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Effectiveness of Applying Coughing Exercises during Prostration in Improvement of Pulmonary Parameters among COVID-19 Patients Using a Face Mask for Oxygen

Haider Nawaf Abed-Ali[1], Noor H. Mashallah[2], Mustafa A. Yaseen Al-khaqani[3], Ali Alaa alhashmi[4]

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[1]Registered Nurse//, Karbala health directorate.// AL- Imam Hussein medical city.,
[2]Department of the Basic Medical Sciences.,College of the Dentistry, University of Al-Ameed, Kerbala- Iraq
[3]Assist-Lecturer/Adult Health Nursing. / College of the Nursing, University of Al-Ameed, Karbala
[4] Assist-Lecturer/Adult Health Nursing // College of the Nursing, University of Al-Ameed, Karbala ali_alhahsmi@alameed.edu.iq.
Corresponding author: haider84nawaf@gmail.com

Abstract:
Background: Applying coughing exercises and patient's position alteration are considered non-pharmacological nursing managements which are helping to enhancement exchange of gases also respiratory status, this is of benefit to some pulmonary indicators for the COVID-19 patients.
Method: a clinical trials study done from October, 11th, 2021, to May, 17th, 2022. To determine the Effectiveness of applying Coughing Exercises during Prostration in improvement of pulmonary Parameters on the sixty patients who were randomly selected.
Results: more than 60% of the patient was within the age of more than 60 years, 61% of study group was males and 46.7% for control group as well as, more than 36 % of the patients did not suffering from any chronic diseases, but 30% of them had asthma. 40% of patients had effect in bilateral peripheral part and central area. Additionally, the mean of the pulmonary parameters in the study group reported a statistically significant difference, whereas the control groups did not.
Conclusion: The COVID-19 patients' respiratory parameters were improved by the coughing exercises during prostration, and the beneficial effects persisted to more than 4 hours.
Keywords: COVID-19, Prostration, Coughing Exercises, pulmonary Parameters.

Introduction:

The newly discovered COVID-19 has spread globally. As to the WHO, viral illnesses are still emerging highly infectious diseases. The WHO Emergency Committee promised that COVID-19 would be a global health emergency in January 2020. (Faris, et al., 2021). As of 22th , February, 2022, there were excessive than 422 million COVID-19 instances, of which 416,200,000 patients (98.6.2%) were recovered clients, and 1.37% of them were dead, that mean much excessive than 5 million deaths (up from the time the virus first emerged in China (WHO, 2022). According to the Ministry of Health, /Environment, / the Public Health Department, as of March 1st, 2022, there have been a total of 2,303,814 confirmed cases in Iraq, involving about 2,246,472 (95.4%) cured cases and 24,998 (1.07%) fatalities.

The respiratory disease COVID-19, which is brought on by COV2, affects the majority systems and does not just affect the pulmonary system since the intensity of its symptoms and signs vary from mild to severe cases (Balkheir , 2020). It may produce changes in the ECG, BP, and PR (Baji, et al. 2021), which can indicate major respiratory and cardiovascular complications. According to Behesht et al. (2021), COVID-19 produces a variety of problems and disorders for all major organs. It alters respiratory parameters including respiratory rate (RR), PaO2, PaCO2, SpO2 or SaO2, coughing, breathing difficulties, and hypoxia. According to Retucci, et al , (2020), said that "altering in the position of any patients is considered the best none -pharmacological nursing actions that assist in enhancing exchange of gases and the breathing mechanism, which then in turn has a good

impact on the pulmonary markers". The prostrate position improved the rate of SpO2 and decreased the HR and RR, according to Mahrous and Aboelmagd (2022). Therefore, it was decided that adopting this position would be the best strategy to minimize COVID-19 infection consequences, particularly changes to pulmonary measures.

