

## DIFFERENCE RATE PRESSURE PRODUCT (RPP) BEFORE AND AFTER PHASE II CARDIOVASCULAR REHABILITATION PROGRAM IN PATIENTS WITH CORONARY HEART DISEASE

Albertus Magnus Yubel Andro<sup>1</sup>, Dyana Sarvasti<sup>2</sup>, Nita Kurniawati<sup>3</sup>

\*Corresponding author email: [magnusalbertus19@gmail.com](mailto:magnusalbertus19@gmail.com)

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### ABSTRACT

**Background:** Coronary heart disease (CHD) is a cardiovascular disease with the highest mortality rate worldwide, representing 16% of the total deaths worldwide. Phase II cardiovascular rehabilitation programs reduce the risk of complications and death from CHD by controlling modifiable risk factors. **Objective:** To study the differences between RPP before and after participating in a phase II cardiovascular rehabilitation program in patients with CHD. **Methods:** This study used analytical observational methods, cross-sectional approaches, and total sampling techniques. Statistical analysis of the RPP using t-tests of paired samples. Statistical analysis of the RPP using a marked rank paired t-test. **Results:** There were 67 rehabilitation patients experienced an increase in their RPP value with a mean value of  $2071.01 \pm 1674.54$  or 19.61%, while 30 patients experienced a decrease in their RPP value with a value of  $2032.30 \pm 15.18.28$  or 15.85%. The results of statistical analysis on the test of the difference in the value of the increase in RPP before and after the program showed a value of  $p = 0.00$  ( $p < 0.05$ ), as well as the difference in the value of the decrease in RPP before and after the cardiovascular rehabilitation program ( $p = 0.00$  ( $p < 0.05$ )) while statistical analysis of the difference test in total RPP values before and after the phase II cardiovascular rehabilitation program showed significant results ( $p = 0.019$  ( $p < 0.05$ )). **Conclusion:** There were differences in the RPP before and after participating in the phase II cardiovascular rehabilitation program in patients with CHD. The target of the phase II cardiovascular rehabilitation program has still not been achieved because it is still dominated by the increase in RPP values after the phase II cardiovascular rehabilitation program.

**Keywords:** Rate Pressure Product; Phase II cardiovascular rehabilitation program; Coronary heart disease

1 Faculty of Medicine, Widya Mandala Catholic University, Surabaya

2 Department of Internal Medicine, Faculty of Medicine, Widya Mandala Catholic University Surabaya

3 Department of Pediatric, Faculty of Medicine, Widya Mandala Catholic University Surabaya

## INTRODUCTION

Coronary heart disease (CHD) is a disruption of blood flow due to plaque growth or calcification processes in the coronary blood vessels. Coronary heart disease causes death and disability in many developing countries.<sup>1</sup> According to research, there are 9.4 million deaths due to cardiovascular disease, and 45% of these deaths are caused by coronary heart disease. This figure is expected to increase to 23.3 million in 2030.<sup>2</sup> Based on Basic Health Research (Riskesdas) data in 2013, the prevalence of coronary heart disease in Indonesia was 0.5% or reached 883,447 people.<sup>2</sup> The prevalence of coronary heart disease is highest at the age of 25-34 years, followed by the age group 15-24 years. Coronary heart disease has appeared in the young age group at 0.7% and the prevalence increases at ages 45-54 years and above, highest at ages 65-74 years at 3.6%, above age 75 years it decreases slightly to 3.2%.<sup>2</sup>

The cardiovascular rehabilitation (CR) program is a multiphase intervention designed to optimize the physical, psychological, and social functioning of patients with heart disease, in addition to stabilizing, slowing, or even stopping the progression of the atherosclerosis process so as to reduce morbidity and mortality.<sup>3</sup> Actions carried out in the cardiovascular rehabilitation program; first, assess the patient's condition and medical history; both education and counseling in order to increase knowledge and patient awareness so that through their own efforts they are able to avoid risk factors able to overcome risk factors so that the disease process or atherosclerosis process can be stopped or inhibited, as well as anxiety; third, efforts to control risk factors, involving education, lifestyle modification towards healthy living and necessary treatment; fourth, physical exercise programs and physical

activity counseling, especially in efforts to improve healthy lifestyles, fitness levels, quality of life and control of risk factors.<sup>4</sup>

