The Effectiveness Of The Circuit Bodyweight Training Method In Improving Cardiovascular Endurance

La efectividad del método de entrenamiento de peso corporal del circuito para mejorar la resistencia cardiovascular


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Abstract. Cardiovascular endurance is very important to improve so it is expected that all students have good physical freshness. This study aims to find out: (1) the effect of the circuit bodyweight training method on increasing cardiovascular endurance and (2) the difference in the effect of the circuit bodyweight training method between the treatment group and the control group on increasing cardiovascular endurance. This type of research is an experiment with one group pre-test and post-test design. The sample in this study amounted to 77 people taken using random sampling techniques. The subjects were divided into 2 groups, namely the group given treatment of as many as 36 people and the control group with as many as 31 people. The instrument used to measure cardiovascular endurance is a multistage test. The data analysis technique used is an independent sample t-test followed by a paired sample t-test. The results showed that: 1) There was a significant effect of the circuit bodyweight training method on increasing cardiovascular endurance with a significance value smaller than 0.05 (p<0.05). 2) There was a significant difference in influence between the treatment group and the control group on increasing cardiovascular endurance, it was proven that the average value of cardiovascular endurance in the treatment group was 760.72 while the average value of cardiovascular endurance in the control group was 623.54 with an average difference in post-test of 137.18. The treated group had better cardiovascular endurance compared to the untreated control group.

Keywords: Circuit, Body Weight Training, Cardiovascular endurance.

Introduction

Physical freshness is an important physical aspect as the main basis for supporting every human activity. Different levels of physical freshness will affect everyone’s ability to carry out activities (Hauschild & Friedl, 2017; Teresa & Henrique, 2017). In terms of physical work physiology, the element of physical freshness can be divided into two, namely physical freshness related to physical health, and physical freshness related to sports skills (Erickson et al., 2014; Yuniana et al., 2023). Physical freshness is related to health when physical activity can be done without significant fatigue. Elements of physical freshness related to health include cardiovascular endurance, muscle strength, muscular endurance, flexibility, and body composition. The element of physical freshness related to skills includes speed, power, balance, agility, coordination, and reaction speed. Physical freshness is very important for students at school because it is a strategic goal to improve the quality of Human Resources (HR). One of the most important physical components needed by students is cardiovascular endurance (Dimarucot & Macapagal, 2021; Mok et al., 2015).

Cardiovascular endurance is very important to improve so it is expected that all students have good physical freshness so that they can do physical activity for a relatively long time without significant fatigue so that they can enjoy the remaining free time. In other words, good cardiovascular endurance will affect student activities where students will be more enthusiastic in participating in learning (Donnelly et al., 2017; Marques et al., 2017). Given the importance of the role of cardiovascular endurance for students, the cardiovascular endurance of students needs to be improved. The most effective way to improve physical fitness is to exercise regularly. Sports activities that can increase physical fitness are sports that are enough to put a burden on the heart and lungs (Barnard et al., 2019; Sonchan et al., 2019).

However, the reality is that the ability of cardiovascular...
endurance is still not optimal for sport science students. Based on observations made by researchers on April 1, 2023, at the Sports Hall of Yogyakarta State University, a lecturer who teaches physical condition revealed that the Vo2Max ability of sport science students is still low, this is because the exercise program to improve cardiovascular endurance is not effective and is still inappropriate. Researchers obtained the latest data from physical condition lecturers during the cardiovascular endurance test using a multistage test obtained a Vo2Max value of 22.7, the results were included in the category of less once. Previous sports were only more about muscle strength, agility, and speed training, so cardiorespiratory endurance was neglected. If this continues to be allowed, it will certainly have a bad impact and there will be a decrease in physical condition and fitness when attending sports lectures for sport science students.

