



## **Aerobic And Anaerobic Capacity Analysis Of Rowing Rowers Using Wattbike And Rowing Ergometer Concept II**

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### **ABSTRACT**

*The purpose of this study was to determine "whether there is a comparison of aerobic and anaerobic capacities using a stationary and rowing bicycle ergometer". The research method used is a descriptive method with a purposive sampling technique, namely 10 athletes rowing training athletes in the city of Bandung, with the criteria for determining the sample are rowing athletes of the female gender. The research instruments used were a modified Wingate rowing ergometer test (WanTr) performed on a Concept II rowing machine (Vermont, USA) and a 30-second "all-out" WAnTr test on a cycling ergometer to determine the athlete's anaerobic capacity. This finding is following the assumptions formulated, namely that there are differences in the results of aerobic and anaerobic tests using an ergometer rowing machine and a Wingate test (watt bike). shows the results of the independent samples test output between the aerobic ergo rowing and the aerobic Wingate test, it is known that the t value is 0.171 and the Sig. (2-tailed) value is 0.888 which is greater than 0.05. it can be concluded that there is a comparison of aerobic and anaerobic capacity using the rowing ergometer and Wingate test*

**Keywords:** Aerobic; Anaerobic; Rowing.

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### **INTRODUCTION**

Human energy capacity is divided into two main parts, namely aerobic and anaerobic, according to the nature of the biochemical processes that produce energy that takes place in cells. The characteristics of physical activity depend on the volume and rate of energy release required for physical activity and differ significantly in different forms and forms of activity. The volume of energy capacity and the level of utilization differ significantly between individuals. This is very important to achieve the best sports results, especially rowing. Energy capacity can be measured accurately in many ways. In efforts to prepare good physical conditions for regional athletes, it is hoped that seeds will emerge who will later be able to take part in national training (Pelatnas). This exercise consisted of the best rowing athletes in Indonesia from all over. This training is held to improve the

quality of athletes who will compete in an event with a measurable training program. In training, everything will be controlled, starting from nutritional status, physical condition status and even mental condition. After doing a relatively long training, the coaches will measure the readiness of their athletes by holding a Try In or Try Out. From there, the strengths or weaknesses of each athlete will be seen, so it will be useful for the coach to determine the tactics or strategies that will be used in the actual match.

Rowing is a sport that requires aerobic and anaerobic endurance, (Ozgun et al., 2011) Hartmann (1987); Droghetti et al., (1991) reported that 2000-mt performance occurred 65-75% percent aerobic and 25-35% percent anaerobic, from the above opinion aerobics is the main energy source used by rowing athletes but does not rule out anaerobic because anaerobic also plays an important role in rowing. The training program will be more effective when the coach knows the goals of the athlete's ability. to improve the quality of national athletes, we must also improve the quality of regional athletes, therefore to improve the quality of regional athletes the coach must know the quality standards of national athletes so that regional coach programs aimed at regional athletes have the quality of national athletes.

According to Nurjaya (2002, p. 8), which explains that: "The characteristics of rowing rowers are high aerobic and anaerobic abilities, good coordination, long concentration, height, size, long legs, arms and body, and resistance to fatigue and stress". Thus it can be said that to do rowing at this rowing number requires several characteristics such as physical abilities which include high aerobic and anaerobic abilities, good coordination, and long concentration, and physical biometric conditions which include height and weight, and length. arm. In rowing, Jonath and Krempel in Harsono (2001, p. 6) explain that the dominant physical condition components that must be trained properly in rowing are: aerobic capacity endurance and anaerobic capacity and then supported by muscular strength partially Other minor factors are speed, coordination and flexibility.

At this time there is no standardization of the anaerobic ability of rowing athletes in Indonesia's rowing numbers, therefore the purpose of this study is to standardize the anaerobic ability of rowing women nationally. Based on this explanation, the researcher is interested in conducting a study entitled "Comparison of anaerobic capacity using a stationary and rowing bicycle ergometer".

Existing research has described rowers as athletes with a well-developed cardiovascular system (aerobic strength) and high levels of strength. Researchers have estimated that the contribution of the anaerobic energy system to rowing ranges between

14 and 23% during simulated race conditions but few studies have evaluated the anaerobic performance of rowers. The contribution of anaerobic power output is greatest during the start and drive to the finish during a rowing race. (Bell et al., 1989)

The purpose of this study was to determine the effect of high-speed and low-speed hydraulic resistance training on anaerobic power output, peak blood lactate and peak torque of knee extensors and flexors. The relationship between measures of isokinetic strength and the anaerobic strength of the rower was also investigated.

