulates the system and fills the lungs with fresh air; retention (kumbhaka) raises the internal temperature and plays an important part in increasing the absorption of oxygen; exhalation (rechak) causes the diaphragm to return to the original position and air full of toxins and impurities is forced out by the contraction of inter-costal muscles. Due to the proper functions of these organs, vital energy flows to all the systems. The success of Pranayama depends on proper ratios being maintained between inhalation, exhalation and retention[11].

The role of ancient health systems like yoga needs to be explored as an integrated therapy in reducing the burden of COVID-19. The term 'Yoga' originated from the Sanskrit term which means 'to unite' and is meant to strengthen the human body and mind, and Pranayama is a form of breathing exercise known to improve lung functions. The immune system of the body is responsible for fighting external invaders in the body like bacteria, viruses, etc. Poor nutrition of the organs, tissues ultimately results in increased chances of getting infections, slow healing from injuries and diseases. In such a scenario, Yoga and Pranayama techniques may become helpful to improve the strength of lungs as well as general immunity of the body[12]. These deep breathing exercises help unloading respiratory muscles, decrease work of breathing (WOB), improve blood flow to inspiratory muscles and heart and confer autonomic stability. There are very few literatures related are on about benefit of immediate effects of pranayama on post COVID-19 individuals. Hence, the purpose of this study was to study the immediate effect of Anulom Vilom pranayama on post COVID-19 individuals.

Keeping this in view, the present study is designed to determine whether anulom vilom pranayama practice for 20 minutes has any immediate effect on heart rate, systolic and diastolic blood pressure, peak expiratory flow rate. Slow and deep breathing itself has a calming effect on the mind and helps an individual to de-stress. This calming effect may also exert profound physiological effects on cardiopulmonary function.

Aim

The aim of study is to examine the immediate effect of ANULOM VILOM pranayama on selected of cardiovascular and pulmonary parameters in post COVID-19 individuals.

Objective

The objectives of this study are:

- To study the effect of ANULOM VILOM Pranayama on heart rate.
- To study the effect of ANULOM VILOM Pranayama on systolic blood pressure.
- To study the effect of ANULOM VILOM Pranayama on diastolic blood pressure.
- To study the effect of ANULOM VILOM pranayama on peck expiratory flow rate.

2. Materials and Methods

This study was carried out in a Physiotherapy college in Ahmedabad. Study duration was 1 month. Materials used are: Consent form, Sphygmomanometer, Stethoscope, Peak expiratory flow meter, Mouthpiece, Stopwatch, Sanitizer, Mat, Chair, Pen, Paper. Both males and females aged 17-20 years who had COVID-19 in past 6 months and having BMI of 18.5-23 kg/m^2 were included in the study and any other cardiac disease and not suffered from COVID-19 were excluded.

3. Procedure

Out of 70 students pursuing bachelor in Physiotherapy, 30 students met the inclusion criteria and were recruited and divided into two groups (Group A and Group B, n = 15 each). Study parameters included heart rate, systolic and diastolic blood pressure, Peak expiratory flow rate, to explain the cardiopulmonary function. In Study group A, a recording was done before and immediately after performing 20 minutes ANULOM VILOM pranayama and 10 minutes quiet breathing with eyes open and immediately after recording was done. In Control group B, a recording was done before performing quiet breathing in any comfortable sitting posture and immediate after 20 minutes quiet breathing with closed eyes. Each student was explained about test and sufficient trials were given for proper understanding. The procedure was carried out in quiet room. The pranayama was done during morning hours (10am-12am) and measurements were done before and after the pranayama.

Anulom Vilom Pranayama Training:

Students were asked to assume 'Sukhasana' (the comfortable posture) and regulate the alteration of breathing as follows:

1) Open the right hand and bend index and middle fingers against the palm. The thumb was used for closing the right nostril while the fourth and fifth fingers were used for the left nostril.
2) Place the right thumb against the ala at the end of the nostril to close it and similarly press the fourth and fifth fingertips against the left nostril.
3) Start the exercise in the 'Sukhasana posture', with relaxed attitude and concentration as below.
   - Exhale slowly and deeply without closing the nostrils but being ready to do so.
   - Inhale slowly and quietly through the left nostril while closing the right.
   - Keep the left nostril closed and exhale through the right.
   - After exhaling completely, Now do it revers, this time inhaling through the right nostril and exhaling through the left.

