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Impact of deep breathing exercise on oxygen saturation of patients with coronavirus disease

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***Abstract*---**An experimental comparative study design was done for 30 patients to assess the impact of deep breathing exercises and chest physiotherapy on the oxygen saturation of patients with COVID19 in Imam Hussein Teaching Hospital and Al Rifai General Hospital/ Thi Qar. The reliability of the questionnaire was achieved through a pilot study and then presented to experts to prove its validity. The total number of items was 40-items in two questionnaires and measure oxygen saturation for five days before and after deep breathing exercises and chest physiotherapy. The data was collected by using simple random methods and analyzed by the application of a descriptive and inferential statistical data analysis approach.Results: The results showed for 30 patients there was significant improvement in oxygen saturation values after chest breathing exercises and deep breathing exercises from 82.3333 ± 2.78337 in first before intervention day to 93.5000 ±1.38340 in day five after chest breathing exercises and deep breathing exercises at $P < 0.05$. Also there were no significant statistical correlation between patient's age and their oxygen saturation after chest breathing exercises and deep breathing exercises at $P > 0.05$. The results also showed there were no significant statistical differences between patient's gender, housing environment, and level of education, marital status and occupation with their oxygen saturation after chest breathing exercises and deep breathing exercises at $P > 0.05$.

***Keywords*---**breathing, oxygen, patients, coronavirus.

Introduction

Coronavirus disease, formally known as COVID-19 by the World Health Organization (WHO), is a highly contagious respiratory illness caused by a coronavirus 2 that causes severe acute respiratory syndrome (SARS-CoV-2).

Coronavirus disease is the name given to the sickness caused by SARS-CoV-2 infection (COVID-19) (WHO,2021). COVID-19 causes a mild disease, such as a respiratory tract infection with or without pneumonia, in 80 percent of cases, and most of them recover. However, in 14 percent of cases, COVID-19 progresses to a more serious disease requiring hospitalization, and the remaining 6% of cases experience critical illness requiring intensive care. COVID-19-related hospitalizations result in a 4% death rate (European Centre for Disease Prevention and Control,2020).

Coughing and sneezing create respiratory droplets, which carry the virus quickly from one person to another(Ahmad et al.,2020). The most prevalent COVID-19 symptoms were non-specific, with fever, cough, and myalgia being the most common. Sore throat, headache, chills, nausea or vomiting, diarrhea, ageusia, and conjunctival congestion were among the other mild symptoms. The COVID-19 was divided into three categories: mild to moderate disease (non-pneumonia and pneumonia), severe disease (dyspnea, respiratory frequency greater than 30/min, oxygen saturation less than 93 percent, PaO2/FiO2 ratio less than 300, and/or lung infiltrates covering more than 50% of the lung field within 24–48 hours), and critical disease (respiratory failure, septic shock, and/or multi-organ dysfunction/fail (Raoult et al.,2020).

The measurement of oxygen saturation is crucial in the management and comprehension of patient care. Because hypoxemia can have a variety of acute negative consequences on various organ systems, oxygen is strictly controlled inside the body. The brain, heart, and kidneys are among them. The amount of hemoglobin that is now bound to oxygen vs the amount that is unbound is measured by oxygen saturation (Kaufman et al.,2021).

Breathing exercises and chest physiotherapy may help post-COVID-19 patients improve their respiratory function and quality of life. Physical rehabilitation is utilized as an adjuvant treatment during the acute period. However, under discharge settings or for COVID-19 patients with a slight illness, breathing exercises and chest therapy may be the primary treatment [6]. Therefore, this study concerns impact of deep breathing exercises on the oxygen saturation of patients with COVID-19 in Thi Qar Province/ Iraq.

Method

An experimental comparative study design was done for 30 patients to assess the impact of deep breathing exercises and chest physiotherapy on oxygen saturation of patients with COVID19. Study instrument: The questionnaire is one of the means to help collect data that contribute to achieving the results expected by the study, so the researcher designed this questionnaire.

This questionnaire consists of four for parts which includes the following:

Part I: This section composed of socio-demographic information which includes age, gender, housing environment marital status, level of education, salary income, information about COVID19, problems other than COVID19 and occupation.

Part II: This section deals with the patients to done deep breathing exercises for 10 minutes in prone and sitting and Simi flower positions and documented the effect by using the questioner consist of 20 items and three likert scale from 1 = never to 3= always with minimum and maximum 20- 60.
Part III: This section deals the patient's to done chest physiotherapy for 10 minutes in prone and sitting and Simi flower positions and documented the effect by using the questioner consist of 20 items and three likert scale from 1 = never to 3= always with minimum and maximum 20- 60.
Part VI: That used were digital pulse oximeter (Pulse Oximeter Jumper 500 E) to measure oxygen saturation for five days before and after deep breathing exercises and chest physiotherapy.

Content validity was determined by evaluation of the questionnaire through a panel of (10) experts, who had more than 10 years of professional experience in their fields, to investigate the content of the questionnaire. The reliability of the questionnaire is determined through (10) patients selected from Imam Hussein Teaching Hospital in Thi Qar and the interval period was five weeks. Cronbach's alpha was discovered to be 0.88.