## METHOD

This research is quantitative and descriptive. Descriptive research does not intend to test certain hypotheses but describes what it is about variables, symptoms or a situation. The descriptive method according to Gay at all (2006, hlm.175) "Descriptive research, or survey research, determines and describes the way things are. It involves collecting data to test hypotheses or to answer questions about people's opinions on some topic or issue". Based on this explanation, descriptive understanding is research that aims to describe an event at present that appears in a situation. The data obtained were collected, compiled, explained and then analyzed to establish conclusions. This is to obtain a clear picture so that the objectives of this study are achieved as expected by using data collection techniques in the form of tests and measurements.

This research was conducted at the centre for training and rowing training for the Bandung City Training Center, FPOK Padasuka Campus, Bandung City, West Java. And GOWLAB, South Jakarta. Research time is the time used to perform tests and measurements. This research was conducted on 15 May – 15 June 2022.

In compiling to analyzing the data to get a picture as expected, a data source is needed. In general, the source of data in research is called the population and research sample. According to Fraenkel et al., (2012, p.92) "Population is the group to which the researcher would like the results of a study to be generalizable it includes all individuals with certain specified characteristics". When translated briefly population is a group where researchers want the results of their research to represent the individuals in it. In this study, the population used were all athletes from the Bandung City Paddle Plateau as many as 10 people. In this study, the population used were all athletes from the Bandung City Paddle Plateau as many as 10 people. In determining the sample, all members of the population can be used and can also use part of the population. Sugiyono (2015, p. 118) explains that:

"The sample is part of the number and characteristics possessed by the population". This research uses a purposive sampling technique. So from the number of samples used in this study, 6 of the rowing athletes in the city of Bandung, with the criteria for determining the sample are rowing athletes with rowing numbers, male gender, age 20-25 years, achievements that have been achieved, and educational background.

Instruments are needed to get the data needed for research. Sugiyono (2016, p.222) reveals that "the quality of research instruments is related to the validity and reliability of the instrument and the quality of data collection regarding the accuracy of the methods used to collect data". Meanwhile, Nurhasanah (2007, p. 3) explains that a "test is a measuring tool used to obtain objective data to be measured, while the measurement is a process to obtain data". From this explanation, the research instrument is a data measuring instrument to obtain data from the problem being studied, the results of the data processing are then used as a conclusion from the research and can answer the existing problems. The instruments used in this research are.

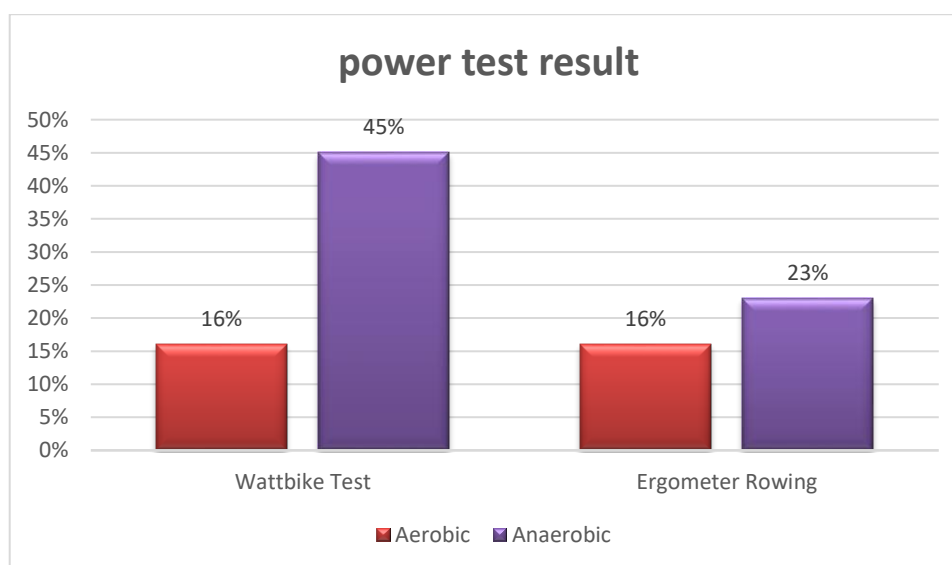
The modified Wingate rowing ergometer test (WanTr) was performed on a Concept II rowing engine (Vermont, USA). The faster the subject spins the wheel, the more resistance it produces. The Want r test was carried out for 30 seconds and the results were processed in the device software system. Average contraction strength was measured by finding the average value of individual contractions in every 5-second interval. Six values were obtained in 30-second intervals. The subjects already knew how to do the test and before the main test they had carried out a pilot test on the paddle ergometer. The pilot test lasted 10 minutes and, as in previous tests on the cycle ergometer, the aim was to warm up the subject and familiarize the subject with the test procedure. The test started with the sound signal, after which the subjects performed their first contraction. After the first contraction, the subject "paddled" using ergo rowing for 60 seconds with maximum power to determine the sample's anaerobic capacity, then after a break, the sample did "rowing" using ergo rowing again with a distance of 6000 meters to determine the sample's aerobic capacity. The movement on a rowing ergometer is most similar to that made in a rowboat by a rower during a race.