Based on the results of previous literature, there are already several methods of physical exercise to increase cardiovascular endurance. Physical training programs that previously did more, cycling, swimming, and interval running, and some used external weights, but there is no more varied physical exercise method, namely physical training using your body weight which is divided into several posts or called circuit bodyweight training. Nasrulloh et al., (2022) mentioned that weight training can be done using weights from one’s body weight (body weight) or using external weights, namely free weights such as dumbbells, barbells, and machines (gym machines). Training using deep weights tends to be easier to do anywhere because the loading system only uses its weight. Body weight training is weight training that emphasizes more on how to exercise using deep weights or your body weight.

Circuit bodyweight training is an exercise system that can simultaneously improve the entire body, namely endurance, strength, flexibility, power, muscular endurance, agility, speed, balance, and several other components of physical condition (Hartati et al., 2020; Yuniana et al., 2023). Circuit bodyweight training is a combination of aerobic and endurance exercises using one’s body weight that is done in a short time and can be done anywhere (Nasrulloh et al., 2021; Teofa et al., 2022). Their initial circuit training series consisted of several stations arranged in circles to train muscle groups alternately from station to station (Nasrulloh et al., 2022; Romero-arenas et al., 2013). Circuit training is a form of conditioning that combines high-intensity resistance and aerobic training (Martins et al., 2020). It is designed to be easy to follow and targets strength-building as well as muscular endurance (Linhares et al., 2022). Based on the problems that have been developed previously, the purpose of this study is to determine the difference in the effect of the circuit method of body weight training between the treatment group and the control group on cardiovascular endurance.

Research Methods

Study Design

This study used a type of quasi-experimental research with a pre-test design and a post-test control group design. This experimental study used 2 different groups, namely the treatment group and the control group not given treatment. This type of quasi-experimental research means that researchers are not able to control all variables that can influence them. Therefore, the researchers did not control for physical activity outside the exercise program, we did not monitor specifically.

Subject

The population in this study was sports science students. The sample in this study amounted to 77 people taken using the purposive sampling technique. This study applied inclusion criteria to determine the sample of this study, which is based on certain criteria desired by the researcher, including male sample, sample aged 18-22 years, sample willing to follow the exercise program given, sample able to follow all exercise programs that have been prepared by the researcher. The exclusion criteria in this study are things that cause samples not to meet the criteria to be sampled, such as samples in a sick state. The sample was divided into 2 groups, namely the group that gave treatment to as many as 36 people and the control group as many as 31 people. This research has received approval from all samples who have filled out a statement of ability to become a research sample and have met the requirements of the research code of ethics.

Procedure

Data collection techniques in this study are tests and measurements. The instrument used to measure cardiovascular endurance is a multistage test (Yan et al., 2016). The first stage of the research procedure is to conduct a pre-test to find out the initial data of cardiovascular endurance using a multistage test after that circuit weight training is given 16 times a meeting with a frequency of 3 times a week, and an increase in sets is carried out after the 9th meeting or week 4. Bompa & Buzzichelli, (2019) It is said that an enhanced set of exercises during 4 weeks of exercise can improve cardiovascular endurance. After 16 appointments, researchers took final test scores or post-tests to measure cardiovascular endurance after treatment.

There are details of the Circuit Weight Training training program using internal weights as follows:

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Set</th>
<th>Reps</th>
<th>Between Posts</th>
<th>Between Sets</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Shuttle run</td>
<td>2</td>
<td>12 times</td>
<td>20 second</td>
<td></td>
</tr>
<tr>
<td>2. Frog Jump</td>
<td>2</td>
<td>12 times</td>
<td>20 second</td>
<td></td>
</tr>
<tr>
<td>3. Side Jump</td>
<td>2</td>
<td>12 times</td>
<td>20 second</td>
<td></td>
</tr>
<tr>
<td>4. Half Squat</td>
<td>2</td>
<td>12 times</td>
<td>20 second</td>
<td></td>
</tr>
<tr>
<td>5. Lateral Run</td>
<td>2</td>
<td>12 times</td>
<td>20 second</td>
<td></td>
</tr>
<tr>
<td>6. Bench Jump</td>
<td>2</td>
<td>12 times</td>
<td>20 second</td>
<td></td>
</tr>
<tr>
<td>7. Zig-zag Run</td>
<td>2</td>
<td>12 times</td>
<td>20 second</td>
<td></td>
</tr>
<tr>
<td>8. Jogging</td>
<td>2</td>
<td></td>
<td>20 second</td>
<td></td>
</tr>
</tbody>
</table>
Table 2.
Training program session 9-36 Circuit Weight Training

