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Effect of 2.4 Km Run Training Method on Changes in Blood Glucose Levels of Handball Athletes

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ABSTRACT

Changes in blood glucose levels play an important role in maintaining the fitness of athletes, especially in the sport of handball. This research uses an experimental method with a quantitative type of research. The sample consisted of 20 people taken using total sampling technique. The instrument used for blood glucose levels is a glucometer which has been standardized by a health analyst before use. The data analysis technique uses the t test with a sig value <0.05. The research results showed that the results obtained were 5.125 with a P value = 0.000 < 0.05. This means that there is a significant influence between changes in blood glucose levels before and after the 2.4 km running treatment in handball athletes. This can be seen from the average value of 95.45 mg/dl, as well as a standard deviation of 27.32mg/dl in the initial data on changes in blood glucose levels, and an average value of 88.23 mg/dl, also a standard deviation value of 24.16 mg/dl. So it can be concluded that there is a significant influence of the 2.4 km running training method on changes in blood glucose levels. Using the 2.4 km running method, you get a good impact if you do this activity consistently.

INTRODUCTION

Regular sports activities produce a fit and healthy body, so sports activities certainly should not be abandoned (Rizkyanto, 2022) . In this case, it can tell that sports activities in society are very important (J. Nugroho et al., 2021) . For this reason, in choosing and doing sports activities, it can adjust to the abilities possessed by a Medical and health experts emphasize that the body's work ability is enhanced by the proper functioning of the blood circulation and respiratory systems, while physiologists argue that the integration of tissues and organs is a function of physical fitness and that a person's physical fitness for a task must be done (Onsiri et al., 2020) . Involving a lot of physical effort in accordance with the standards that must be met in terms of intensity (Fajar et al., 2021) .

One of the most important aspects of the goal of comprehensive education is the formalization of training programs and maintaining physical fitness in the athlete's environment. This is because the goal of both programs is to produce capable and healthy young people (Wisløff,)2019 . Because one of the crucial components that determine a person's success is their level of judgment (Garber et al.,2019) . Even if they have good techniques and tactics, they will not be able to achieve satisfactory

results without good judgment (Wierda et al., 2012) . Therefore, physical fitness needs to be improved with honest, disciplined, and continuous training (Petray et al., 2019) .

In accordance with the results of preliminary observations by athletes in *handball* Malang City, East Java obtained interesting things to be followed up in research, namely in the blood glucose levels of *handball* athletes. It is known that glucose levels have energy stores in a person's body to inhibit the process of fatigue until energy depletion. The body uses glucose as a fuel source for cells and tissues, and can also store glucose as an energy reserve. But in fact, the lack of fitness or endurance causes athletes in Malang city *handball* to get tired or run out of energy

Therefore, to prevent fatigue or ensure athletes have sufficient energy reserves (glucose levels) during competition, athletes must perform quality physical exercise to improve their fitness level (García-Ponce et al., 2021) . A high level of physical fitness can be achieved through proper exercise, which is very important to support the quality of human resources (Elsa Ariestika et al., 2022) . To successfully improve physical fitness and enhance sporting performance, sports health initiatives focus on offering services and advice on appropriate physical activity (Ariestika & Aofal, 2024) . Running with a distance of 2.4 km is one of the popular types of exercise. Walking or jogging with a distance of 2.4 km can be considered a healthy pattern in sports (Amali et al., 2021) . The benefits for health are enormous, especially for the body. Running requires a lot of energy because it includes continuous movement. The energy required by body cells to perform physiological activities (Dugerdil et al., 2022)). Burning fat and carbohydrates stored in the body will drive energy metabolism and produce ATP.

Oxygen obtained through breathing is necessary for the metabolic process of energy sources to function (Tarango et al., 2023) . Both the body's energy sources are also fat and carbohydrate stores, such as blood glucose, muscle glycogen, and liver glycogen which will increase the speed at which the body produces energy when jogging or running (Kristiyandaru et al., 2023) . Nonetheless, the relative contribution of these two energy reserves may vary depending on the level of activity performed. Player performance is influenced by the availability of blood glucose at the time of training. As nerve cells cannot retain carbohydrates, a decrease in blood glucose levels will lead to impaired brain cell activity and decreased performance in *handball* athletes (Spees et al., 2019) .