The Want is a 30-second "all-out" test on a cycling ergometer to determine an athlete's anaerobic capacity. The load is recorded directly via a computer module, set to measure the number of flywheel revolutions of the ergometer cycle. Software support provides data storage and analysis. This method allows direct monitoring of the parameters of anaerobic capacity, maximum power (Peak Power, Peak Power/weight), medium

power (Mean Power /weight) and fatigue index. Subjects are familiar with how to do the test. Before the test, all subjects performed a warm-up procedure which lasted 10 minutes. The purpose of heating is to achieve adaptation of physiological parameters to a higher level, which gives maximum test results. The test started with an audio signal from the computer, after which the subject pedalled at maximum speed for 30 seconds to determine the anaerobic capacity, and after a break continued to do a wattbike pedalling test for 3 minutes to determine the sample's aerobic capacity. The instrument refers to the theory written on the <http://support.wattbike.com> page (accessed April 5, 2022).

## RESULTS AND DISCUSSION

The results are intended to measure aerobic and anaerobic abilities with the same sample. After the test data is collected, it will then be processed with the SPSS version 16 data processing application. The results of the calculation of the collected data can be seen in table y as follows.



**Image 1.**

The results of aerobic and anaerobic tests with an ergometer rowing machine and a wattbike test using units of watts, if presented in the form of a diagram.

Next, do a descriptive statistics test to find out the average value and standard deviation of the research data which will then be processed to find out the answers to the hypotheses that have been previously proposed. The results of the descriptive statistics test can be seen in the Table as follows.

**Table 1**  
 Results of the Mean Value and Standard Deviation

Class		N	Mean	Std. Deviation	Std. Error Mean
aerobic	ergometer rowing	6	281.67	18.960	7.740
	wingate test	6	280.00	14.533	5.933
anaerobic	ergometer rowing	6	416.67	27.746	11.327
	wingate test	6	812.00	98.689	40.290

Based on table 1 above, from the data obtained in conducting the aerobic test, it can be seen that the average value of the rowing ergometer is 281.67 with a standard deviation of 18.960, for the post-test average value of the wingate test is 280.00 with a standard deviation of 14,533. While the average value data obtained from the anaerobic test, the average value of the rowing ergometer is 416.67 with a standard deviation of 27.746, and the average value of the wingate test is 812.00 with a standard deviation of 98.689.

### Normality test

The normality test is used to determine whether the data is normally distributed or not. To get the results of the normality test, it is necessary to calculate the normality test. This study will use nonparametric statistical calculations. According to Sugiyono (2010, p. 104) that "Nonparametric statistics are used to test descriptive hypotheses of one sample, both in the form of nominal data and ordinal data". According to Nurhasan et al (2008, p. 1999) that: "The decision-making method for the normality test is if the significance > 0.05 then the data is normally distributed and if the significance < 0.05 then the data is not normally distributed.". This calculation will use the One Sample Kolmogorov-Smirnov Test method, which is to test the normality of the data for each variable with the help of SPSS 16 software. The results of the calculation of the data normality test are as follows:

**Table 2.**  
 Normality Test

Class		Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
aerobic	ergometer rowing	.195	6	.200*	.915	6	.467
	wingate test	.301	6	.095	.771	6	.032
anaerobic	ergometer rowing	.325	6	.046	.844	6	.141
	wingate test	.187	6	.200*	.945	6	.699

Based on table 2. the normality test with the Kolmogorov-Smirnov approach shows that the sig. The aerobic test using a rowing ergometer is 0.200, and the aerobic test using a wingate is 0.095. And the anaerobic test uses a rowing ergometer of 0.046, and the anaerobic test uses a wingate of 0.200. While the normality test with the Shapiro-Wilk approach shows that the value of sig. The aerobic test using a rowing ergometer is 0.467,

and the aerobic test using a wingate is 0.032. And the anaerobic test using the rowing ergometer is 0.141, and the anaerobic test using the wingate is 0.699. Then all data variables are normally distributed because the sig value of each variable shows greater than the alpha value, which is 0.05.