<table>
<thead>
<tr>
<th>No.</th>
<th>Exercise</th>
<th>Set</th>
<th>Reps</th>
<th>Breaks between posts</th>
<th>Breaks between sets</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Shortest run</td>
<td>3</td>
<td>15 times</td>
<td>20 second</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Frog Jump</td>
<td>3</td>
<td>15 times</td>
<td>20 second</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Side Jump</td>
<td>3</td>
<td>15 times</td>
<td>20 second</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Half Squat</td>
<td>3</td>
<td>15 times</td>
<td>20 second</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Lateral Run</td>
<td>3</td>
<td>15 times</td>
<td>20 second</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Bench Jump</td>
<td>3</td>
<td>15 times</td>
<td>20 second</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>zig-zag Run</td>
<td>3</td>
<td>15 times</td>
<td>20 second</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Jogging</td>
<td>3</td>
<td></td>
<td>20 second</td>
<td></td>
</tr>
</tbody>
</table>

**Statistical analysis**

The data analysis technique used in this study using SPSS 22 uses an independent sample t-test and continues with a paired sample t-test. Previously, prerequisite tests were carried out for normality and homogeneity tests.

**Results**

**a. Normality Test**

A normality test is performed to test whether the data has a normally distributed distribution or not. The calculation of data normality is carried out using the Kolmogorov-Smirnov test. The normality test results are shown in the table below.

1) **Treatment Group**

Table 3.
Pre-Test and Post-Test Data Normality Test Treatment Group

<table>
<thead>
<tr>
<th>Data</th>
<th>Significance</th>
<th>p</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-cardiovascular endurance test</td>
<td>0,05</td>
<td>0,641</td>
<td>Usual</td>
</tr>
<tr>
<td>Post-cardiovascular endurance test</td>
<td>0,05</td>
<td>0,765</td>
<td>Usual</td>
</tr>
</tbody>
</table>

Based on a statistical analysis of normality tests that have been carried out using the Kolmogorov-Smirnov test, the pretest and post-test data of the treatment group were obtained from the results of the normality test of the p > 0.05 significance value data, which means that the data is normally distributed, it can be concluded that all pre-test and post-test data in the treatment group are declared normal.

2) **Control Group**

Table 4.
Control Group Pre-Test Data Normality Test Result

<table>
<thead>
<tr>
<th>Data</th>
<th>Significance</th>
<th>p</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-cardiovascular endurance test</td>
<td>0,05</td>
<td>0,246</td>
<td>Usual</td>
</tr>
<tr>
<td>Post-cardiovascular endurance test</td>
<td>0,05</td>
<td>0,189</td>
<td>Usual</td>
</tr>
</tbody>
</table>

Based on the statistical analysis of the normality test that has been carried out using the Kolmogorov Smirnov test, the control group’s pretest and post-test data obtained from the normality test results of p > 0.05 significance data, which means that the data is normally distributed, it can be concluded that all pre-test and post-test data in the control group are declared normal.

b. Homogeneity Test

The homogeneity test is used to test the similarity of variance between the compared data. The results of the homogeneity test of pre-test and post-test data between the treatment group and the control group of this study are as follows:

Table 5.
Test results of homogeneity of pre-test and post-test data

<table>
<thead>
<tr>
<th>Group</th>
<th>F count</th>
<th>p</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>1,144</td>
<td>0,289</td>
<td>Homogeneous</td>
</tr>
<tr>
<td>Control</td>
<td>0,196</td>
<td>0,659</td>
<td>Homogeneous</td>
</tr>
</tbody>
</table>

Results of homogeneity test to test the similarity of variance of pre-test post-test data between the treatment group and the control group. Since the significance value is greater than 0.05 (p>0.05), it can be stated that the pre-test and post-test data between the treatment group and the control group are homogenous.

