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Effect of Selected Types of Breathing Exercise on Different Outcome Measures in Covid-19 Patients

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Abstract:

Purpose: to evaluate the effect of Buteyko breathing versus Bhastrika Pranayama on Modified Borg Dyspnea Scale (MBS), blood samples (levels of CRP and d-dimer), six-minute walk test (6MWT), Pittsburgh Sleep Quality Index (PSQI), 36-Item Short-Form Health Survey (SF-36) Questionnaire in COVID-19 Patients.

Methods: Sixty patients who were 40-50 years old were recruited from El Khankah Centeral Hospital, from May 2022 to July 2022, with COVID-19. Patients were divided equally and randomly into two groups and took their medications. Group A underwent traditional physical therapy program (mobility exercises and Postural drainage) with Bhastrika Pranayama breathing exercise. Group B underwent traditional physical therapy program with Buteyko breathing exercise. Treatment was applied as daily sessions for a week. Subjects were evaluated, at baseline and after treatment, by (MBS), (CRP and d-dimer), (6MWT), (PSQI), (SF-36). Mixed MANOVA was conducted.

Results: There was significant interaction effect of time and treatment improvements in all outcomes after intervention in group A and B (p<0.05). Between group differences were non-significant in all outcomes except in 6MWT that was higher in favor of Group A. Both types of breathing techniques were effective in improving QoL in post-COVID-19 patients, but Bhastrika one is better in terms of 6MWT.

Conclusions: Both types of breathing techniques were effective in improving (MBS), blood samples (levels of CRP and d-dimer), (6MWT), (PSQI), (SF-36) QoL in COVID-19 patients, but Bhastrika one is better in terms of 6MWT.

Keywords: Bhastrika Pranayama breathing, Buteyko breathing, COVID-19, Dyspnea, Quality of life, Sleep Quality.

1. Introduction:

The World Health Organization declared "Coronavirus Disease 2019 (COVID-19)" as a global pandemic on 11/3/2020, which is a severely infectious disease brought on by "the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)" (1). It had a disastrous influence on humankind, causing huge deaths of about 4 million making it the most substantial health disaster worldwide since beginning of twentieth century (2).

The COVID-19 severity varies from being non-symptomatic or having mild symptoms (e.g., breathlessness, fatigue and soreness in muscles...) to SARS or pneumonia, several structural malfunction, and death (3). According to reports, psychological distress was present in 50% of COVID 19 patients, and this distress was reportedly accompanied by poor sleep and a worse QoL (4).

COVID-19 patients should get rehabilitation services both during and immediately following their hospitalization (5). One of these treatments is pulmonary rehabilitation, which enhances gas exchange, stops the course of pathology, lessens or eliminates the requirement for artificial ventilation, and enhances dyspnea and QoL in various respiratory problems (6, 7).

Several variations of pulmonary rehabilitation are present; among them, two were shown to be productive. The first is Buteyko breathing technique that was created to manage anxiety and hyperventilation, which causes shortness of breath. It encourages patients to breathe less deeply and more slowly (8). It has been discovered to improve symptoms of COVID-19 (9). The second is Bhastrika, Bellow or diaphragmatic breathing and involves using the diaphragm in place of the auxiliary muscles to breathe deeply. Controlled pranayama exercises provide for inhaling, keeping the respiratory muscles isometrically contracted, and forcing the breath out. These exercises bolster the respiratory system's muscles (10). and thus, it has been discovered to improve symptoms of COVID-19 (11).

There aren't enough studies comparing the effects of various breathing strategies on COVID-19 patients. Hence, in order to identify which sort of exercise can provide the greatest advantages, this study compared the effects of Buteyko breathing and Bhastrika Pranayama on COVID-19 patients.

2. Patients and Methods:

2.1.: Design and Setting:

Patients were divided randomly into two groups demonstrated about purpose and procedures of the study before participation. As well, they signed the informed consent prior to participation The study was approved by the Institutional Review Board of the Faculty of Physical Therapy at Cairo University under the code P.T.REC/012/004298, and the patients provided informed consent for publication. Additionally, the study was registered on clinicaltrials.gov (registration number NCT05753293). This study followed the principles of Helsinki Declaration.