Methodology:

Sixty verified COVID-19 patients who were currently residing in COVID-19 wards at AL- Imam AL - Hussein Medical City in Iraq, \ Karbala city, were chosen at random to participate in this experimental investigation from October 11, 2021, until May 17, 2022. Using the systematic random sampling procedure, the study sample was chosen, with 30 patients as the treated group and remaining 30 as the control group. SpO2 and RR were monitored 4 times. The interventional strategy involved placing the participants in the prostrate posture (as depicted in figure 1) for an hour while performing coughing exercises on them.

Figure 1: coughing exercises during the prostrate posture

The sample in this research was chosen via a systematic random technique , with 30 patients serving as the experiment and the other 30 serving as the control group. SpO2 and RR were evaluated 4 times. The patient was placed in a prostrate posture (as depicted in figure 1) as part of the interventional strategy, and coughing exercises were administered to the patient during the prostration.

The researcher developed survey questionnaires to gather all the pertinent information related to demographic and clinical data, as well as some pulmonary parameters, such as SpO2 % , which investigated by using a pulse oximetry. The researchers determined the RR by counting the number of times the patient's chest rose and dropped over the course of one minute. The researcher utilized the interviewing method to collect the required data. A p-value of 0.05 was regarded as statistically significant when analyzing the data using the SPSS Version 24 program. Descriptive statistical analysis strategies that including percent , frequency, and chi-square. Concerning to an inferential statistical syntheses we use the repeated measurement (ANOVA) and assess the study's findings.

