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The Effects of Physical Exercise Intensity Towards Heart Rate Deflection Point

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Abstract--- *This study aimed to analyze the effect of physical exercise with various types of exercise intensity on heart rate deflection points. The point of heart rate deflection is the meeting between the number of minute heartbeats, with the number of lactic acid levels of 4 mmol / L. Lactic acid level of 4 mmol / L is a point of fatigue felt by someone during physical activity. This type of research is a quasi-experimental with a population of UNP FIK Sport Coaching Department students. The sample involved 30 students of UNP FIK Sport Coaching enrolled in 2016/2017. The treatment is in the form of physical exercise with the ergo cycle at the specified intensity (70% - 75%, 80% -85% and 90% -95%). To monitor the intensity of exercise using the pulse meter (pulsoximeter-beurer). The instrument measures lactic acid levels using the lactate analyzer The Accutrend Plus brand. Data analysis using t test at a α 0.05 significance level. The results of the study show that; 1. The intensity of 70% -75% does not affect the shift of the deflection point ρ > α = 0.05, 2. The intensity of 80% -85% affects the shifting of the deflection point (ρ < α = 0.05), 3. Intensity 90% -95% has an effect towards shifting the deflection point (ρ < α = 0.05), with the conclusion that physical exercise with an intensity above 80% can cause a shift in the heart rate deflection point.*

Keywords--- *Exercise Intensity, Deplection Point, Heart Rate.*

I. BACKGROUND OF STUDY

The excellent physical quality is one of the main conditions that must be possessed by an athlete if you want to achieve maximum performance. Among these excellent physical qualities is anaerobic endurance. Anaerobic endurance is the ability of the human body to carry out high-intensity physical activities for a relatively long time without experiencing significant fatigue, both when exercising or when competition can be maximized.

Fatigue felt by someone, one of which is caused by the accumulation of lactic acid both in the muscles and in the blood. The high and low lactic acid levels are directly proportional to the number of minute heartbeats. This means that if the lactic acid level is high, the number of minute heart rates is also high. High and low levels of lactic acid and the number of minute heart rates are influenced by work intensity or intensity of exercise. Because the intensity of the exercise gives direct stress to the number of minute heartbeats and lactic acid levels, this is related to the supply of energy needed quickly in high intensity anaerobic exercise.

The number of minute heartbeats, when associated with the amount of blood lactic acid levels and both analyzed in a graph, the meeting of the number of heart rate per minute with the amount of blood lactic acid level is called the deflection point1. This deflection point of the heart rate is a meeting between the blood lactic acid level of 4 mmol / L and the number of minute heartbeats.

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The number of lactic acid blood levels of 4 mmol / L is a fatigue point felt by a person during physical activity. This fatigue point is also called the anaerobic threshold

Based on the description above it can be concluded that; the higher the number of heartbeats per minute, the higher the level of the lactic acid in the muscles and blood. However, using the right intensity of exercise will have an effect on increasing the number of minute heartbeats, but not followed by rapid accumulation of lactic acid.

This means that there is a shift in the deflection point from a heart rate of 130 beats per minute with lactic acid level of 4 mmol / L, to a number of heartbeats of 160 beats per minute with lactic acid level of 4 mmol / L. In other words, the tolerance of the active muscle to lactic acid levels is higher. This is very beneficial for an athlete in the effort of energy efficiency when participating in a match. Because after all, one of the causes of fatigue felt by someone during physical activity is the accumulation of lactic acid in the muscle.

The heart rate deflection point can also be used as a parameter to determine the predominance of the energy system used during physical activity. Blood lactic acid levels below 4 mmol / L, the energy system is still aerobic dominant. Whereas if the blood lactic acid level has reached 4 mmol / L and above, the dominant energy system is anaerobic. For more details, see the figure below.

