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The Impact of Pursed-lips Breathing Maneuver on Cardiac, Respiratory, and Oxygenation Parameters in COPD Patients

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Keywords: Chronic Obstructive Pulmonary Disease; Pursed Lip Breathing; Vital Sign; Pulse Oximetry; Blood Oxygen Saturation

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Abstract

BACKGROUND: Respiratory system, together with the cardiovascular and central nervous system, is responsible for all processes related to oxygenation and hemodynamics and the defect in the functioning of each of these systems, along with ageing, can have mutual effects on their performance and physiological symptoms. The use of Pursed-lips Breathing (PLB) training is an essential part of the treatment of patients with the obstructive pulmonary disease, PLB stimulates the autonomic nervous system and causes relaxation and improvement of physiological parameters.

AIM: This study was conducted to evaluate the effect of PLB on cardiac, pulmonary and oxygenation level in patients with Chronic Obstructive Pulmonary Disease (COPD).

METHODS: A three-group clinical trial study with experimental and control which was purposefully conducted with the participation of patients with COPD and healthy individuals referring to Madani hospital Khoy, in 2017. The sample size was selected to be 60 subjects. The patients were randomly allocated to two groups of intervention and control with 20 patients, and 20 healthy subjects were assigned to the healthy intervention group. The demographic, anthropometric information form and checklist recording changes in levels of oxygenation, respiration, temperature, heart rate and blood pressure with cardiopulmonary follow up in three stages before, during and after PLB were used for data collection. Data were analysed using descriptive statistics, repeated measure test, ANOVA, and Chi-square.

RESULTS: On evaluation within the COPD patient intervention group in Saturation of Peripheral Oxygen (SPO_2) index with the mean difference of 2.05 percent, Respiratory Rate(RR)-0.65 minute and Pulse Rate(PR)-1.6 bpm was significant ($p \leq 0.05$), and systolic blood pressure index in healthy subjects was increased (3.35 mmHg).

CONCLUSION: The results of this study indicated that using effective PLB as an easy, inexpensive, non- invasive and non-pharmacological method is considered as an important factor in improving the status of oxygenation and physiological indicators in patients with COPD and should be considered as an important part of rehabilitation programs for these patients.

Introduction

Chronic illness is a multidimensional health challenge with various manifestations and disabilities that the patients are in need of long-term care and education to adapt to their physiological changes [1]. COPD is a collection of physiological disorders, in which the airflow restriction is their most important characteristic. Emphysema and chronic bronchitis are included in this complex [2]. These diseases cause a wide range of pathological changes in the respiratory system, and with a gradual decrease in the air flow of exhalation, increasing dyspnea, coughing, and confusion [3]. COPD is a common progressive, preventable, therapeutic disease [4] and spirometry is the most important test for the diagnosis and determination the stage of disease, where the Forced Expiratory Volume in the second first (FEV1) is a good marker for determining the severity of the disease and the function of the lung.

According to the results of spirometry, the patients are divided into 4 types of mild, moderate, severe and very severe [5]. The importance of this disease in public health is increasing worldwide, and the increasing prevalence of chronic obstructive pulmonary disease as one of the priorities of the WHO has a significant impact on health care system [6] [7]. This illness is the fourth leading cause of death and the fifth cause of disability in the United States, and

according to Global Initiative for Chronic Obstructive Lung Disease (GOLD) estimates, it will move from the world's sixth most common cause of death to the third rank in 2020. It is estimated that about 64 million people in the world will get COPD by 2030 [5].

To assess signs and predisposing factors, consideration of the index of vital signs is the most important physiological criteria for assessing hemodynamic status [8]. The early prediction of the patient's physiological conditions based on vital signs is an important and valuable issue, the regular and continuous monitoring of it results in proper decisions and provision of necessary care to patients [9]. Along with vital signs, pulse oximetry as the sixth sign of vitality is a standard measure and reliable tool for monitoring cardiac and respiratory conditions [10]. Lung rehabilitation as part of COPD treatment aimed at relieving uncomfortable symptoms, preventing cardiovascular and respiratory complications and improving quality of life [11].