Parameter Measurements:
Heart rate was measured by counting radial pulse for a minute. Both systolic and diastolic blood pressures were measured with the auscultatory method by using sphygmomanometer and stethoscope. Peak expiratory flow rate was measured using a pocket peak expiratory flow meter (a mini version of Wright peak flow meter). Three readings were taken for all the parameters and average value was taken. The subject was asked to take a deep breath and then to blow hard into the mouthpiece of the flow meter with a sharp blast. The movement of the needle on the dial indicated the peak expiratory flow rate in liters per minute. We had used Disposable Mouthpieces for safety precautions of COVID-19.

Peak Expiratory Flow Rate Meter

Statistical Analysis:
The data was analysed using SPSS version 20. All the values obtained before and after performing "Anulom Vilom pranayama", rest and quiet breathing were expressed as mean ± SD. The student paired t test was used to compare parameters within groups. P value of less than 0.05 indicates a significant difference.

4. Results

The average age of the study group was 19 years with body mass index of 22.39 ± 1.55. group A and group B have 15participants and each group have 8 males and 7.The average body mass index of the group A was 21.43 ± 1.55 and that of the group B was 23.22 ± 0.64.

Table 1: Group A Immediate effect of anulom vilom Pranayama on Cardiovascular and Pulmonary parameters

Parameters	Before Pranayama	After Pranayama	Mean Difference	T Value	P Value
Basal heart rate (beats/minute)	84.9 ± 4.94	75.8 ± 4.73	9.1 ± 1.2	5.15	<0.0001
Systolic blood pressure (mmHg)	119.21 ± 3.71	118.33 ± 3.4	8.8 ± 2.3	6.7	NS
Diastolic blood pressure(mmHg)	79.0 ± 4.2	78.6 ± 4.1	0.3 ± 0.8	2.33	NS
Peak expiratory flow rate(1/minute)	405 ± 58.26	445.67± 65.07	40.9 ± 5.5	5.39	<0.01

In GROUP A (Table 1) Changes were seen in cardiovascular and Pulmonary parameters in that significant decline in heart rate (P< 0.0001) and peak expiratory flow rate improved significantly (P < 0.01) was observed in and no significantly changes were seen in systolic blood pressure and diastolic blood pressure.

Table 2: Group A Cardiovascular and Pulmonary Parameters in after 10 minute quiet breathing.

Parameters	Before breathing	After 10 min quiet breathing	Mean Difference	T Value	P Value
Basal heart rate (beats/minute)	83.7 ± 4.7	82.6 ± 3.9	1.1 ± 3.2	0.68	NS
Systolic blood pressure (mmHg)	119.4 ± 2.9	120.3 ± 3.0	0.8 ± 4.6	0.8	NS
Diastolic blood pressure(mmHg)	79.5 ± 4.4	79.21 ± 4.3	0.2 ± 4.8	0.18	NS
Peak expiratory flow rate(1/minute)	415.6 ± 39.07	435.46 ± 49.2	19.7 ± 8.2	1.21	NS

In (Table 2) No significant difference was found between baseline and after 10 minutes of quiet breathing in heart rate, systolic blood pressures and diastolic blood pressure, peak expiratory flow rate.

Table 3: Group B 20 minutes quiet breathing on Cardiovascular and Pulmonary Parameter

Parameters	Before	After quiet breathing	Mean Difference	T Value	P Value
Basal heart rate (beat/minute)	83.5 ± 4.8	81.2 ± 4.1	2.2 ± 2.6	1.37	NS
Systolic blood pressure (mmHg)	120.4 ± 3.2	119.4 ± 3.0	1.0 ± 2.1	0.9	NS
Diastolic blood pressure(mmHg)	79.9 ± 4.9	79.1 ± 4.76	0.8 ± 1.5	0.46	NS
Peak expiratory flow rate(1/minute)	410.3 ± 51.6	412.4 ± 49.8	3.1 ± 4.2	0.49	NS

In GROUP B (Table 3) No significant difference was found between baseline and after 20 minutes of quiet breathing in heart rate, systolic blood pressures and diastolic blood pressure, peak expiratory flow rate.