### Validity Test

In finding the results of the research conducted, whether the research is feasible or not to be used, one must pass a calculation process using several statistical formulas, such as the explanation of Fraenkel et al (2012 p.147) "Validity refers to the appropriateness, meaningfulness, correctness, and usefulness of the inferences a researcher makes". This means that an instrument is said to be valid if it can measure what is desired and provide measurement results that are following the purpose of the measurement.

**Tabel 3**  
 Test Instrument Validity Criteria

r Value	Interpretation
0,81 – 1,00	Very high
0,61 – 0,80	High
0,41 – 0,60	Enough
0,21 – 0,40	Low
0,00 – 0,20	Very low

After the validity coefficient score of each test item is obtained, then the results are compared with the r value from the table at a significance level of 5%, assuming if  $r_{count} > r_{table}$ , the test item validity coefficient at the significance level can be used. The results of the instrument validity test can be seen in the following table.

**Table 4**  
 Validity Test

	N	Pearson Correlation	Sig. (2-tailed)	Information	Criteria
aerobic (ergometer rowing)	6	.598	.210	Invalid	Enough
anaerobic (ergometer rowing)	6	.959	.002	Valid	Very High
aerobic (wingate test)	6	.727	.101	Invalid	High
anerobic (wingate test)	6	.979	.001	Valid	Very High
Valid N (listwise)	6				

By taking a significance approach, that is, if r - count is greater than r - table with a significance level of = 0.05 and N = 6 is 0.811. The results of the anaerobic test with the rowing ergometer and wingate test meet the requirements for submission, namely the r-count value is greater than the r-table value, so it can be concluded that it is valid. Meanwhile, the results of the aerobic test using the rowing ergometer and wingate test did

not meet the submission requirements, namely, the r-count value is smaller than the r-table value, so it can be concluded that it is invalid. After the results of data processing are obtained, the next step is to analyze and interpret according to the results of the study.

### Reliability Test

After looking for the validity results, the next step the writer has to do is look for the reliability of the instrument that has been tested, so that the instrument can produce reliable data, it must have good reliability. Fraenkel et, al (2012 p.154) “reliability refers to the consistency of the scores obtained-how consistent they are for each individual from on administration of an instrument to another and from one set of items to other”. Calculation of instrument reliability coefficient using SPSS 16 program with alpha model.

**Table 5**  
Reliability Value

Score	Description
0,00 - 0,199	The degree of reliability is very low
0,20 - 0,399	Low degree of reliability
0,40 - 0,559	The degree of reliability is sufficient
0,60 - 0,799	The high degree of reliability
0,80 - 1,00	The degree of reliability is very high

To facilitate research, researchers used SPSS 16 for windows, the results were as follows in table 6.

**Table 6**  
Reliability Statistics Test

Cronbach's Alpha	N of Items
.632	4

From the table above, it can be seen that the reliability value of the aerobic test and anaerobic test using the rowing ergometer and wingate test got a value of 0.632 which indicates that the instrument has a high degree of reliability.

### Difference Test

After testing the pre-hypothesis test data analysis, the next step is to do a comparison test. A comparison test, namely the two-sample t-test is used to compare (differentiate) whether the two data (variables) are the same or different. Two t-test formulas can be used to test the comparative hypothesis of two independent samples.

The decision-making guidelines in the paired sample t-test, based on the significance value with the help of SPSS 16 software as follows:

If the probability value or Sig. (2-tailed) < 0.05, then Ho is rejected and Ha is



accepted, which means that there are differences in the results of aerobic and anaerobic tests using the rowing ergometer and wingate test machines.

Conversely, if the probability value or Sig. (2-tailer) > 0.05, then Ho is accepted and Ha is rejected, which means that there is no difference in the results of aerobic and anaerobic tests using the rowing ergometer and wingate test machines. The following is a table that can explain in detail.

**Table 7**  
 Average Difference Test Results with Paired Sample t-Test

	Score t	Sig. (2-tailed)
Aerobic ergo rowing-aerobicwingate test	.429	.686
Anaerobic ergo rowing-anaerobic wingate test	13.336	.000

Viewed from Table 7, which shows the results of the paired samples test output between the aerobic ergo rowing and the aerobic wingate test, it is known that the t value is 0.429 and the Sig. (2-tailed) value is 0.686 which is greater than 0.05, following the decision-making guidelines that have been described. above, Ha is rejected and Ho is accepted, which means that there is no difference in the average results of the aerobic test using the rowing ergometer and the wingate test. The output of the paired samples test between the anaerobic ergo rowing and the anaerobic wingate test is known to have a t-value of 13,336 and a Sig. (2-tailed) 0.000 value less than 0.05, following the decision-making guidelines described above, Ho is rejected. and Ha is accepted, which means that there is a mean difference in the results of the anaerobic test using the rowing ergometer and wingate test.