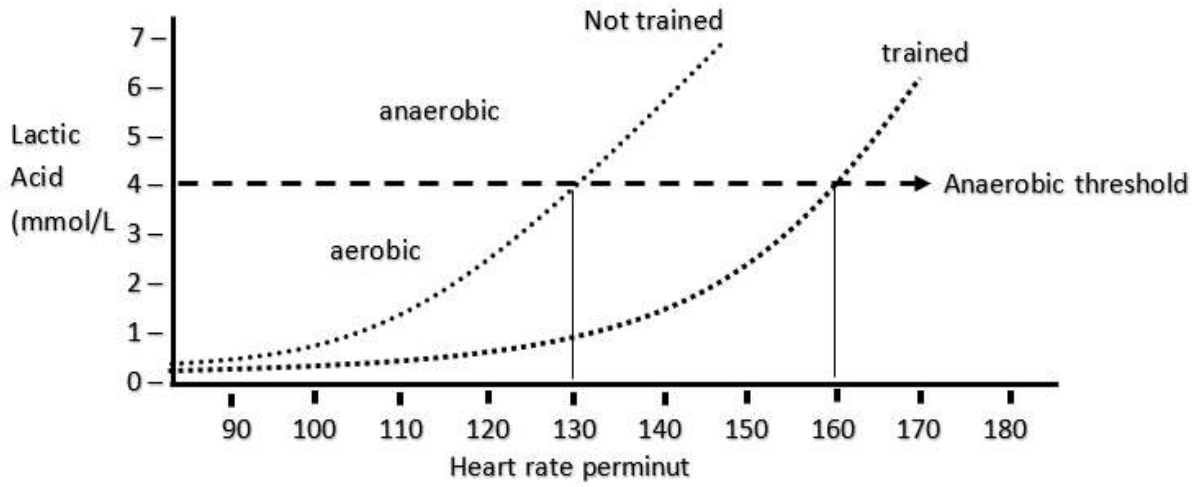

Figure 1: Deflection Point between Lactic Acid Level and Heart Rate

The Conconi test is a field test used to assess HRDP, and is used as a non-invasive method to see anaerobic threshold values. Next; HRDP (Heart Deflection Point) can be used for the purpose of setting an exercise program. Clinically, it can be entered to set parameters for the intensity of exercise for cardiac rehabilitation5. Based on some of the quotes above, it can be explained that, the deflection point of the heart rate can be used as a reference in physical exercise, so that physical exercise can be achieved optimally in accordance with the goals previously set.

Heart rate or also called pulse is the frequency of the heart to contract to pump blood throughout the body. Umar3 said that; Heart rate can be felt in several places such as; in the radial pulse, carotid pulse in the neck and

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forehead left and right3. The perceived pulses are counted in units of pulses per minute. Heart rate is the amount of heart rate that is measured by the number of heart contractions per minute (bpm)4. Usually in measurements the number of heartbeats is calculated in minutes per unit.