In the study conducted by Emtner, Herala, Stalenheim [12], results indicated that after the implementation of lung rehabilitation programs, the clinical status and functional tests of the lung have improved in COPD patients. The study conducted by Solanes et al., [13] showed the importance of using lung rehabilitation programs to increase activity tolerance, improving quality of life, and reducing the clinical symptoms of COPD. Although breathing exercises in the form of pursed-lip breathing may be useful to reduce the symptoms of dyspnea and improve pulmonary function and quality of life, objective evaluation based on pulse oximetry, respirogram, and arterial blood gas analysis indicates contradictory results and pursed-lip breath exercises is not considered as a major component of the lung rehabilitation program, because their usefulness is still uncertain [14] [15].

Therefore, the role and efficacy of respiration with the pursed lips has remained unclear in the rehabilitation of people with COPD. Since all patients cannot access the formal and regulated lung rehabilitation program, the nurse can play an effective role in educating and following-up of a rehabilitation program such as self-care, pursed-lips breathing, exercise, and energy conservation techniques in daily activities [1] [4]. Based on observations and clinical experience, nurses do not consider this technique as part of a complementary clinical treatment program and to improve the health of the patient.

Studies conducted in Iran regarding the lung rehabilitation program, especially the pursed-lip breathing, do not appear to be adequate in the field of nursing, this study was conducted to evaluate the effect of pursed-lips breathing on cardiac, pulmonary and oxygenation index in patients with COPD.

Material and Methods

This study was a three-group clinical trial, randomised controlled and interventional which was purposefully conducted with the participation of patients with COPD and healthy individuals referring to the spirometric unit of Madani hospital Khoy, in 2017. The content and methods of this study were approved by the Ethics Committee of the Deputy of Technology and Research of Urmia University of Medical Sciences (Approval no. 1395.438).

Informed written consent was obtained from all participants before they took part in the study. Participants were informed that they could leave the study at any time without penalty, and all personal information was kept confidential. The required sample size was selected to be 60 subjects based on the study conducted by Rossi et al., [16] with $\alpha = 0.05$, $\beta = 0.2$, the effect size of 0.17, in the three groups by using the G* Power software. Participants were randomly allocated to one of two treatment groups: posterolateral fusion with pedicle fixation or cognitive intervention and exercises. Each eligible patient was assigned an identification number by the randomisation central at the University of Bergen. The concealed random allocation was conducted by a computer-generated the random list. Blocks of 10 patients were used to ensure fairly even-numbered treatment groups.

The samples were selected purposively with the participation of 40 COPD patients. Participants were randomly allocated in two groups of 20 subjects: PLB intervention and the control group. The control group received just routine cares and drug treatments. In PLB intervention group, the patients with mild to moderate disease were selected. For data gathering, first, demographic and anthropometric information was recorded then the pulmonary function parameters, vital signs and spo2 were measured by the Italian SpiroLab MIR Maggiotiro 125 Spirometric device. The vital signs were measured and recorded in three stages, before PLB with rest and normal breathing, during PLB and after PLB with rest, within 30 minutes in two groups of COPD patients and healthy subjects. Recording the measurements in the control group was carried out in just three 10-minute periods.

To perform the PLB, the subjects were trained to breathe by relaxing the neck and shoulder muscles and breathe in the tidal volume range through the nose and count up to number 2, then close the mouth. In exhalation, she should almost press her lips and be constricting the abdominal muscles; she should slowly exhale the air in her lungs through her mouth by extending the exhalation time through the pursed lips counting from 1 to 5. The inclusion criteria for the study include the age over 40, diagnosis of COPD, stability in clinical condition, unused rehabilitation programs other than PLB, the

absence of underlying chronic illnesses (hypertension, cardiomyopathy, or diabetes) and the patient's willingness to participate in the study. SPSS version 22.0 was used for statistical data analysis. All analyses were two-tailed, and the significance level was set a 0.05. General characteristics were analysed with descriptive statistics. The difference of between groups to general characteristics and Cardiac, Respiratory, and Oxygenation Indicators were analysed with Chi-square and ANOVA or Kruskal Wallis. Repeated measure test was used to examine the influence of PLB Maneuver on Cardiac, Respiratory, and Oxygenation Indicators within groups.

