Progressive Muscle Relaxation (PMR) Enhances Oxygen Saturation in Patients of Coronary Heart Disease

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Abstract. Coronary Heart Disease (CHD) is a disorder of heart function due to heart muscle lacking blood due to the narrowing of coronary arteries. Attack of coronary heart disease will result in decreased blood supply to the heart muscle, so that blood pumped throughout the body will decrease. This can be indicated by the value of decreased oxygen saturation. The purpose of this study was to determine the effect of progressive muscle relaxation on oxygen saturation in coronary heart disease in General Hospital Ciamis Indonesia. This research is quantitative by using a research *quasi-experimental design*. The design used was *a pre-test* and *post-test* without a control group. The Technique *sampling* used in this study was *consecutive*, as many as 30 people. Analysis of data using univariate and bivariate analysis, dependent t-test *(paired t*-test) to test differences in oxygen saturation values before and after the intervention. Statistical test results obtained p-*value* 0,000 (p <0.05), it can be concluded that there is an increase in the value of oxygen saturation after progressive muscle training.

1. Introduction

The morbidity and mortality rates due to cardiovascular disease are currently increasing. This is caused by one of the core behaviors of health (including diet, physical activity, smoking, and energy balance) and health factors (including blood pressure, cholesterol, and glucose) so that cardiovascular disease now not only attacks the elderly but also attacks young age [1] [2]. Cardiovascular disease (CVD) is a heart and blood vessel disorder and includes coronary heart disease, cerebrovascular disease, rheumatic heart disease and other conditions [3]. One of the diseases of the cardiovascular system is *Coronary Artery Disease* (CAD) or often referred to as Coronary Heart Disease (CHD), namely impaired heart function due to heart muscle lacking blood due to narrowing of the coronary arteries [4].

17.9 million people die each year from cardiovascular disease and an estimated 31% of all deaths in the world [3]. In developing countries, CAD is a leading cause of death and disability. CAD is one of the causes of death for women and men in America. One-third of deaths due to CAD, attack at the age of more than 35 years [5]. The American Heart Association (AHA) (2016) reports that 15.5 million people ≥20 years in the US suffer from CAD, while reported prevalence increases with age for both women and men [6]. While the prevalence of CAD in West Java at 15 years of age in 2013 was 1.6% [7].

CAD has an impact on various aspects of his life. This disease is still an important health problem and has a socio-economic impact because the cost of medicines is quite expensive, the length of time for treatment and treatment, as well as other investigations needed in the treatment process [8].

Physically, sufferers will experience tightness, fatigue, and chest pain [9]. CAD is a disease characterized by a lack of oxygenated blood supply to the myocardium caused by coronary artery atherosclerosis or plaque that has accumulated in the coronary arteries that supply oxygen to the heart muscle [10]; [8]. This makes it possible for blood clots in this narrowed artery. If blood continues to clot, then no more blood can flow because this blood is blocked by blood clots that have become hard [11]. This blockage can expand and disrupt oxygen supply throughout the body, then the patient experiences shortness of breath and has the effect of reducing oxygen saturation [12].

Currently, there are many studies conducted to increase oxygen saturation in CHD patients. One of them is progressive muscle relaxation exercises. Relaxation techniques are proven to positively affect psychological well-being and respiratory function [13]. The results show that exercise can make molecular, microscopic, and macroscopic changes that increase each of these variables and increase oxygen delivery to the muscles that are training [14]. The purpose of this study is the effect of progressive muscle relaxation on oxygen saturation in coronary heart disease in General Hospital Ciamis Indonesia.

2. Research method

This research type is quantitative with a quasi design of the experiments *pre* and *post-test* without a control group. This study aims to determine the effectiveness of progressive muscle relaxation on oxygen saturation in patients with coronary heart disease in General Hospital Ciamis. The sampling technique was done by *consecutive sampling*, as many as 30 people with the inclusion criteria of respondents diagnosed with CHD, the patient's condition was stable, treated for at least 3 days, adult patients. Data collection using two hours after meals were measured respondent's oxygen saturation and recorded on the form, rested 15 minutes, then exercised PMR for 10 minutes. The PMR intervention is carried out twice a day, morning and evening for two consecutive days, then oxygen saturation is measured and recorded on the form.

3. Result and discussion

Table 1. Distribution of Respondents by Age at General Hospital Ciamis August - October 2018 (n = 30)

Variable	Mean	SD	Min - Max	95% CI
Age	59.43	12.539	33 - 87	54.75 - 64.12

Based on table 1, the mean age of respondents in the control group was 59.43 years (95% CI: 54.75 - 64.12), with a standard deviation of 12.539 and a minimum age of 33 years and a maximum of 87 years.

Table 2. Distribution of Respondents by Gender and history of the disease in General Hospital Ciamis August - October 2018 (n = 30)

Variable	n = 30	
	N	%
Gender		
1. Male	21	70
2. Women	9	30
History of Diabetes Mellitus (DM)		
1. No	26	86.7
2. Yes	4	13.3
History of Heart Disease in Families		
1. No	11	36.7
2. Yes	19	63.3
History of Hypertension		
Variable	n = 30	

	N	%
1. No	7	23.3
2. Yes	23	76.7
History of Cholesterol Disease		
1. No	20	66.7
2. Yes	10	33.3
Smoking History		
1. No	11	36.7
2. Yes	19	63.3
Total	30	100

From table 2 it can be seen that the proportion of respondents by sex is mostly male, as many as 21 people (70%) and women only 9 people (30%). The proportion of respondents based on the history of DM obtained the results of some of the respondents who do not have a history of DM as many as 26 people (86.7%), a family history of heart disease mostly has a history of 19 people (63.3%). History of hypertension mostly has a history of as many as 23 people (76.7%). History of good cholesterol mostly does not have a history of as many as 20 people (66.7%). The proportion of respondents who have a history of smoking are 19 people (63.3%), meaning that most of the respondents have a history of smoking habits.