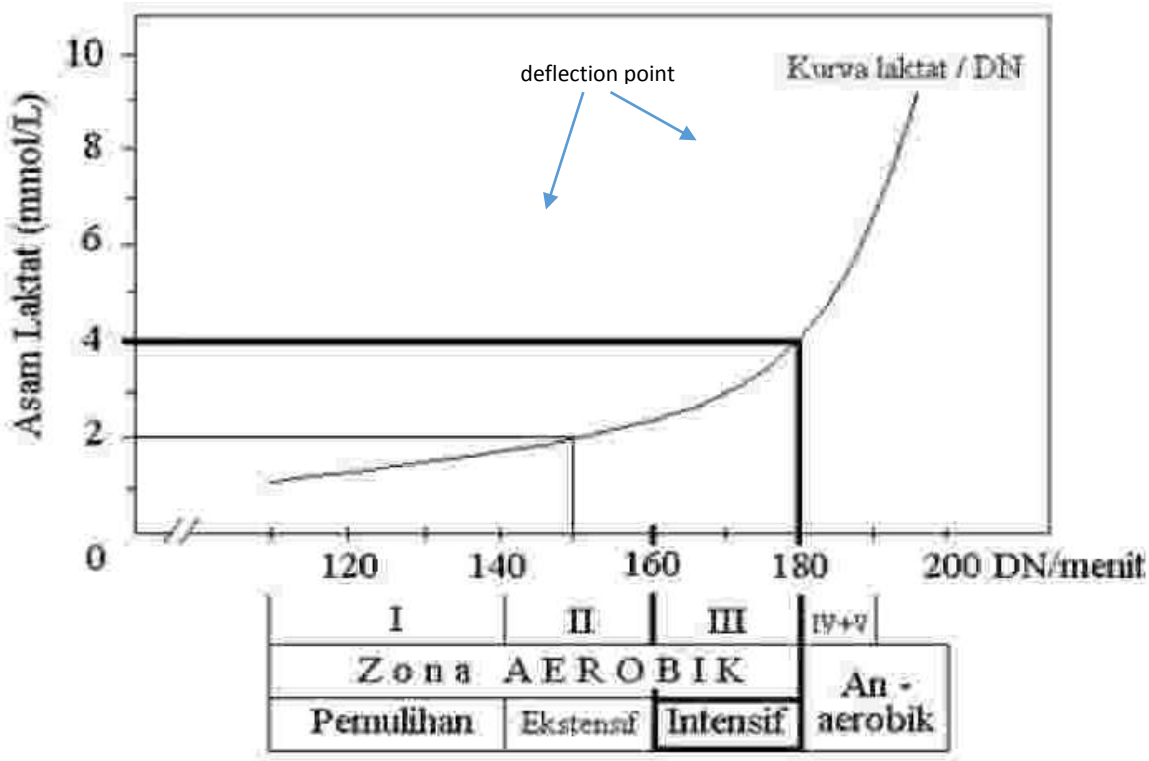

Figure 2: Deflection Point between Lactic Acid Level and Heart Rate

Heart rate can be used to monitor a person's physical condition, whether a person is healthy or not, fresh or not, and in sports activities can be used to monitor the intensity of the exercise performed. Because heart rate is directly related to the workload carried out. Umar3 said that; heart rate can be used as a parameter to determine the level; 1) The level of one's health, 2) The level of one's physical fitness, 3) The intensity of the exercise3.

Basically, there are three stages in the increase in heart rate to the intensity of the exercise performed. These include: 1) Low-intensity exercise increases the heart rate by 40% to 50% of the maximum heart rate, 2) Moderate-intensity exercise increases the heart rate by 50% to 70% from the maximum heart rate, and 3) High-intensity exercise increases the heart rate to 70% to 80% of the maximum heart rate5.

Anaerobic threshold is defined as the level at which the intensity of exercise results in lactic acid accumulating in the bloodstream faster than the time to remove it from the bloodstream6. Physical exercise is physical activity in working on an activity in an effort to improve or maintain physical conditions to stay excellent. Physical exercise is an activity carried out by someone to improve or maintain body fitness. Physical exercise is generally grouped into several categories, depending on the effect it has on the human body7.

The application of training load (intensity) in each athlete must be adjusted to the abilities of each athlete. Because among these athletes there are different physical abilities. Another principle that must be exercised is an

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increase in loading (overload). According to Tudor O. Bompa8, that; "Increasing the training load must be increased gradually and with periodic variations based on each athlete's physical capacity, psychological abilities and workload tolerance"9.

In other words it can be concluded that; so that the exercise effect can occur, the training load must be increased, if the training load is not increased in the next training sessions, there will be no new adaptation of the body, meaning that there will be no increase in physical abilities.

Intensity Exercise is also called training load, which is the lightness of the physical workload when doing physical activities such as exercise, namely during training and when competing in a championship.

The light weight of a physical workload is directly proportional to the minute heart rate frequency, as well as the amount of lactic acid accumulation in both the active muscle and the blood. This is related to the process of energy metabolism. The heavier and longer the physical activity is carried out, the more the number of heartbeats increases.

Intensity is the amount of work and activities performed each repetition. Simply put, it's just the amount of weight the exercise does. Intensity is often defined as the percentage of one maximum repetition (the maximum weight you can lift for one repetition) for the exercise10.