## Discussion

Components of physical condition are needed to support the mastery of technical and tactical skills in a sport, especially rowing. Because in principle exercise greatly affects physical conditions related to patterns of coaching, improvement and optimal achievement, the exercise in question is a physical exercise that must be organized, planned and carried out properly and systematically so that it can increase the required biomotor abilities (Rusli Lutan et al., 2000, p.60).

Some of the physical components that need to be developed are: 1) cardiovascular endurance is useful for maintaining the endurance of the heart's work during rowing which requires high energy and in travelling long distances, 2) endurance strength to maintain the endurance of arm muscle strength in rowing for long distances. determined, 3) muscle

strength, especially leg and arm muscle strength, 4) body flexibility that supports arm and body movement in rowing, 5) speed in rowing, 6) power which is a combination of speed and strength, which is a component of physical condition which is absolute in rowing, 7) agility that supports rowing, namely being able to maintain the condition of the boat, the frequency of rowing, 8) explosive power at the start and near the finish or to reduce the lag of the opponent in a match.

In providing physical exercise a lot of stress should be given to the development of the body regularly and carefully, and its intensity can be increased. This process must be done with patience and vigilance. With the good physical condition, 1) There is an increase in the ability of the circulatory system and the work of the heart. 2) There is an increase in the physical condition component. 3) There is better movement during practice. 4) There is a faster recovery time in the organs of the body after exercise. 5) There is a rapid response from the body's organism (Harsono, 1988, p.153).

The ability of this explosive power will determine the results of a good motion. For example, if a person has good explosive power, he will produce strong and fast foot and hand pulls in rowing. Explosive power has two components, namely strength and speed, so explosive power can be manipulated or increased by increasing muscle strength without increasing speed. Or conversely increasing speed without neglecting strength, this approach is usually by manipulating or by training both simultaneously to produce good explosive power. Explosive power is a sequence of work of several elements of muscle movement and produces explosive power if the two forces work simultaneously, explosive power has many uses in an activity such as running, throwing, hitting or kicking. The motion of the object will be achieved perfectly if the person applies maximum force in a short time unit (Widiastuti, 2011, p. 100). From this description, it is clear that power has many uses in certain sports.

The standard limits put forward by Hatfield, (1989, p.59) are that power is the product of force and distance divided by time or power can also be expressed as work divided by Kirkendall time, (1980, 1980). p.59). Thus, a test that aims to measure power should involve the components of force, distance, and time. Thus, before measuring a person's power, it is necessary to pay attention to the form of the test that we use. Sometimes the test used is not suitable for measuring power, but it is widely used to measure power. Of course, the results will be wrong. So someone must be careful in choosing a test in measuring an athlete's power.

Based on some of the opinions above, power can be interpreted as strength and

speed that are carried out together in carrying out a motion. Therefore, the sequence of power training is given after the athlete is trained in the elements of strength and speed. But basically, every form of strength and speed training always involves the element of power. Speed and power training affect each other. The motion of power is always explosive. Power training can improve physique because it involves movement at high speed and can be increased if given at the beginning of the exercise to create a better physical condition with strong reflex functions.

## CONCLUSIONS AND SUGGESTIONS

### Conclusion

Based on the results of research, calculations, and analysis of research data that has been carried out, it can be concluded that there is a comparison of aerobic and anaerobic capacities using the rowing ergometer and wingate test. the results of this study have implications for the context of the training process and rowing athletes' competitions, including: (1) Exercise with an appropriate and attractive program method will produce maximum ability for athletes, especially rowing athletes in rowing numbers, and (2) Aerobic and anaerobic ability tests using the rowing ergometer and the wingate test both produced good scores, but using the rowing ergometer was felt to be more optimal because it was following the characteristics of the rowing sport.

### Suggestions

From the results of the research that has been done, the researcher would like to convey some suggestions that might be input for the actors and people involved in rowing sports. Suggestions from researchers are as follows: (1) For trainers and practitioners of rowing, to gain more knowledge about various methods of weight training to improve the ability of the rowing ergometer, (2) For athletes, it becomes a reference for the process during training so that they pay more attention to good and correct training methods, and (3) For fellow students who will research rowing number rowing, the author recommends conducting research related to other matters in rowing.

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