Table 3. Distribution of respondents based on average oxygen saturation values Before PMR relaxation at General Hospital Ciamis August - October 2018 (n = 30)

Variable	Mean	SD	Min - Max	95% CI
Average Morning Oxygen Saturation	93.63	1.497	91 - 96	3.07 - 94.19
Average Oxygen Saturation Afternoon	96.33	1.729	92 - 99	5.08 - 96.97
Average Saturation Before an intervention	96.33	1,373	92 - 97	4.82 - 95.84

Table 3. shows the mean oxygen saturation values before relaxation. Total PMR Relaxation average of morning and evening measurements. The mean measurement of morning oxygen saturation was 93.63 (95% CI: 94.07 = -94.19) with a standard deviation of 1.497 and the maximum-minimum value was in the range of 91-96. The average measurement of afternoon oxygen saturation was 96.33 (95% CI: 95.68 - 96.97) with a standard deviation of 1.729 with a maximum-minimum value of 92 - 99. Measurement of the total mean oxygen saturation was 96.33 (95% CI: 94.82 - 95.84) with a standard deviation of 1.373 with a value of minimum-maximum 92 - 97.

Table 4. Distribution of Respondents Based on Oxygen Saturation Values After PMR Relaxation at General Hospital Ciamis August - October 2018 (n = 30)

Variable	Mean	SD	Min - Max	95% CI
Average Saturation Morning Oxygen	96.23	1.869	91 - 99	- 96.93 Average
Variable	Mean	SD	Min - Max	95% CI

Saturation Oxygen	97.2	1,494	94 - 99	'6.64 - 97.75
Average Saturation After intervention	97	1,640	93 - 99	6.38 - 97, 61

Table 4. shows the mean oxygen saturation values after PMR Relaxation at morning and evening measurements. The mean measurement of morning oxygen saturation was 96.23 (95% CI: 95.53 - 96.93) with a standard deviation of 1.869 and the maximum-minimum value was in the range of 91 - 99. The average measurement of afternoon oxygen saturation was 96.23 (95% CI: 95.49 - 96.97) with a standard deviation of 1.994 with a maximum-minimum value of 91 - 99. Measurement of the total mean oxygen saturation is 97 (95% CI: 96.38 - 97.61) with a standard deviation of 1.529 and a maximum-minimum value is in the range of 93 - 99.

Table 5. Distribution of Average Oxygen Saturation Values
Before and After Intervention in General Hospital Ciamis
August - October 2018 (n = 30)

Oxygen Saturation	Mean	SD	SE	p-*Value*	n
Before	95.33	1,373	0,251	0.000	30
After	97	1,640	0.299		

Table 5 shows the average oxygen saturation value before the intervention in the control group is 95.33 while the average oxygen saturation after the intervention is 97. The statistical test results obtained p-*value* 0.000, it can be concluded that there is a significant difference in oxygen saturation values between before and after PMR intervention.

PMR is an effective technique and is used outside to reduce stress and create deep relaxation by increasing pressure and relaxation on the muscles. PMR focuses on muscle groups, muscle stretches and muscle relaxation, which are repeated until the body feels relaxed. PMR is useful as a complement in overcoming certain physiological conditions. Muscle contraction is carried out 5-10 seconds and relaxation for about 10-20 seconds. The patient's attention is directed to being able to feel the difference between when muscles are contracted and when they are relaxed. The purpose of this relaxation exercise is to produce a response that can combat the stress response [15].

PMR is a type of relaxation that can reduce the work of parasympathetic nerves in reducing stress, contraction of blood vessels. Relaxation is a resting condition on the physical and mental aspects of humans, while the spiritual aspect is still actively working. In a state of relaxation, the whole body is in a homeostatic or balanced state, in a calm state but not asleep, and all the muscles in a relaxed state with a comfortable body position. Individuals who experience tension and anxiety who work are the sympathetic nervous system, while at the time of relaxation that works is the parasympathetic nervous system, thus relaxation can suppress tension, anxiety, oxygen saturation, and pain and blood supply to the peripheral parts of the body to increase the value oxygen saturation.

Oxygen saturation (SaO2) is the percentage of hemoglobin that binds to oxygen in the arteries, normal oxygen saturation is between 95-100% a measure of how much percentage of oxygen can be carried by hemoglobin. Normal O2 saturation is 96% to 98% according to PaO2 which is around 80 mmHg to 100 mmHg [16]. At the time of breathing, the oxygen entering the airways will undergo a process of ventilation, perfusion, and diffusion. When oxygen diffuses continuously diffuses from the air in the alveoli into the bloodstream and carbon dioxide (CO_2) continues to diffuse from the blood into the alveoli. Diffusion is the movement of molecules from areas of high concentration to areas of low concentration. The diffusion of respiratory air occurs between the alveoli and capillary membranes. The difference in pressure in the area of the respiratory membrane will affect the diffusion process. For example, the partial pressure of PO2 in the alveoli is around 100 mmHg while the partial pressure on pulmonary capillaries is 60 mmHg so that oxygen will diffuse into the blood. Unlike the case with CO2 with PCO2 in capillaries 45 mmHg whereas in alveoli 40 mmHg the CO2 will diffuse out of the alveoli.

The condition of lack of oxygen to the tissues is called hypoxia. One of the causes of hypoxia is blocked arteries, lack of *cardiac output* due to interference in the heart [16].

4. Conclusion
Fatigue scores in pregnant women can be reduced by providing progressive muscle relaxation exercises and administration of aromatherapy.

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