Table 1: Prediction of the Distribution of Energy Consumption at Various Levels of Exercise Intensity for the Age of 20 Years and have Good Health with Maximum Heart Rate

Intensity (MHR)	Heart Rate (bpm)	% Carbohydrate	% Fat
65% - 70%	130 - 140	15%	85%
70% - 75%	140 - 150	35%	65%
75% - 80%	150 - 160	65%	35%
80% - 85%	160 - 170	80%	20%
85% - 90%	170 - 180	90%	10%
90% - 95%	180 - 190	95%	5%
100%	190 - 200	100%	0%

II. METHODOLOGY

This research is a quasi-experimental study to see how influence of physical exercise intensity towards heart deflection points, held in a laboratory owned by the Faculty of Sports Science, Padang State University. The study population was FIK students from Padang State University, Sports Coaching Education study program. While the sample of male students of the Sports Coaching Study Program class of 2016-2017 is 30 people. For each group consisted of 10 sample people.

The research process was conducted in 2 (two) main stages, namely measurement of blood lactic acid levels, measurement of exercise heart rate, and physical exercise in the sample with 3 types of exercise intensity as a treatment. This physical exercise is done with pre-test 3 times a week, so that the total physical exercise reaches 16 times.

The instrument used to measure blood lactic acid levels is the Accutrend Plus brand blood lactic acid analyzer. Measurements are taken immediately after doing physical activity.

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Figure 4: Lactic Acid Analizer, the Accutrend Plus

While the instrument for measuring heart rate exercises is using the Heart Rate monitor, (pulsoximeter-beurer).

Figure 5: The Heart Rate Instrument (Pulsoximeter-Beurer)

Analysis of research data using the t test at a significance level of α 0.05.

III. FINDINGS

1. The intensity of physical exercise 70% -75% of the maximum pulse turns out not to have a significant effect on shifting the heart rate deflection point, this is based on the results of data analysis obtained $\rho = 0.193 > \alpha = 0.05$;

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Table 2: Results of Data Analysis on the Intensity of Physical Exercise Groups 70% -75%

PAIRED SAMPLES TEST									
		Paired Difference					t	df	Sig.(2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	LA Pretest G-3 LA Posttest G-3	0.00300	0.00675	0.00213	-0.00183	0.00783	1.406	9	0.193

2. The intensity of physical exercise 80% -85% of the maximum pulse has a significant effect on shifting the heart rate deflection point, this is based on the results of data analysis obtained $\rho = 0.000 < \alpha = 0.05$;

Table 3: Results of Data Analysis on the Intensity of Physical Exercise Groups 80% -85%

PAIRED SAMPLES TEST									
		Paired Difference					t	df	Sig.(2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	LA Pretest G-3 LA Posttest G-3	1.01500	0.10596	0.03351	0.93920	1.09080	30.291	9	0.000

3. The intensity of physical exercise 90% -95% of the maximum pulse turns out not to have a significant effect on shifting the heart rate deflection point, this is based on the results of data analysis obtained $\rho = 0.000 < \alpha = 0.05$;

Table 4: Results of Data Analysis on Group Intensity of Physical Exercise Group 90% -95%

PAIRED SAMPLES TEST									
		Paired Difference					t	df	Sig.(2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	LA Pretest G-3 LA Posttest G-3	0.66600	0.36846	0.11652	0.40242	0.92958	5.716	9	0.000

IV. DISCUSSION

Physical exercise with an intensity of 70% -75% does not have an effect on shifting the deflection point, this is due to the intensity of the physical exercise used is still low or the energy system used is still in the aerobic system, so the accumulation of lactic acid does not occur significantly, and the frequency the pulse rate is also still low.

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Whereas physical exercise with an intensity of 80% -85% has influenced the shifting of the heart pulse deflection point, this is due to the intensity of the exercise used has been predominantly anaerobic energy system, resulting in accumulation of lactic acid, and minute heart rate is also high causing an adaptation to the cardiovascular system and muscle tolerance to lactic acid also increases.

Likewise with the intensity of physical exercise 90% -95% can cause a shift in the heart rate deflection point, because with maximum intensity it will obviously increase the accumulation of lactic acid and minute pulse, so that adaptations gradually occur at the shift of the deflection point.

V. CONCLUSION

With the conclusion that physical exercise with an intensity above 80% can cause a shift in the heart rate deflection point. so it is necessary to pay attention to what percentage of the target intensity is needed in a physical exercise, in order to achieve the desired results.

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