Table 1: Demographic and Anthropometric Characteristics of the Studied Groups

Groups Frequency Variables		Intervention (Patient) n%	Intervention (Health) n%	Control (Patient) n%	P
Gender	Male	9 (45)	7(35)	10 (50)	0.621
	Female	11 (55)	13(65)	10 (50)	
History of Smoking	Yes	14 (70)	20(100)	16 (80)	0.035
	No	6 (30)	0(0)	4 (20)	
History of Drug use	Yes	8 (40)	20(100)	9 (45)	0.001
	No	12 (60)	0(0)	11 (55)	
History of Hospitalization	No	15 (75)	20(100)	17 (85)	0.168
	Once	1 (5)	0(0)	0 (0)	
	Twice and more	4 (20)	0(0)	3 (15)	
Groups Statistical Indicator Variables		Intervention (COPD) M ± SD	Intervention (Healthy) M ± SD	Control (COPD) M ± SD	F	P
Age (Year)		60.65 ± 12.80	38.80 ± 10.85	61.85 ± 13.38	21.93	*0.001*
Duration of COPD (Month)		48.27 ± 52.44	0.0 ± 0.0	205.71 ± 83.84	29.33	*0.001*
Weight (Kg)		72.37 ± 17.82	73.35 ± 11.73	73.55 ± 16.50	0.03	*0.968*
Height (cm)		159.45 ± 10.90	164.70 ± 10.27	163.95 ± 10.31	1.46	*0.240*
BMI (kg/m2)		28.45 ± 7.20	27.36 ± 4.34	27.34 ± 5.65	0.23	*0.792*
BSA (m2)		1.75 ± 0.203	1.80 ± 0.17	1.79 ± 0.224	0.32	*0.731*

Results

Based on the pulmonary function indexes, the highest mean of Forced Volume Capacity (FVC) (4.41 ± 1.31 L), FEV1 (3.39 ± 0.97 L), FEV (70.36 ± 15.3%), FEV/FVC (85.3 ± 6.8 %) were in the control group of healthy subjects (Table 2).

Table 2: Mean, Standard Deviation and Variance Analysis within Group of Pulmonary Function Indexes in Three Group of COPD Patients and Healthy Subjects

Groups Statistical Indicator Variables	Intervention (COPD) M ± SD	Intervention (Healthy) M ± SD	Control (COPD) M ± SD	F	P
FVC (L)	2.64 ± 1.025	4.41 ± 1.31	3.11 ± 1.35	11.09	*0.001*
FEV1 (L)	1.94 ± 0.85	3.39 ± 0.97	2.02 ± 0.94	15.71	*0.001*
FEV (%)	65.10 ± 21.92	70.36 ± 15.45	59.98 ± 13.15	1.81	*0.173*
FEV/ FVC (%) Predicted	71.57 ± 16.27	85.32 ± 6.89	64.16 ± 13.19	5.37	*0.007*
VC (L)	2.79 ± 1.53	3.87 ± 1.43	2.80 ± 1.16	4.01	*0.023*
PEF (L/s)	3.52 ± 1.55	6.73 ± 2.18	3.85 ± 2.07	16.27	*0.001*
PEF2575 (L/s)	1.70 ± 0.10	3.08 ± 1.095	1.38 ± 0.77	17.57	*0.001*

Comparing between the groups in the SPO2 index the highest mean with 96.9 ± 1.2 per cent was increased in the healthy group after the intervention of the pursed lips breathing. Pulse Rate at the time of pursed-lip breathing was decreased than before in intervention groups. There was a significant difference within groups in the three stages before, during and after PLB in comparison with Blood Pressure Systole (BPS), Blood Pressure Diastole (BPD) and Arterial Mean Pressure (AMP) that were decreased in three stages.

Table 3: Mean, Standard Deviation and Variance Analysis between Group of Oxygenation and Cardiopulmonary Parameters, Before, During and After PLB in the Studied Groups