2.2. Patients:

Sixty patients of both genders with age ranged from 40-50 years old were recruited from El Khankah Centeral Hospital (between May and July 2022) with COVID-19. They were divided randomly into two groups. Group A underwent Bhastrika Pranayama breathing exercise. Group B underwent Buteyko breathing exercise. All patients underwent conventional physiotherapy protocol (mobility training and postural drainage).

Sample size calculation was performed using G*Power statistical software (version 3.1.9.2; Universitat Kiel, Germany) and revealed that the total sample is 60 (30/group), considering dropouts. The calculations were made using $\alpha = 0.05$, $\beta = 0.2$ and effect size = 0.8 and allocation ratio N2/N1=1.

All of the participants in this study fulfilled the following requirements: they were between the ages of 40 and 50, had COVID-19 confirmed by positive nasopharyngeal swab samples and "ground-glass opacification", were moderately hospitalized COVID-19 patients who were fully conscious and oriented, and had BMIs between 20 and 25 kg/m2.

Participants were not allowed to participate in the trial if they had any musculoskeletal disorders, a history of chronic illnesses like diabetes, hypertension, or heart disease, a clear clinical mental or cognitive impairment, or a history of another respiratory condition.

2.3. Procedures:

I. Assessment procedures:

All patients were assessed, before and after one week of the treatment, using the following:

Ia. Modified Borg Scale: it was used for measuring dyspnea of patients who rate it on a 0 to 10 scale (12).

Ib. Blood Samples: they were taken at the start and at the end of the study to measure C-reactive protein (CRP) and d-dimer levels.

Ic. The Six-minute Walk test (6MWT): it was done pre & post exercise program, in which patients were asked to walk for 6 minutes and number of steps were calculated.

Id. Pittsburgh Sleep Quality Index (PSQI): The PSQI questionnaire is 18-item scale, which includes seven categories, was used to calculate how well people slept. These items included how well people slept, length of sleep, time taken to sleep, regular efficiency of sleep, disruption of sleep, usage of pills to sleep, and daytime dysfunction. Each dimension received a value between 0 and 3. Overall score

varying from 0 to 21. A larger score denoted poorer sleep quality, and, with a total score ranging from 0 to 21 (13). The Arabic version (14) was used in the current study.

Ie. The 36-Item Short-Form (SF-36): it is a health questionnaire that measures 8 areas of wellbeing; physical and social functioning, physical and emotional role limitations, bodily pain, overall wellbeing experience, energy/vitality, and psychological wellbeing. Each section's questions are added together to create the weighted scores. Scores are between 0 and 100. Higher scores equal less disability, while lower scores indicate more.

II. Treatment Procedures:

The treatment lasted one week. One session was applied every day. The interventions were:

IIa. Traditional physical therapy program: the right way of cough, mobility exercises, postural drainage, and other airway clearance ways as percussion and vibration, were performed to all patients daily for one week (6).

IIb. Bhastrika pranayama: The patients were sitting down. They maintained a straight spine and relaxed their shoulder muscles. The patient was instructed to bring the right elbow to the level of the right shoulder while covering the right nostril with the right thumb. Then, with your eyes closed, breathe in and out slowly at first via your left nostril and gradually a little faster. There were 20 to 25 occasions of this. The patients were then instructed to breathe deeply in and hold it for as long as they could. This is one Bhastrika pranayama cycle that was repeated on the right side (15).

IIc. Buteyko breathing exercise: Patients firstly performed a control pause (CP), which involved inhaling through their nose, exhaling through their mouth, and then holding their breath until they felt either the first clear and distinct need to breathe or an uncontrollable movement or jerk originating from their diaphragm. The patient then breathed slowly until they felt a slight lack of air. They maintained this while remaining calm. They then took a long pause while gently inhaling and exhaling. The breath is then held for as long as feasible without becoming too uncomfortable. Up to five repetitions of this were done so. They then performed a final control pause at the beginning (16).