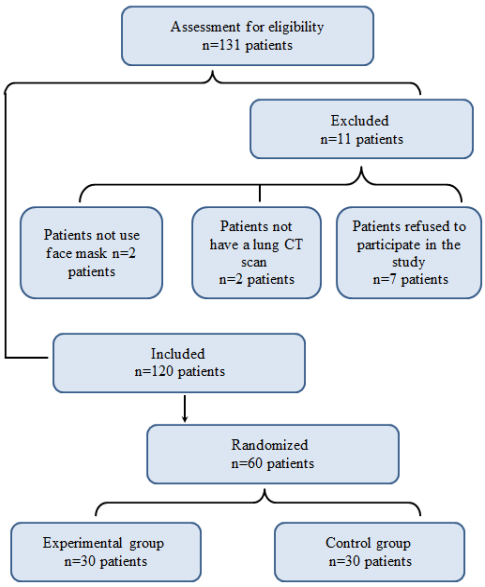

Figure 2: Randomized control trial flowchart and eligibility requirements

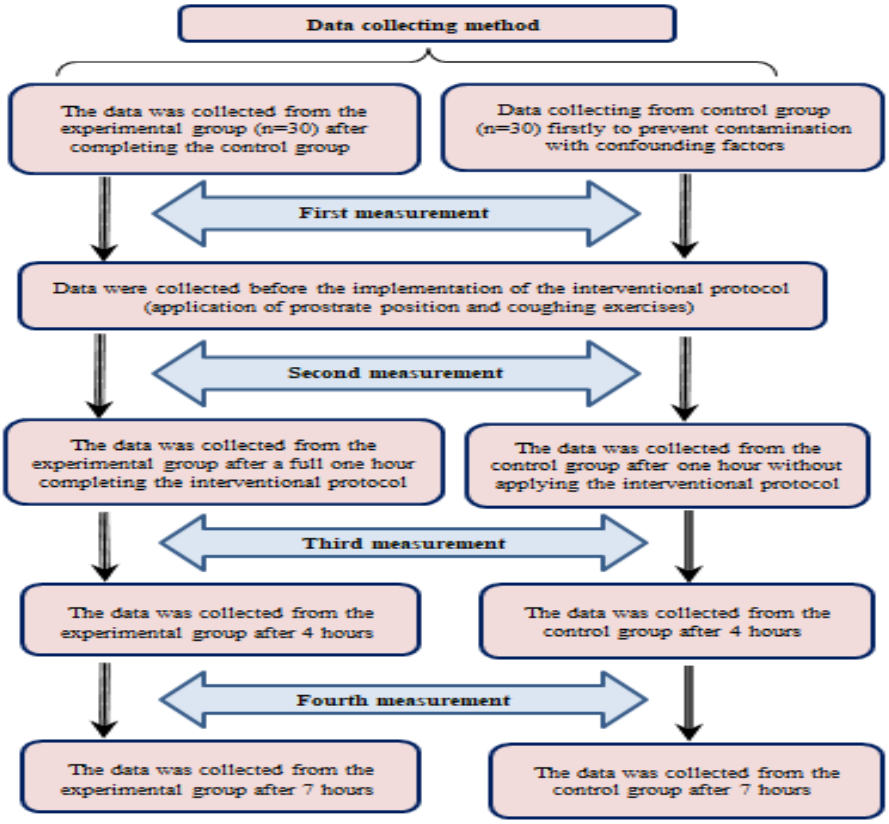

Figure 3: Diagram of the data collection process

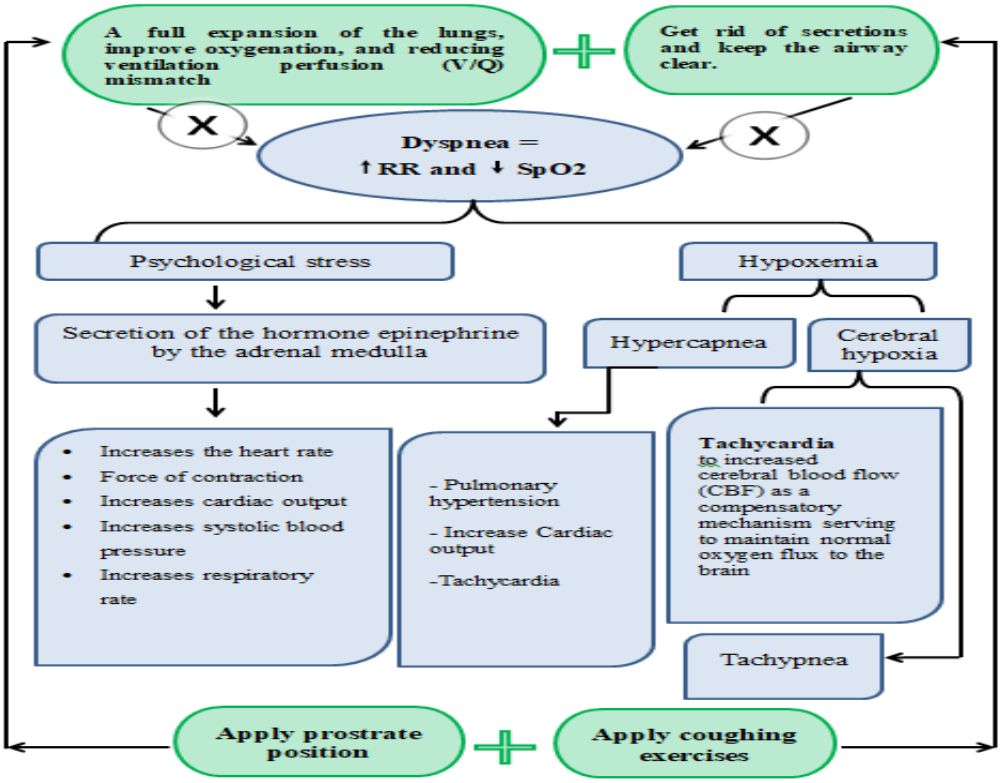

Figure 3: Flow chart: impact of coughing exercises and the prostration in reducing dyspnea and enhancing pulmonary indicators

Results and discussion:

Table 1. Distribution of the sociodemographic characteristics of COVID-19 patients

Demographic data		Control. group N=30		Experimental. group N=30	
		f	%	f	%
Age groups (years)	20-39	2	6.7	3	10
	40 - 59	8	26.7	8	26.7
	≥ 60	20	66.4	19	63.5
Gender groups	Male	14	46.7	18	61
	Female	16	53.3	12	39
Smoking status	Never.	20	66.7	23	76.7
	Previously	9	30	4	13.3
	Currently.	1	3.3	3	10
Body mass index (BMI)	Normal body weight	5	16.7	7	23.3
	Overweight.	7.0	23.1	1.1	3.2
	Obesity class (I)	14.1	46.8	16.1	53.4
	Obesity class (II)	3.1	10.1	3.1	10.1
	Obesity class (III)	1.1	3.3	3.1	10.1