The data were analyzed using (SPSS) version 21 application of statistical analysis system for 30 Samples for patients with COVID19. First, the Mean, Standard deviation, Frequency and Percentage , then, Paired sample t- test, Pearson correlation, one way ANOVA and linear regression. The Significance level is at $p< 0.05$.

Result

The finding in table 1 revealed that age of participant with Mean ± SD 59.066 ± 11.116. According to gender, the male that participant in the study was (63.3%). According to housing environment more than 50% of participant living in the center of the city, and about the level of educational the most of participant was completed the primary school. Also a high percentage of participants were married (63.3%). And about the salary income the most of participants had enough salary income. The 43.3% of participants not had information about COVID19 and 36.7% had information from media, also just 20% of participant not had problems other than COVID19 and the others had problems such as heart disease, respiratory system diseases, hypertension, diabetic, Kidney disease, obesity, smoking and drinking alcohol. Also regarding the occupation 43.3% of participants not work.

Table (1): Participants Characteristics

Characteristics	f.	%
Age		
18 – 35 years	1	3.3
36 – 50 years	6	20
51 – 65 years	14	46.7
66 - Above	9	30.0
M ± SD 59.066 ± 11.116		

Total	30	100
Gender		
Male	19	63.3
Female	11	36.7
Total	30	100
Housing environment		
Rural	14	46.7
Center	16	53.3
Total	30	100.0
Level of education		
Illiterate	7	23.3
Primary school	12	40.0
Secondary school	6	20.0
Institute	4	13.3
College	1	3.3
Total	30	100.0
Marital status		
Single		
Married	19	63.3
Divorce	4	13.3
Widower	4	13.3
separate	3	10.0
Total	30	100.0
Salary income		
Not enough	10	33.3
Enough	12	40.0
Somewhat enough	8	26.7
Total	30	100.0
Information about COVID19		
Not have	13	43.3
Had from doctor	3	10.0
Had from nurse	1	3.3
Had from media	11	36.7
Had from the health institution	2	6.7
Total	30	100.0
Problems other than COVID19		
Not have	6	20.0
Heart disease	2	6.7
Respiratory system diseases	3	10.0
Hypertension	4	13.3
Diabetic	4	13.3
Kidney disease	3	10.0
Obesity	3	10.0
Smoking	2	6.7
Drinking alcohol	3	10.0
Total	30	100.0
Occupation		
Earner	9	30.0
Employer	7	23.3
Student	1	3.3

Not work	13	43.3
Total	30	100.0

f.: Frequency, No.: Number, %Percentage

Findings demonstrated in table 2 the evaluation level of participants for the effect of chest breathing exercises and deep breathing exercises on improving oxygen saturation was moderate.

Table (2): Distribution the evaluation level of participants for the effect of chest breathing exercises and deep breathing exercises on improving oxygen saturation

Chest breathing exercises 20Q = 20 - 60			Deep breathing exercises 20Q = 20 - 60		
Range of scores	N.	%.	Range of scores	N.	%.
20-33 Poor	1	3.3	20-33 Poor	3	10.0
34-46 Moderate	22	73.3	34-46 Moderate	19	63.3
47-60 High	7	23.3	47-60 High	8	26.7
Total	30	100.0	Total	30	100.0
Mean ± SD 40.67 ± 6.388			Mean ± SD 43.26 ± 7.357		

Poor = (20-33), Moderate = (34-46) and High (47-60).

Findings demonstrated in table 3 there was significant improvement in oxygen saturation values after chest breathing exercises and deep breathing exercises from 82.3333 ± 2.78337 in first before intervention day to 93.5000 ±1.38340 in day five after chest breathing exercises and deep breathing exercises at $P < 0.05$.

Table (3): Distribution oxygen saturation before and after chest breathing exercises and deep breathing exercises

	Spo2 before		Spo2 after		P. value
Day1	82.3333	2.78337	84.4333	2.76285	.000
Day2	84.0667	2.47656	86.3333	2.32428	.000
Day3	85.9000	2.32453	88.6667	2.03983	.046
Day4	87.8667	2.14530	90.9333	1.81817	.043
Day5	90.0333	1.86591	93.5000	1.38340	.032
Total	86.040 ± 2.232		88.773 ± 1.969		.003

M = Mean of score, S.D=Standard Deviation, P=probability value, NS: Non-Significant at $P > 0.05$, S: Significant at $P < 0.05$, HS: Highly Significant at $P < 0.01$.

The results in table (4) showed there were no significant statistical correlation between patient's age and their oxygen saturation after chest breathing exercises and deep breathing exercises at $P > 0.05$. The results also showed there were no significant statistical differences between patient's gender, housing environment, and level of education, marital status and occupation with their oxygen saturation after chest breathing exercises and deep breathing exercises at $P > 0.05$.