3. Statistical analysis:

Two sample t tests were applied to detect differences between groups in baseline data. For the purpose of comparing the distribution of sex between groups, chi-square test was performed. Shapiro-Wilk test was applied and revealed that data not significantly violate assumption of normality. Levine's test was applied and revealed homogeneity in terms of variances. To compare within and between group effects on outcomes, a mixed design (MANOVA) was adopted. Post-hoc tests with Bonferroni correction were used. Alpha was set at 0.05. The statistical programme for social sciences (IBM SPSS, Chicago, IL, USA) (v. 25) was used for all analyses.

3. Results:

Demographics of all participants were presented in **table (1)** that shows that groups were not differ significant at baseline (p>0.05).

Table (1): Demographic data of patients in both groups.

Demographics	Groups	Mean ± SD	p-value
Age (years)	**Group (A)**	44.56 ± 4.46	0.68
	Group (B)	45.06 ± 5.13	
BMI (kg/m2)	**Group (A)**	23.42 ± 1.85	0.46
	Group (B)	23.75 ± 1.63	
Sex Distribution (Male/Female)	**Group (A)**	18/12	0.6
	Group (B)	16/14	

SD: Standard Deviation. p: Probability.

Influence of intervention on CRP, D-dimer, 6MWT, PSQI and SF-36:

There was a significant interaction effect of treatment and time (p = 0.001). There was a significant main effect of time (p = 0.001). There was no significant main effect of treatment (p = 0.16). **(Table 2).**

Table 2. Influence of intervention on CRP, D-dimer, 6MWT, PSQI and SF-36:

Effect	F	p-value
Time	559.12	0.001
Group	1.64	0.16
Interaction	3.56	0.007
P: Probability		

Within group comparison:

Mean values of CRP, D-dimer, PSQI, SF-36, MBS and 6MWT in both groups before and after intervention were presented in **table (3).** There were significant reductions in CRP, D-dimer, PSQI, and MBS after treatment in group A and B (p= 0.001), and significant rise in 6MWT and SF-36 after intervention in group A and B (p= 0.001).

Percentage (%) of improvements in CRP, D-dimer, PSQI, SF-36, MBS and 6MWT were 37.33, 20, 41.6, 21.7, 33.3, 8.9 in group A and were 40.34, 22.7, 39.33, 18.6, 33.3, 5.75 in group B, respectively.

Table (3): Descriptive and analytical statistics of C-reactive protein, D-dimer, and 6MWT scores in both groups, before and after intervention.

Outcomes	Groups	Pre	Post	P-value	% of change
C-reactive protein (mg/L)	Group (A), Mean ± SD	13.77 ±7.20	8.63 ± 6.07	0.001*	37.33
	Group (B), Mean ±SD	11.90 ±7.22	7.10 ± 4.51	0.001*	40.34
	P-value	0.32	0.27		
D-dimer	Group (A), Mean ±SD	0.45 ±0.23	0.36 ± 0.16	0.001*	20.00
	Group (B), Mean ±SD	0.44 ±0.29	0.34 ± 0.17	0.001*	22.73
	P-value	0.88	0.63		
6-Minute Walk Test	Group (A), Mean ±SD	396.9 ±11.8	432.16 ±13.43	0.001*	8.88
	Group (B), Mean ±SD	399 ±10.03	422.13 ±11.83	0.001*	5.74
	P-value	0.41	0.003*		
Pittsburgh Sleep Quality	Group (A), Mean ±SD	17.86 ± 1.5	10.43 ± 1.95	0.001*	41.60
	Group (B), Mean ±SD	18.4 ± 2.06	11.16 ± 2.36	0.001*	39.35
	P-value	0.25	0.19		
Short Form-36	Group (A), Mean ±SD	76.4 ± 6.1	93.13 ± 2.47	0.001*	21.90
	Group (B), Mean ±SD	77.53 ± 4.59	91.96 ± 3.82	0.001*	18.61
	P-value	0.42	0.16		
Modified Borg Scale	Group (A)a	3 (4-3)	2 (3-2)	0.001*	33.3
	Group (B)a	3 (4-3)	2 (3-2)	0.001*	33.3
	P-value	0.62	0.89		