Groups Statistical Indicator Variables		Intervention (COPD)	Intervention (Healthy)	Control (COPD)	F	P
SPO2 %	Pre	92.10 ± 3.76	94.05 ± 2.41	91.75 ± 4.98	2.05	*0.138*
	Inter	94.15 ± 5.23	95.75 ± 1.68	92.5 ± 4.92	2.91	*0.043*
	Post	93.25 ± 4.81	96.90 ± 1.20	93,05 ± 5.53	5.10	*0.009*
RR min	Pre	20.15 ± 1.92	20.45 ± 1.76	21.90 ± 1.71	5.08	*0.093*
	Inter	19.50 ± 1.87	19.20 ± 1.03	20.85 ± 1.75	3.35	*0.042*
	Post	19.65 ± 1.53	19.75 ± 1.10	20.60 ± 1.67	7.98	*0.001*
T °C	Pre	37.06 ± 0.23	37.13 ± 0.23	37.07 ± 0.16	0.65	*0.528*
	Inter	36.96 ± 0.18	37.11 ± 0.23	37.08 ± 0.23	2.68	*0.077*
	Post	36.97 ± 0.16	37.13 ± 0.23	37.08 ± 0.20	3.09	*0.053*
PR	Pre	90.75 ± 14.70	84.10 ± 11.23	82.50 ± 12.37	2.32	*0.108*
BPM	Inter	89.15 ± 14.34	80.55 ± 12.75	80.55 ± 12.13	2.87	*0.053*
	Post	90.25 ± 15.32	85.35 ± 14.16	84.70 ± 13.47	0.89	*0.414*
BPD	Pre	121.50 ± 12.89	121.50 ± 14.34	134.75 ± 11.18	7.07	*0.002*
mmHg	Inter	119.12 ± 12.70	124.85 ± 14.79	133.65 ± 9.69	6.78	*0.002*
	Post	117.75 ± 12.62	121.15 ± 12.61	133.07 ± 10.14	9.23	*0.001*
BPD	Pre	78.75 ± 10.87	78.50 ± 13.09	89.75 ± 7.16	7.27	*0.002*
mmHg	Inter	76.50 ± 8.90	78.25 ± 12.28	88.62 ± 6.75	9.35	*0.001*
	Post	76.75 ± 9.77	77.75 ± 10.94	87.40 ± 7.75	7.62	*0.001*
AMP	Pre	92.99 ± 11.33	92.83 ± 13.38	104.75 ± 7.75	7.62	*0.001*
mmHg	Inter	90.70 ± 9.99	93.78 ± 12.74	103.68 ± 7.44	8.69	*0.001*
	Post	90.91 ± 9.98	92.21 ± 11.33	102.62 ± 8.07	8.43	*0.001*
RPP	Pre	10960.25 ± 2292.15	9771.75 ± 1825.98	10788 ± 1300.15	2.41	*0.099*
mmHg/min	Inter	10729.40 ± 2155.53	10505.55 ± 1916.30	11014.85 ± 1472.089	0.37	*0.690*
	Post	10744.50 ± 2445.67	15620.90 ± 27033.66	11241.70 ± 1852.87	0.58	*0.561*

Saturation of Peripheral Oxygen (SPO2); Respiratory Rate (RR); Temperature (T); Pulse Rate (PR); Blood Pressure Systole (BPS); Blood Pressure Diastole (BPD); Arterial Mean Pressure (AMP); Rate Pressure Product (RPP).

In evaluation within COPD patient intervention groups with repeated measure test in spo2 with a mean difference of 2.05 RR -0.65 and PR 1.6, there was a significant statistical difference (Table 4).

Table 4: Mean, standard deviation and variance analysis within the group of oxygenation and cardiopulmonary parameters, before, during and after PLB in the intervention COPD group

Stage Statistical Indicator Variables	Pre (PLB) M ± SD	Inter(PLB) M ± SD	Post (PLB) M ± SD	Repeat Measure	*P*
SPO2%	92.10 ± 3.77	94.15 ± 5.23	93.25 ± 4.81	F(2) 4.47	*0.018*
RR min	20.15 ± 1.92	19.50 ± 1.87	19.65 ± 1.53	F(2) 0.91	*0.049*
T °C	37.07 ± 0.23	36.96 ± 0.18	36.97 ± 0.16	F(1.26) 0.28	*0.099*
PR bpm	90.75 ± 14.70	89.15 ± 14.34	90.25 ± 15.32	F(2) 0.37	*0.054*
BPS mmHg	121.5 ± 12.88	119.12 ± 12.70	117.75 ± 12.61	F(2) 2.36	*0.108*
BPD mmHg	78.75 ± 10.87	76.50 ± 8.90	76.75 ± 9.77	F(2) 1.56	*0.310*
AMP mmHg	92.99 ± 11.33	90.70 ± 9.99	90.90 ± 9.98	F(1.17) 1.40	*0.259*
RPP mmHg/min	10960.25 ± 2292.15	10729.40 ± 2155.35	10744.50 ± 2445.67	F (2) 0.37	*0.691*

Saturation of Peripheral Oxygen (SPO2); Respiratory Rate (RR); Pulse Rate (PR); Temperature (T); Blood Pressure Systole (BPS); Blood Pressure Diastole (BPD); Arterial Mean Pressure (AMP); Rate Pressure Product (RPP).

In the intervention group of healthy subjects, there is a significant difference within the group in evaluation spo2 1.7, respiratory rate -1.20, heart rate 3.55, and systolic blood pressure 3.35 (Table 5) ($p \leq 0.05$).