**c. Test Effectiveness**

1) **Independent Sample t-Test Results**

The results of the independent sample t-test on the pre-test data compared between the treatment group and the control group are as follows:

Table 6.
Results of Independent Sample T-test Data Pre-Test

<table>
<thead>
<tr>
<th>Data</th>
<th>Group</th>
<th>Mean</th>
<th>t count</th>
<th>p</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiovascular endurance test</td>
<td>Treatment</td>
<td>596,77</td>
<td>0,251</td>
<td>0,803</td>
<td>Significant</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>588,25</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Based on the results of the Independent Sample t-test analysis, cardiorespiratory endurance data obtained a calculated t-value of 0.251 with a significance value of 0.803. Because the significance value of 0.803 is greater than 0.05 (p>0.05), it can be concluded that there is no significant difference in cardiorespiratory endurance between the treatment group and the control group at the time of the pre-test. This means that both groups had the same cardiorespiratory endurance before being treated in the treatment group.

Based on the results of the analysis, the average value of cardiovascular endurance in the treatment group was 596,77 while the average value of cardiovascular endurance in the control group was 588,25. This means that the treatment group had a better cardiovascular endurance average compared to the control group that did not receive treatment.

2) **Post Test**

The results of the independent sample t-test on the post-test data compared between the treatment group and the control group are as follows:

-1222-
Based on the results of the Independent Sample t-test analysis, cardiorespiratory endurance data obtained a calculated t-value of 3.975 with a significance value of 0.000. Because the significance value of 0.000 is less than 0.05 (p<0.05), it can be concluded that there is a significant difference in cardiorespiratory endurance between the treatment group and the control group.

Based on the results of the analysis, the average value of cardiorespiratory endurance in the treatment group was 760.72 while the average value of cardiorespiratory endurance in the control group was 623.54. This means that the treatment group had better cardiorespiratory endurance compared to the control group that did not receive treatment.

2) Paired Sample t-Test Results

a) Treatment Group

Based on the results of the Paired Sample t-test analysis, cardiorespiratory endurance data obtained a calculated t-value of 5.506 with a significance value of 0.000. Because the significance value of 0.000 is smaller than 0.05 (p<0.05), it can be concluded that there is a significant difference in cardiorespiratory endurance during the pre-test and post-test in the treatment group. This means that there is a significant increase in cardiorespiratory endurance before and after treatment.

b) Control Group

Based on the results of the Paired Sample t-test analysis, cardiorespiratory endurance data obtained a calculated t-value of 1.761 with a significance value of 0.088. Because the significance value of 0.088 is greater than 0.05 (p>0.05), it can be concluded that there is no significant difference in cardiorespiratory endurance during the pre-test and post-test in the control group.

Discussion

The discussion of the results of this study provides a further interpretation of the results of the data analysis that has been presented.
2. The effect of differences in circuit bodyweight training methods between the treatment group and the control group on increasing cardiovascular endurance

The results of the analysis showed that there was a significant difference in influence between the treatment group and the control group on increasing the cardiovascular endurance of sports science students. The group of students who were given circuit weight training treatment was better than the control group in increasing muscle strength, muscle endurance, and balance of wrestling athletes. This is supported by the results of previous research (Azeezul et al., 2016) that said the experimental group had significant differences in all physical fitness variables when compared to the control group. It was therefore concluded that six weeks of circuit weight training can improve cardiovascular endurance. The implication of this study is to produce an appropriate and effective circuit weight training exercise program to increase the cardiovascular endurance of sports students. In other words, good cardiovascular endurance will affect student activities where students will be more enthusiastic in participating in learning.

Conclusion

Based on the results of data analysis using the Independent Sample t-test and continued with the Paired Sample t-test, conclusions can be drawn in this study: a) there was a significant increase in cardiovascular endurance before and after treatment, and there was no significant increase in the control group, b) the group given the circuit bodyweight training method treatment had better cardiovascular endurance than with an untreated control group.

Acknowledgment

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References