6-minute walk test (6 MWT) is a test to measure the distance a patient can walk for 6 min on a flat surface.<sup>5</sup> This test evaluates several systems globally, such as the pulmonary, cardiovascular, circulatory, neuromuscular, and muscle system.<sup>6</sup> The 6-minute walk test is highly recommended because it is easy to use, simple, cheap, and requires minimal equipment. Rate pressure product (RPP) is the product of heart rate in units of times/minute and systolic blood pressure (TDS) in units of mmHg, and is often used to estimate the need for oxygen in the heart. Normal RPP values vary depending on age, sex, physical condition, and medication use. In general, the normal RPP value for adults aged 20-60 years is between 7,000-11,000 mmHg per second ( $\text{mmHg} \times \text{beats/minute}$ ). Normal RPP values may vary in people who are older or have cardiovascular diseases or other medical conditions. The 6MWT determines the maximum stride distance for a cardiovascular rehabilitation program. The walking test will serve as a guide for training sessions in cardiovascular rehabilitation programs. By measuring the RPP value, we can determine the oxygenation capacity of the myocardium and whether exercise cardiovascular rehabilitation programs have been effective in improving myocardial perfusion in coronary heart disease. By knowing the RPP value based on 6 MWT in patients participating in a cardiovascular rehabilitation program, it is hoped that it can help evaluate therapy and improve the quality of life of patients with coronary heart disease. Therefore, this research will focus on RPP value data based on 6MWT before and after the Cardiovascular rehabilitation program and changes in RPP values.

## METHODS

The research design used observational analytical methods with a cross-sectional research design based on medical records and was carried out on patients with coronary heart disease who underwent a phase II cardiovascular rehabilitation program. The population in this study comprised secondary data from all patients with coronary heart disease who participated in the phase II cardiovascular rehabilitation program at the Husada Utama Hospital in Surabaya between 2012 and 2019 and the Dharmahusada Premier Clinic in Surabaya for the period 2022-2023. This study was conducted using historical/secondary data collection methods in the form of medical records of patients participating in the cardiovascular rehabilitation program at Husada Utama Hospital and Dharmahusada Premier Clinic, Surabaya. The systolic blood pressure and heart rate of CHD patients were measured after carrying out a 6-minute walk test, which was carried out before and after the rehabilitation program. The product of the patient's systolic blood pressure (mmHg) and heart rate (beats/min) was the patient's RPP value. The RPP values were compared with the RPP values before and after the phase II cardiovascular rehabilitation program, where the RPP values were obtained after a 6 minute walking test.

## RESULTS

**Table 1.** Patient characteristics by gender

Gender	Frequency (n)	Percentage (%)
Female	11	13,92
Male	78	86,08
<b>Total</b>	<b>89</b>	<b>100</b>

Table 1 shows that of the 89 research respondents, the highest frequency was in men.

**Table 2.** Patient characteristics by age

Age Interval	Frequency (n)	Percentage (%)
31-40	2	2,24
41-50	15	16,85
51-60	35	40,44
61-70	31	34,83
71-80	6	6,74
<b>Total</b>	<b>89</b>	<b>100</b>

Table 2 shows that the age of patients with heart disease who participated in a cardiovascular rehabilitation program was most often in the age range of 51-60 years and the least was in the age range of 31-40 years.

**Table 3.** Table of risk factor characteristics

Risk factors	Frequency (n)	Percentage (%)
Dyslipidemia	45	17,11
Hypertension	44	16,73
Diabetes Mellitus	40	15,21
Smoking	34	12,93
Stress	28	10,65
Lack of exercise	26	9,89
Family history	23	8,75
Obesity	21	7,98
Stroke	1	0,38
Menopause	1	0,38

Table 3 shows that patients who participated in the cardiovascular rehabilitation program had the highest risk factor, namely dyslipidemia (16.6 %), followed by the risk factor for hypertension (16.2 %). Meanwhile, the least risk factors were stroke risk factors (0.39).

**Table 4.** Table of characteristics of research subjects based on actions

Action type	Frequency (n)	Percentage (%)
CHD without action	3	3,37%
CHD post PCI	41	47,19%
CHD post CABG	37	41,57%
CHD post PCI and CABG	8	8,99%

Total	89	100,00
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From the results of data collection in the field. It was found that patients who took part in the phase II cardiovascular rehabilitation program had the most diagnoses of CHD Post PCI, namely 41 people, while the least number of patients had a diagnosis of CHD without action, namely three people.