(Gleeson et al., 2021) states that carbohydrate consumption will initiate the burning of these carbohydrates through energy metabolism and blood glucose or muscle glycogen. All carbohydrates eaten, whether simple (glucose, sucrose, fructose) or complex (rice, cassava, potatoes, bread, etc.), will be stored as energy reserves in the form of glycogen in the muscles and liver, and potentially in the body. Circulate as blood glucose or absorbed by cells that need it. One type of carbohydrate found in food is glucose, which is widely absorbed into the blood and then transported to the liver (Arnett et al., 2019) .

Thus, the novelty in research is focused on changes in blood glucose levels carried out by *handball* athletes in Malang, East Java as a reference in the 2.4 km running training method. So the purpose of this study is to determine the effect of the 2.4 km running training method on changes in blood glucose levels in *handball* athletes in Malang City, East Java.

METHODS

The research method used is Experiment with quantitative research type using Pre-Experiment design (*One-Group Pretest-Postest design*). The population used in this study were 20 *handball* athletes in the city of Malang, so the use of samples in this study with total sampling techniques where the population was sampled as a whole. Thus, the sample in this study were 20 athletes. In addition, instruments on blood glucose levels are carried out using a glucometer that has been standardized by a health analyst expert before use (Amali et al., 2021) . Thus, the research design can be described below as follows.

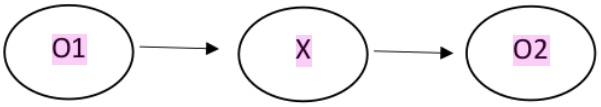

Figure 1. Research design

Description:

O1 = Glucose Level Value (Initial Data)

X = Giving *Treatment* (2.4 km Running/Jogging Exercise)

O2 = Blood Glucose Level Value (Final Data)

The data analysis technique in this study is descriptive statistical test analysis in this analysis aims to obtain a general description of the research data consisting of *mean*, number of samples, *standard deviation, range, minimum* and *maximum* values, and the amount of data. The data analyzed were glucose levels at *pretest* (initial data) and blood glucose levels at *posttest* (final data). Furthermore, the normality test is important to obtain research data that gives meaning to the measurement data of blood glucose levels in the initial and final tests. Thus, the data is normally distributed if the sig. P > 0,05. *Independent sample t test the* purpose of this test is used to answer the research hypothesis whether there is an effect or not using SPSS. The data analyzed using the reference sig value. <0.05.

RESULTS AND DISCUSSION

Descriptive and inferential statistical analyses were included in the presentation of data analysis results. The results of the data analysis were then interpreted through discussion of the findings of the analysis and continuity with the theory that guided this study from factual information collected in the field, including the findings of tests and measurements of blood glucose variations before and after the 2.4 km running exercise. After that, data tabulation was conducted to determine how the research data

were distributed. An inferential statistical approach was used to conduct the data analysis used in this study. An overall picture of the data, including mean, standard deviation, variance, maximum and lowest values, ranges, and frequency tables, is the purpose of descriptive data analysis. The results of the research analysis below are as follows.

Table 1. Statistical Analysis Results

Statistical Descriptive Test						
Research Variables	N	*Mean*	*SD*	*Min*	*Max*	*Sum*
Posttest Data Glucose Level	20	95,45	27,32	75,00	142,00	972,00
Posttest data Glucose Level	20	88,23	24,16	59,00	120,00	884,00

According to the exposure of table 1 above, there are changes in blood glucose levels before doing 2.4 km running exercises at pretest, obtained a mean value of 95.45 mg/dl, standard deviation of 27.32 mg/dl, minimum value of 75.00 mg/dl, maximum value of 142.00 mg/dl, total amount of 972.00 mg/dl. Whereas, on the changes in blood glucose levels after running 2.4 km in the posttest, the obtained values mean 88.23 mg/dl, standard deviation 24.16 mg/dl, minimum value 59.00 mg/dl, maximum value 120.00 mg/dl, total 884.00 mg/dl.

Table 2. Test Results

Research variables	Asymp P > 0,05	Description
(Baseline) Blood Glucose Level	0,714	Normal
(Final Data) Blood Glucose Level	0,763	Normal

Table 2 above obtained the results of the normality test on the initial data of blood glucose levels before the 2.4km running exercise was obtained, namely 0.714> 0.05. This explains that the initial data is normally distributed. While in the final data of blood glucose levels before running 2.5 km obtained is 0.763 > 0.05. In these results it is proven that the final data is normally distributed. Furthermore, the results of the hypothesis test below are obtained as follows.