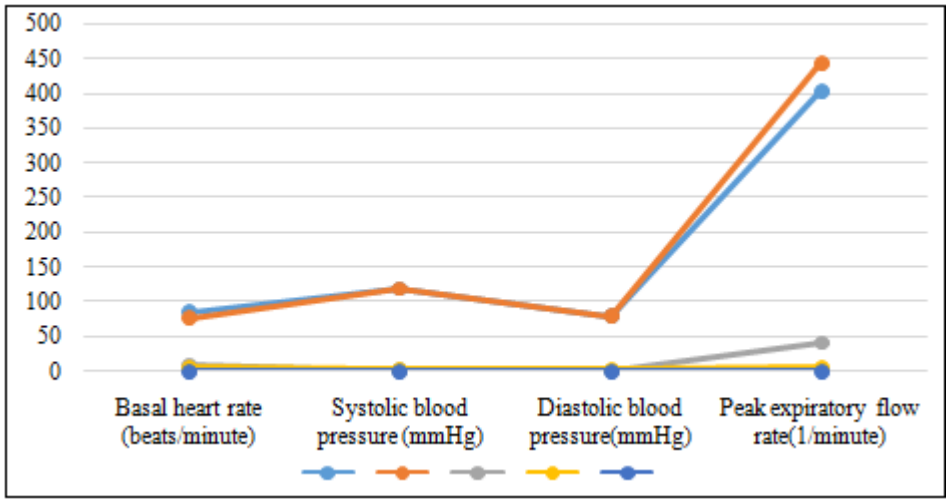

Figure 1: Immediate effect of anulom vilom pranayama on cardiovascular and pulmonary parameters in post COVID- 19 individuals

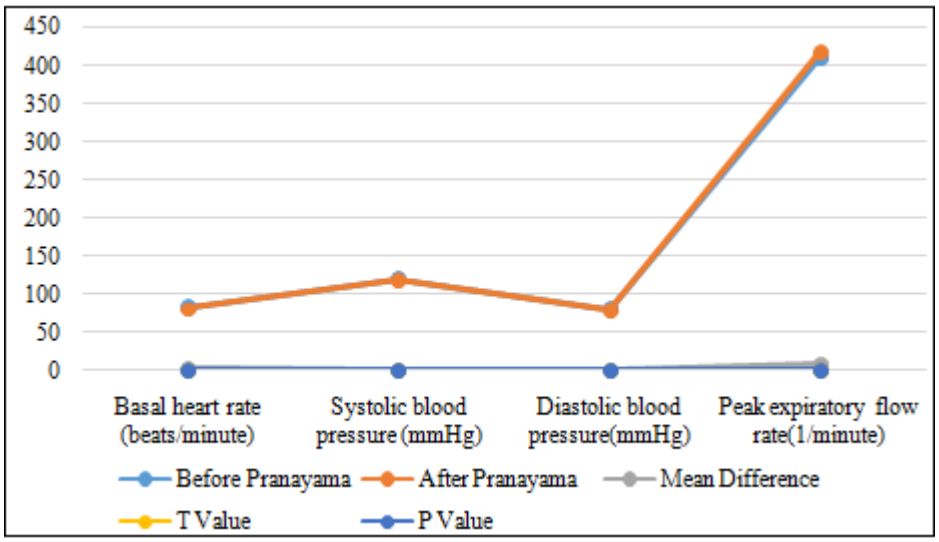

Figure 2: 20 minutes quiet breathing effect on cardiovascular and pulmonary parameters in post COVID- 19 individuals

5. Conclusion

The present study concluded that there is immediate effect of anulom vilom pranayama on selected cardiovascular and pulmonary parameters in post COVID- 19 individuals. Result suggested decrease in heart rate and improved peak expiratory flow rate after 20 min of anulom vilom pranayama. The 'ANULOM VILOM Pranayama' involves using of lung spaces, not used up in normal shallow breathing. Therefore, the increased peak expiratory flow rate might be a consequence of small airway opening in lungs.. The non-significant change in systolic blood pressure and diastolic blood pressure observed in the present study suggests that 'ANULOM VILOM Pranayama' might have not have immediate effect on peripheral vascular resistance.