SD: Standard Deviation. p-: Probability.
*** Significant a Median (Interquartile range).**

4. Discussion:

This work was carried out to compare the influences of two methods of breathing (Buteyko breathing and Bhastrika Pranayama) on CRP, D-dimer, PSQI, SF-36, MBS, and 6MWT in COVID-19 Patients.

Sixty participants with COVID-19 and mean age of 45 years were selected from El Khankah Centeral Hospital. They were divided to groups A (Bhastrika Pranayama breathing and conventional physiotherapy) & B (Buteyko breathing and conventional physiotherapy).

All patients were assessed for CRP, D-dimer, PSQI, SF-36, and 6MWT pre and after treatment.

The finding of the study showed that there was a substantial improvement in CRP, PSQI, MBS, 6MWT, SF-36, and D-dimer after intervention in group A and B (p= 0.001). Percentage (%) of improvements in CRP, D-dimer, PSQI, SF-36, MBS and 6MWT were 37.33, 20, 41.6, 21.7, 33.3, 8.9 in group A and were 40.34, 22.7, 39.33, 18.6, 33.3, 5.75 in group B, respectively. There was no substantial variation after intervention between group A and B in all outcomes (p> 0.05) except 6MWT that was higher (p= 0.003) in group A.

In individuals with COVID-19, breathing may help with outcomes (such as dyspnea, sleep, and life quality) by managing inflammation while lowering CRP. Inflammatory mediator makes endothelial cells dilate and makes capillaries more permeable, which causes fluid to build up in the alveoli and increase surface tension, causing the alveoli to collapse, reducing gas exchange, and increasing labour of breathing (17).. Moreover, psychological discomfort linked to poor sleep quality and worse QoL was present in 50% of COVID 19 patients (4).

The findings of the present trial support the idea that chest physiotherapy improves ventilation, lowering dyspnea and the effort required to breathe, and improving blood-oxygen saturation, all of which aid in preventing multiple organ failure and mortality.

Findings of the current study supports the notion that chest physiotherapy improved air circulation or aeration that increases oxygen saturation and hence decreases dspnea, several structural malfunction, and death by increasing mobility of diaphragm, controlling breathing, removing secretions, enhance the patient's general health, lung function, and ability to live independently as much as feasible (8).

According to the current study's findings, breathing control normalises breathing patterns and boosts the effectiveness of the respiratory muscles, which reduces energy use, soothes airway irritation, lessens tiredness, and improves breathlessness (18).

According to Barmola (11)., the Pranayama breathing technique helps patients with pulmonary

disease enhance their lung function indices and maintain a healthy respiratory system that is strong enough to battle COVID-19. Also, the COVID-19 patients' quality of sleep and psychological well-being improved when they were isolated at home because of pranayama breathing (4).

To manage anxiety and hyperventilation buteyko breathing was created (19). The current study's results, which showed that this breathing pattern enhanced dyspnea, sleep, and life quality, are used to support this report.

In the light of this study, both Pranayama and Buteyko breathing techniques similarly improved sleep, life quality, dyspnea, CRP, but Pranayama improved walking better.

Limitations:

The study was limited due to patients being discharged too normal or to intensive care.

5. Conclusion:

Accordingly, it can be concluded that normal labor markedly decreases the pelvic floor muscles strength compared to cesarean section delivery.

It was concluded that either Pranayama or Buteyko breathing techniques should be a part of the rehabilitative program of COVID-19.

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Disclosure statement:

The research did not involve any financial interest or benefits for the author.

Conflict of interest:

The authors have declared that they do not have any conflict of interest.

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