Table (4): The association between patients' demographics and their oxygen saturation after chest breathing exercises and deep breathing exercises

Demographics	Statistical analysis	p. value	Sig.
Age	Cc = -.269-	.150	NS
Gender	F = .714	.581	NS
Level of education	F = 1.568	.223	NS
Marital status	F = 1.345	.280	NS
Occupation	F = 1.542	.198	NS
Housing environment	F = .886	.506	NS

Discussion

This study used an experimental comparative study design assess the impact of deep breathing exercises and chest breathing exercises on oxygen saturation of patients with COVID19. The present study samples consist of 30 patients with COVID19 in random selection by using simple random methods. The present study showed the age of participant with Mean ± SD 59.066 ± 11.116, according to gender, the male that participant in the study was (63.3%) and about the level of educational the most of participant was completed the primary school and the others had problems such as heart disease, respiratory system diseases, hypertension, diabetic, Kidney disease, obesity, smoking and drinking alcohol. Also a high percentage of participants were married (63.3%). The present study supported by Jiandani, et al. 2021 in India that stated in the results for 112 samples (83 men and 29 females) with mean age was 53.87 ± 15 years (Jiandani et al.,2021).

Mejía, et al. 2020 stated in the study that conducted in Peru that showed 369 patients (65.31 percent) were male, with a median age of 59 years. Obesity (42.55 percent), diabetes mellitus (21.95 percent), and hypertension were all present in the majority of patients (68.56 percent) (21.68 percent) **(**Mejía et al.,2020). According to Thenmozhi & Bindya, 2021, in a survey performed in India, 33.3 percent were illiterates and had secondary education, 33.3 percent were agriculturists and self-employed, and 73.3 percent were in the Rs.10000 – Rs.50000 income range and 73.3 percent were married (Thenmozhi and Bindya,2021).

The present study showed there was significant improvement in oxygen saturation values after chest breathing exercises and deep breathing exercises from 82.3333 ± 2.78337 in first day before intervention to 93.5000 ±1.38340 in day five after chest breathing exercises and deep breathing exercises for patients with COVID19 at $P < 0.05$. The present study showed that the evaluation level of participants for the effect of chest breathing exercises and deep breathing exercises on improving oxygen saturation for patients with COVID19 was moderate.

According to Nirmalasari, Mardiyono, and Dharmana, 2019, a study conducted in Indonesia revealed a 1.69 percent increase in oxygen saturation, demonstrating the effect of deep breathing exercise intervention and active range of motion on oxygen saturation (p=0,000) (Nirmalasari et al.,2020) The present study,

conducted in Italy by Battaglini, et al. 2021, found that chest physiotherapy is beneficial in enhancing long-term respiratory physical performance in ICU survivors (Battaglini et al.,2021).

The current study, which was sponsored by Jiandani, et al. 2021 in India, found that following breathing exercises and prone positioning, all patients on oxygen supplementation had a statistically significant improvement in SpO2, in patients using non-invasive ventilation and a facemask, side-lying orientation improved oxygen saturation. In individuals with COVID-19, both breathing exercises and posture demonstrate an immediate increase in oxygen saturation (Jiandani et al.,2021).

Alahmri, et al. 2021 stated in the study that conducted in Saudi Arabia that showed the paired t-test was used to compare the means pre- and post-the breathing exercises with p-value >0.05 and also showed a significant difference in inspiratory lung volume and SPO2 p-value= 0.001 **(**Alahmri et al.,2021). Kumar, et al., 2020 reported in a study done in India that attempted to determine the association between dyspnea and age, as well as SPO2 levels in COVID-19, that the dyspnea and SPO2 levels were better and statistically significant in contrast to the control group (Kumar et al.,2020)

The current investigation, which was supported by Grbovic et al., 2021 in Serbia, found that the levels of oxygen saturation changed considerably before and after respiratory exercise sessions (95.77 to 98.02) ($p < .001$)(Grbovic et al.,2021). The present study showed there were no significant statistical correlation between patient's age and their oxygen saturation after chest breathing exercises and deep breathing exercises at $P > 0.05$. According to Kumar, et al., 2020, a study done in India found a slight positive connection between levels of dyspnea and age ($r= 0.0385$) $p > 0.05$, which is no statistically significant (Kumar et al.,2020).

Conclusion

The characteristics of the current study revealed the highest percentage were male at age with mean fifty years old. In addition, the highest percentage of them living in the center of the city, and the highest percentage of participants was completed the primary school, also a high percentage of participants were married with enough salary income. The most of participants had information about COVID19 from media, and the most of the participant had problems such as heart disease, respiratory system diseases, hypertension, diabetic, Kidney disease, obesity, smoking and drinking alcohol. The results showed there was significant improvement in oxygen saturation values after chest breathing exercises and deep breathing exercises in five days for patients with COVID19. Conclude the study there was no statistically significant association between patient's socio-demographic characteristics with their oxygen saturation after chest breathing exercises and deep breathing exercises.

Financial Disclosure
There was no financial disclosure.

Conflict Of Interest
None to declare

Ethical Clearance
All experimental protocols were approved by the Thi Qar Health Directorate in Iraq, and all experiments followed the permitted procedures.

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