Discussion

The respiratory system plays a crucial and determining role in maintaining and sustaining vital human processes. This system, together with the

cardiovascular and central nervous system, is responsible for all processes related to oxygenation and hemodynamics and the defect in the functioning of each of these systems, along with ageing, can have mutual effects on their performance and physiological symptoms [5, 17, 18].

Table 5: Mean, Standard Deviation and Variance Analysis within Group of Oxygenation and Cardio- Pulmonary Parameters, Before, During and After PLB in the Healthy Intervention Group

Stage Statistical Indicator Variables	Pre (PLB) M ± SD	Inter (PLB) M ± SD	Post (PLB) M ± SD	Repeat Measure	*P*
SPO2%	94.05 ± 2.41	95.75 ± 1.68	96.90 ± 1.20	F(2) 6.09	*0.001*
RR min	20.45 ± 1.76	19.20 ± 1.03	19.70 ± 1.10	F(2) 0.85	*0.342*
T c0	37.135 ± 0.23	37.115 ± 0.23	37.130 ± 0.23	F(2) 677	*0.677*
PR bpm	84.10 ± 11.23	80.55 ± 12.75	85.35 ± 14.16	F(2) 3.40	*0.044*
BPS mmHg	121.50 ± 14.33	124.85 ± 14.79	121.15 ± 12.61	F(2) 3.47	*0.041*
BPD mmHg	78.50 ± 13.09	78.25 ± 12.27	77.75 ± 10.94	F(2) 0.16	*0.856*
MAP mmHg	92.83 ± 13.38	93.78 ± 12.74	92.21 ± 11.33	F(2) 0.80	*0.458*
RPP mmHg/min	9771.75 ± 1825.98	10505.55 ± 1916.30	15620.90 ± 27033.66	F(1.01) 0.87	*0.363*

Saturation of Peripheral Oxygen (SPO2); Respiratory Rate (RR); Pulse Rate (PR); Temperature (T); Blood Pressure Systole (BPS); Blood Pressure Diastole (BPD); Arterial Mean Pressure (AMP); Rate Pressure Product (RPP).

In this study, smoking history in the intervention and control group was 30% and 20% respectively, and the healthy group did not have a history of smoking. In the study conducted by Izadi, Afshar, Adib-Hajbaghery [19], 56.3% of COPD patients were smokers. In the study of Wade [4], cigarette smoking was the main cause of disease and quitting was regarded as an essential step in controlling COPD. Comparing the mean FVC index in the patient intervention group with an average of 2.64 litres in comparison to the control group (3.11 litres) and healthy subjects (4.41 litres), the results were indicating a high intensity of shortness of breath in the intervention group. In the patient intervention group, the mean FEV1 was 65 ± 10%, and FEV1 was 1.94 ± 0.85 litres, which was matched with the study conducted by Ramos (FEV1 60 ± 25%, FEV1 1.53 ± 0.60 litres) [20]. In the FEV1/FVC index in the COPD intervention group with a mean of 71.57 ± 16.27%, the severity of the disease was less than the control group (64.16 ± 13.19 %) that indicating the presence of patients with stable status in this study.

In the study conducted by Wade [4], before pursed-lip breathing, the FEV1 was 2.29 ± 0.58, Peak Expiratory Flow (PEF) 459 ± 198, and FVC 3.22 ± 0.53. In the Spo2 evaluation, a significant difference was observed within the groups, during and after the pursed-lip breathing and this improvement was observed due to PLB with a proportional increase of 2.05 per cent in the patient intervention group, healthy subjects (1.7%) and control group (0.75%). After the intervention and the 10-minute interval of rest, recovery was continued in the healthy intervention group (1.15%) and control group (0.55%), but in the patient intervention group, the patient experienced a decrease of (-0.9%), which was probably due to fatigue and weakness caused by the disease and inability to use of respiratory muscles or the immediate effects of the PLB intervention. Evaluation in the within groups with repeated measure test and follow-up LSD, there was a statistically significant difference only before and during the pursed-lip breathing, in Spo2 which indicates an improvement in the oxygenation state by intervention pursed-lip breathing.