Table 3. *Independent Sample T test* results

Pretest-posttest data	*Treatment*	*Mean*	*SD*	T.count	P < 0,05	Description
Changes in Blood Glucose Levels	Initial data	95,45	27,32	5,125	0,000	Significant
	Final data	88,23	24,16			

Table 3 above shows that the value of 5,125 with a value of P = 0.000 <0.05 concluded that there is a significant difference between changes in blood glucose levels before and after the *treatment of* running 2.4 km in *handball* athletes. This, seen from the average value of 95.45 mg/dl, as well as the standard deviation of 27.32 mg/dl in the initial data of changes in blood glucose levels, and the average value of 88.23 mg/dl, as well as the standard value deviation of 24.16 mg/dl.

Discussion

Intensity in the opinion of Norton et al (2023) in his research suggests is a characteristic that shows how difficult an activity is, the nature and purpose of the exercise determines how intense the exercise is. Because the low and high intensity correlates with the length or shortness of an activity carried out, the intensity of training becomes a crucial part of training (Garber et al., 2019) . According to Eijsvogels et al (2023) exercise duration is often shorter when exercise intensity is high, and longer when exercise intensity is low. The same thing is also expressed by Woodcock et al (2021) which states that the main factor that determines changes in the physiological capacity of the body is the intensity of exercise which expresses the degree of physical activity. Sport puts physical pressure on deliberate physical exercise that is carried out in order to improve and maintain physical fitness (Setiawan et al., 2019) . Men and women of all ages can do inexpensive running or *jogging* activities. Running is one of the easy activities that are beneficial for physical condition. One can start by warming up the muscles by running a few hundred meters at a leisurely pace. When halfway through the journey, it can increase the speed according to the best ability. Prima & Kartiko (2021) states that running 2.4 km is a sports activity that involves running. The feet appear on the ground alternately when walking, but there is a short period of time when running.

Glucose accounts for at least 95% of all monoxide in the blood. All galactose and some fructose will be directly converted into glucose due to absorption (García-Ponce et al., 2021) . Glucose must pass through the membrane and into the cytoplasm of the cell before it can be utilized by body tissue cells. Once glucose enters the cell, it undergoes phosphorylation to produce glucose 6-phosphate. After that, this glucose 6-phosphate will be catabolized or polymerized to produce glucose reserves as glycogen. Glycogenesis is the process of making glycogen, while glycogenolysis is the breakdown of glycogen (Onsiri et al., 2020) . Rather than directly aiding blood glucose control, muscle cells store glycogen, subsequently utilized in the skeletal muscle itself.

This happens when muscles undergo anaerobic glycolysis. The lactic acid produced then enters the bloodstream and liver, where it is converted into glucose. From there, glucose can either be recycled back into the bloodstream as blood glucose, which is used for fuel by the liver, or convert into glycogen and stored as liver glycogen. When glucose enters the bloodstream, it passes through the hepatic portal system. Some of the glucose is then dispersed throughout the body and stored in the liver as glycogen, a backup energy source. Liver cells are able to absorb glucose by diffusion. Furthermore, anaerobic glycolysis and aerobic systems convert glucose into ATP (S. Nugroho et al., 2021) . Thus, running 2.4

km regularly will have an optimal impact on health. In line with the final results of the research exposure that has been carried out, which provides a description of the results of changes in blood glucose levels after applying the 2.4 km running activity with significant results.

CONCLUSIONS

Running 2.4 km has a good impact if the activity is consistently carried out. With significant changes in blood glucose levels from *pretest* and *posttest* results in poor *handball* athletes, East Java. So, it is concluded that there is a significant difference in the results of the 2.4 km running exercise method on changes in blood glucose levels

Further research with variations in exercise intensity and duration is recommended to explore the effect of different running exercise intensities and durations on blood glucose levels. This is to determine whether the results obtained are generally applicable or more effective at certain intensities/durations. Further studies can compare the effect of 2.4 km running training with longer distance training or interval intensity to evaluate the impact of exercise variation on blood glucose levels of handball athletes. The study can be extended to non-athlete groups or groups with other sports to determine whether the effect of this training method is uniform in different populations. It is desirable to conduct similar studies on athletes from different sports, such as football or basketball, to test the generalizability of these findings.

It is also recommended to conduct a long-term study to evaluate how the 2.4 km running training method affects the regulation of blood glucose levels within a few weeks or months. By expanding the scope of the study, it is expected that the resulting findings can provide more comprehensive benefits in the field of sports science and athlete health.

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