Males composed 61% of the clients in the study group and 63.5% of them had more than 60 years as age . Concerning smoking habits, this table reveals that 76.7% and 66.7% had never smoked in the treatment and control groups, respectively. Finally, obesity class (I) (BMI=30-34.9) was present in 46.7% of participants in control group and 53.3% of clients in the study group.

Table 2: Distribution of COVID-19 patient clinical information:

The clinical information		Control group. N=30		Experimental group. N=30	
		f	%	f	%
Chronic diseases	Hypertension (HTN)	7	23.3	4	13.3
	Asthma diseases	9	30.0	8	26.7
	Diabetes mellitus	3	10	7	23.3
	None.	11	36.7	11	36.7
Infected part of the lung	Bilateral, peripheral area & central area	12	40	13	43.3
	The Bilateral, central area	8	26.7	12	40
	The Bilateral, peripheral area	7	23.4	4	13.4
	The Left lung, peripheral area	1	3.3	1	3.3
	The Right lung central area	1	3.3	0	0
	The Bilateral, lateral area	1	3.3	0	0
Percentage of the affected area	15 - 24%	5	16.7	0	0
	25 - 34%	5	16.7	3	10
	35 - 44%	5	16.7	3	10
	≥ 45 %	15	50	24	80

The control and experimental groups, respectively, 30.0% and 26.7% of clients had asthmatic problems, while 23.3% and 13.3% of them had hypertension. This data revealed that two-lateral, peripheral area and central regions of both lungs were impacted in 40.0% of control group & 43.3% of the experimental group, respectively,

while excessive than 45 % of both lungs were impacted in 80% of clients in study group and 50% of patients in control group.

Table 3: Comparison of how the experimental group and the control group's pulmonary indicators responded to coughing exercises while prostrated:

pulmonary parameters	Experimental group (M.S for 30 participants)					Control group (M.S for 30 participants)				
	Before	After 1	After 2	After 3	p-value (Sig.)	Before	After 1	After 2	After 3	p-value (Sig.)
SpO_2 (%)	82.63	95.13	92.80	82.66	**0.000 (HS)**	84.43	84.86	85.16	84.96	**0.398 (N.S)**
Respiratory Rate (breath\ minute)	35.201	22.802	25.063	30.161	**0.000 (HS)**	31.461	30.833	30.433	29.733	**0.086 (N.S)**

Before: prior to the intervention's application; After 1: 1 hour after the application's implementation; After 2: 4 hours after the application's implementation; and After 3: 7 hours after the application's implementation.

Table (3)'s outcome from the repeated measurement ANOVA demonstrates that the control group did not differ from the experimental group in terms of the mean scores for Oxygen saturation % and RR.