6. Discussion

The Anulom Vilom also known as Alternate Breathing Technique. The function of breathing is to provide the appropriate amount of fresh oxygen to the cells for its metabolism and to discharge the carbon dioxide. Breathing directly affects the heart rate; if we hold the breath the heart rate lowers down and gives rest to heart muscles. If you breathe properly all your relevant organs of the body should work in coordination. Like the circuit power (nervous system), the bellows (lungs), the pump (heart), the pipe circuit (arteries and veins), the engine structures (rib cage and diaphragm) all should be in sync. For some individuals inhalation is longer than exhalation, whereas for others exhalation is longer compare to inhalation. This changes the breath flow and the blood pressure from person to person. The physiological changes in cardiorespiratory profile with respect to Chandra Anuloma Viloma Pranayama may be due to the physiology of nostril breathing exercises having the probable relation with nostril and cerebral dominance as explained by Upadhyay- Dhungel K et al and this study depicts fall in Pulse rate, respiratory rate, systolic blood pressure and Diastolic blood pressure after CAV Pranayama in both Naïves and Yoga practitioners. But the significant drop was observed in SBP only (at $p < 0.05$) among Naives and in all parameters except respiratory rate among Yoga Practitioners. Baljinder Singh Bal, conduct a study on Impact of Short-Term Training of Anulom Vilom (Alternative Nostril Breathing) on Respiratory Parameters. In that study Significant differences were found in Expiratory Reserve Volume (ERV), Inspiratory Reserve Volume (IRV), Vital Capacity (VC) and Inspiratory

Capacity (IC) in experimental group and insignificant between-group differences were noted in Tidal Volume (VT) of university level girls. Pal GK, Nanda N, Renugasundari M, Pal P, conduct the study on prevention of COVID-19. They have selected asana in prone position and lyingdown in advasana (prone-shavasana) that a COVID-19 patient can perform. Further, these asanas help in strengthening the muscles of neck, thoracic cage, abdominal wall and pelvic wall and facilitate the functioning of respiratory apparatus. Practice of pranayamic breathing has been shown to be effective in improving cardio-pulmonary and autonomic functions. In anulom-vilom (alternate-nostril) breathings, the duration of expiration is more prolonged to further strengthen the cardiopulmonary functions. Practice of pranayamic breathing has been shown to be effective in improving cardio-pulmonary function. Yogic asanas and pranayama have been shown to reduce the resting respiratory rate and increase vital capacity, timed vital capacity, maximum voluntary ventilation, breath holding time and maximal inspiratory and expiratory pressures (Nayar et al., 1975; Joshi et al., 1992). Anand and his colleagues (1961) observed a preponderance of alpha waves in the EEG of yogis, indicating a more relaxed state of mind. Shirley Telles and her colleagues at Swami Vivekananda Yoga Research Foundation reported that, during meditation, there was a significant reduction in heart rate but an increase in cutaneous peripheral vascular resistance, indicating a physiologically relaxed state but increased mental alertness (Telles and, Desiraju, 1993). Some recent studies have shown that unilateral forced nostril breathing affects cerebral hemispherical dominance (Naveen et al., 1997). The findings are supported by the study conducted by Upadhyay et al. (2008), showed a significant increment in pulmonary parameter such as Peak expiratory flow rate (PEFR L/min) and Pulse pressure (PP). The findings are also supported by the study conducted by Bal. (2008) which showed significant improvement in vital capacity and maximal ventilatory volume with the training programme of bhastrika and anulom vilom pranayama.

7. Limitations

The sample size selected for this study was specifically students who were pursuing Bachelor of Physiotherapy. And Due to time limitations, a greater number of the students were not included. This study mainly focused on patients who suffered from COVID-19.

Financial Support: No funding was taken for the study.

Conflicts of Interest: There are no conflicts of interest.

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