According to the study conducted by Solomon [21], a statistically significant difference was found with a mean of 1.67 ± 1.35 in the pursed-lip intervention group in spo2 improvement. In the study conducted by Ramos et al., [20], showed a significant increase in SPO2 than before and after PLB, which is consistent with the findings of the study. The use of PLB training with oxygen therapy is an essential part of the treatment of patients with the obstructive pulmonary disease, and it is necessary whenever arterial oxygen saturation reaches less than 90 per cent [1]. There was a significant difference in the respiratory rate of the patient intervention group and healthy subjects in both stages during and after pursed-lip breathing. With comparison within-groups in the patient intervention group, a decrease of -0.65 and a decrease of -1.25 in healthy individuals during the pursed-lip breathing was observed in respiratory rate, which indicates a decrease in the number of respirations and increases in respiration depth by application of PLB technique. In the study conducted by Robert et al., [22], it was indicated that PLB decreases RR and increase in SpO2 and the use of PLB relief to dyspnea, increase in self-esteem, and reduced fear especially at night. The decrease respiratory rate in the PLB is probably due to an increase the Resistance air flow during exhalation and the use of muscles resulting from increased in tidal volume, improved gas exchanges and respiratory sufficiency [23]. In pulse rate index, there was a significant difference between groups during pursed-lip breathing. With comparing within groups, this difference before and during the PLB in the intervention group of patients was -1.60 bpm and -3.55 in the group of healthy subjects, which had a significant difference in the stage, before, during and after PLB. Therefore, PLB caused a decrease in heart rate, and this decrease was higher in healthy subjects. This impact is probably due to the stimulation of the autonomic nervous system and parasympathetic activity [24] [16]. The stimulation of vagus nerve causes relaxation and improvement of physiological parameters [25].

Similar to the findings of this study, in the study conducted by Solomon [21], heartbeat difference was reported in the intervention group of the PLB with the Mean and SD (-9.12 ± 6.20). In a study conducted by Silva et al. [26] on 18 patients with COPD there were no significant correlations between using PLB in four activities of walking on the treadmill, wearing shoes, lifting cauldron and taking a shower without using of PLB in Inspiratory Capacity (IC), SPO2, HR,

RR indexes. It seems that in PLB, the exhalation time is twice and longer than the inhalation, so it often results in a decrease in the heartbeat. In comparison between the groups, there was a significant difference in systolic, diastolic and mean arterial pressure before, during and after PLB, which was mainly due to high blood pressure in patients with COPD in the control group. In the healthy intervention group, the difference (3.35 mmHg) in comparing the systolic blood pressure was significant with pursed-lip breathing, and PLB resulted in an increase in systolic blood pressure, possibly due to the excitement and stress caused by spirometric results and stimulating the carotid receptors, which leads to an increase in systolic blood pressure, after the intervention. In the study conducted by Ramos et al., [20], no significant changes were observed in BP by doing pursed-lip breathing.

In the study conducted by Maind et al., [27] the systolic blood pressure before pursed-lip breathing was 144.32 ± 10.80 and after pursed-lip breathing 149.89 ± 8.08 ($P < 0.015$) and diastolic blood pressure changed from 77.35 ± 5.45 to 77.62 ± 5.47, respectively that is consistent with this study. Variation in BP can be due to changes in the chest compression due to respiratory movements, which compensate for the increase or decrease in systolic blood pressure fluctuations [5] [28]. The number and rhythm of respiration not only affects the respiratory system but also has direct effects on the cardiovascular system. It may be possible to adjust the blood pressure and pulse fluctuations and prevent cardiovascular complications through breathing PLB exercises [29]. The limitations of this study were reluctance some of the sampled subjects, especially healthy individuals to collaborate in our study, with sufficient descriptions of their satisfaction for participation. Also, the effects of acute and short-term PLB in 30 minutes were evaluated, which may be determined in the long-term phase with strengthening muscles and respiratory training. Therefore such research is recommended to be evaluated over a long time span.

In conclusion, the results of this study indicated that the pursed-lip breathing manoeuvre in comparison to normal breathing has an improving effect on the level of oxygenation. It can lead to significant positive changes in respiratory and cardiac parameters in COPD patients. Therefore, PLB as an easy, inexpensive, non- invasive and non-pharmacological method is considered as an important factor in improving the status of oxygenation and physiological indicators in patients with COPD and should be considered as an important part of rehabilitation programs for these patients.

Training pursed-lip breathing should be considered as nursing standards in nursing care so that patients at home can have beneficial effects from the PLB whether they are in a family-supported program and during follow-up of caregivers. In the education program of nursing student's, the importance of PLB in lung rehabilitation should be considered in teaching the theoretical classes and practice with implement nursing process.

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