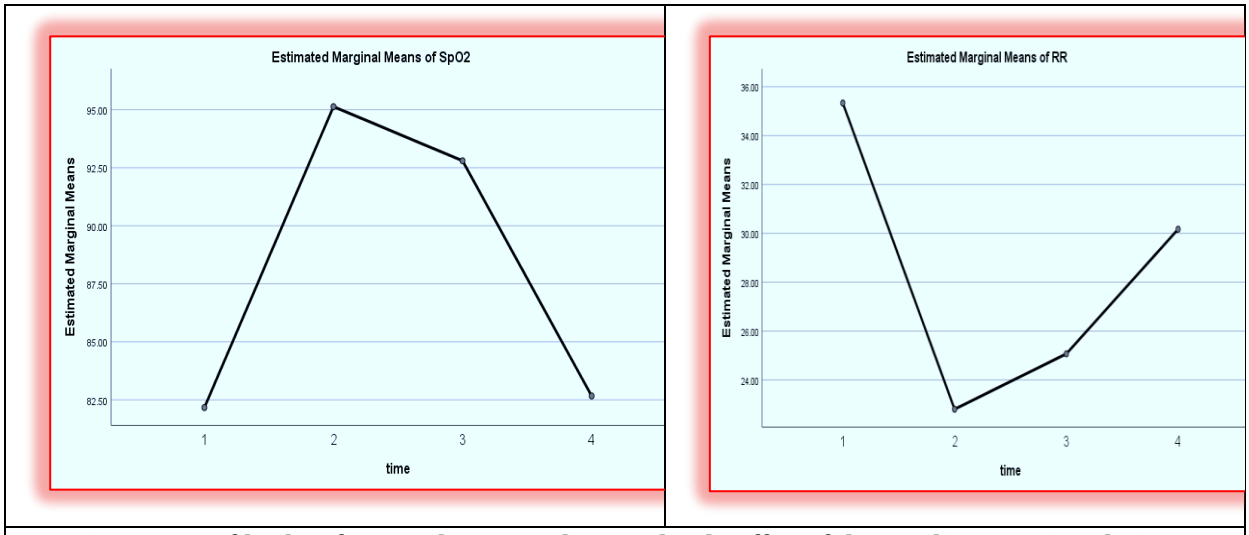

Figure 4: Profile plot of RR, and SpO_2 readings under the effect of the coughing exercises during prostration of the study group.

Table 4: Relationship between impacts of the cough exercises during prostration on the pulmonary indicators for the patients COVID-19 and their demographic data:

pulmonary parameters	Age group		The gender		The smoking condition		The body mass index	
	P-values	Sig	P- values	Sig	P- values	Sig	P-values	Sig
SpO_2	**0.411**	**NS**	**0.450**	**NS**	**0.014**	**S**	**0.151**	**NS**
RR	**0.004**	**S**	**0.021**	**S**	**0.202**	**NS**	**0.012**	**S**

NS : "None-Significant P value >0.05". S : "Significant" P- value ≤ 0.05".

The chi-square test used in this table reveals a statistically significant relationship between the smoked status and enhancement of the SpO_2, as well as a correlation between RR and patients' gender, gender, and BMI..

Table 5: Association between impacts coughing exercises application during prostration in the pulmonary markers for the patients with COVID-19 and their clinical data:

Variables	Chronic diseases		Infected area of the lung		Percent of an affected part	
	P. Values	Sig.	P. Values	Sig..	P. Values	Sig..
RR	0.001	S	0.000	S	0.034	S
SpO_2	0.020	S	0.016	S	0.051	NS

NS : "None-Significant P value >0.05". S : "Significant" P- value ≤ 0.05".

Discussion:

This research is considered the first trial for determining the impact of coughing exercises and the prostration posture on pulmonary measures in COVID-19 patients. Regarding the demographics shown in table 1, the findings show that around 63.5% and 66.4% of study and control group, respectively, the clients were in the age range of 60 years., These results contradict conclusions of study via Boehmer et al. (2020), which found that the majority of the sample's clients were older due to their weakened immune systems. But agree with Abed-Ali & Athbi, (2022). Mueller et al. (2020) revealed that "the immune system ages. Researchers have found that, in contrast to young people who have a strong immune system, hospitalization rates for the elderly are higher due to their lowered immunity, old age intolerance, and disease severity". It was determined by Khattab et al. (2012) that "54.4% of the patients taking part in the study do not smoke, and 53.2% of those infected with COVID-19 were smokers". Researchers believe that the rationale for the limited group of tobacco users in the survey was attributable to nearly half of participants were females as well as percent of tobacco smoke between many women in the eastern public is very restricted. The findings of Athbi, & Abed-Ali, (2020) , revealed a connection among passive smoking and the contracting of certain diseases or an exacerbation of their complications.

It has been found that one of main contributing causes to several disease processes is BMI. The majority of the COVID-19 patients participating in this trial, who made up 53.3% of the study group & 46.7% of control group, those participants were obese, according to our study's findings. This result is supported by a research by Raisi-Estabragh et al. (2020), which found a link between obesity classes (I) to (III) and higher risks of hospital mortality or the mechanical ventilation.