**Table 5.** The difference in average RPP before and after the cardiovascular rehabilitation program based on the increase and decrease in the RPP value

RPP	Frequency (n)	Before CR Program (mmHg. beat/minute) mean $\pm$ SD	After CR Program (mmHg. beat/minute) mean $\pm$ SD	Difference in RPP mmHg. beat/minute (%) mean $\pm$ SD
Increase	57	11071.61 $\pm$ 1859.28	13142.63 $\pm$ 2325.79	1505.04 $\pm$ 891.32 (19,61%)
Stand still	2	10060 $\pm$ 1329.36	10060 $\pm$ 1329.36	0 (0%)
Decrease	30	12919.97 $\pm$ 2434.38	10887.67 $\pm$ 2681.1	-2032.3 $\pm$ 1544.24 (15,85%)

From Table 5, it can be seen that there were 57 cardiovascular rehabilitation patients who experienced an average increase in RPP of 19.67%, 30 cardiovascular rehabilitation patients who experienced an average decrease in RPP of 15.85%, and two patients who did not experience a change in value at all.

**Table 6.** Mean RPP values before and after the program

RPP	Mean $\pm$ SD (mmHg. beat/minute)	Significancy (p)
Before CR Program	11671 $\pm$ 2235	p = 0,019 p < 0,05
After CR Program	12313 $\pm$ 2661	
Mean difference	642 $\pm$ 26	

Table 6 shows that the results of the paired t-test analysis were significant (p = 0.019), indicating that there was a difference in the RPP value before and after the cardiovascular rehabilitation program.

## DISCUSSION

The average RPP value before the phase II cardiovascular program was 11.671 mmHg $\times$ min, and after session 11, it was 12.313 mmHg $\times$ min. This showed that there was a significant change in the oxygenation capacity of the heart muscles. The researchers concluded that there was a significant improvement in patients who participated in the cardiovascular rehabilitation program. Cardiovascular rehabilitation programs contribute to the reduction of blood pressure in patients with coronary heart disease. Cardiovascular rehabilitation programs contribute to the reduction of blood pressure in patients with coronary heart disease. A decrease in blood pressure can occur because the blood vessels widen and relax<sup>7</sup>. In addition, a decrease in blood pressure can cause an increase in heart rate and heart contractility through a decrease in vagus nerve activity<sup>8</sup>. During cardiovascular rehabilitation, adjustments made by the cardiovascular system will ensure that skeletal muscles that are actively exercising can receive the amount of blood flow appropriate to their metabolic needs, as well as maintain adequate blood flow to the brain and heart<sup>9</sup>. This is in accordance with Anggraini (2012), who reported that regular physical exercise results in a decrease in blood pressure and persists as long as physical exercise continues. A supporting statement was also conveyed by Harnia (2014), who stated that blood pressure before and after regular physical exercise intervention was significantly different. Therefore, regular physical exercise has been shown to reduce blood pressure in the elderly. From the results of data collection, it was discovered that 66.29% of the participants experienced an increase in heart rate after the phase II cardiovascular rehabilitation program. This is because the heart repair process is still occurring and there is an

increased need for blood to transport O<sub>2</sub> to active parts of the body, CO<sub>2</sub> buildup, increased body temperature, lactic acid build-up, and reduced O<sub>2</sub>. Researchers believe that the 6-minute walk test can help determine the oxygenation capacity of the heart muscle, which is considered to be able to see the patient's blood pressure and heart rate significantly. The change in the RPP value in this study was still not significant; the researchers believe that this occurred because patients in the phase II cardiovascular rehabilitation program did not attend sessions regularly, and the post-cardiovascular intervention process was still affected up to 6 months later, making the heart itself have a mechanism for remodeling and repairing the heart muscle during the cardiovascular rehabilitation program did not cause a significant reduction in RPP values.

## CONCLUSION

The results of this study indicate a significant difference in the rate pressure product before and after the cardiovascular rehabilitation program in patients with coronary heart disease. This indicates the effectiveness of the program in influencing the patient's cardiovascular function.

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