In addition, table (2)'s findings show that 36.7% of the participants were free of any chronic illnesses and that about one-third of clients had asthma. It was widely recognized that majority of asthmatic client was susceptible to triggers, such as allergens, viral exposure, or irregular drug use, which might result in the asthma attack or worsen his infected with some other respiratory problems.

As the amount of stimuli rises, an asthma attack becomes more severe. Because the virus was one of these triggers, most of asthmatic patient who contracted the covid 19 will experience more severe symptoms than other asthmatics, increasing their risk of hospitalization and lengthening their stay. This table revealed that two lateral- peripheral area & the center of lungs were affected in 40% of the control group & 43.33% of the treated group, respectively, with regard to the infected part of the lung.,

These findings are in line with a research by Soldati, et al. (2020), which found that "early viral pneumonia typically manifests as bilateral. Because the study was conducted on hospitalized patients, the majority of whom had a very high rate of lung damage, the researchers demonstrate that a high incidence of lung damage appeared in the study group".

The advantages of the coughing exercises during prostration on the lung parameters were amply demonstrated in Table 3; it indicates that the experimental group's patients benefited from this nursing

intervention' positive effects on the pulmonary parameters. The 2nd investigate (immediately after the first hour post finishing the application the interventional technique) and third assessment both showed an enhancement in the respiratory parameters (2 hours after finishing the performing of the nursing interventional technique).

The achievement of lung inversion during the application of prostration is one of the mechanisms of drainage of secretion, as well as coughing exercises that assist in removing thick mucus secretions from within the air sacs to the upper respiratory bronchioles, which assists the process of removing them, are believed to be the causes of the decrease in RR and SpO2%. The mechanism of the lungs expanding, the alveoli opening, and the increase of gas exchange are all good effects of this process.

The patient psychologically relaxed, tension diminishes, and breathing effort decreases as the SpO2% increases and the respiratory rate falls. This results in a decrease in HR, BP, CO, and other cardiac markers. After adopting the prone posture, McNicholas et al. (2020) highlighted the enhancement in arterial oxygen by boosting regional ventilation in dependent lung areas close to diaphragm & decreasing pleural pressure.

Muslim patients find psychological pleasure in the prostration because it is one of the actions that are unique to their prayer. According to a research done in Iraq, via Ibraheem et al. (2021), who said that "the prostration (Sajdah), which is a daily practice for spiritual contact with the Lord, who provides them with assurance, calmness, and safety, leads to psychological satisfaction because of the closeness to God, which has a positive impact on health". The knee - chest posture caused a considerably reduced RR, HR, and enhanced oxygen saturation %, according to Mahrous and Aboelmagd in 2022. According to Rossi, et al. (2022), 65% of COVID-19 pneumonia patients had higher PaO2/FiO2 values while lying on their abdomen.

Regarding the correlation between the effect of coughing exercises and the prostrate posture with patient demographic & clinical information. The findings in table of 4 revealed a significant correlation among Oxygen saturation & chronic disease, the lung area that was infected, the percent of the lung that was impacted, and the affected region. Additionally, a clear correlation between the enhancement in breathing rate and chronic illness, the portion of the lung that was infected, and the proportion of the affected area was also demonstrated.

Conclusion:

According to the study's findings, the Appling coughing exercises during prostrate posture were effective in enhancing pulmonary parameters in with COVID-19, and their beneficial effects lasted for approximately 4 hours. Benefits of the prostration and coughing exercises were significantly correlated with patient demographics and clinical information, including chronic illness, lung infection area, and the percent of the damaged lung.

Recommendations:

1. To improve pulmonary parameters in COVID-19 patients, coughing exercises should be done in the prostrate posture for a full hour every 4 hours..
2. We suggest to Conduct a second trial to assess how exercising while in the prostrate posture affects other respiratory indicators in COVID-19 clients as well as those with other pulmonary or cardiovascular disorders.

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