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Original Article Research

The Effect of Interval Training and Rope Skipping on the Results of Increased Vo2 Max in Futsal Extracurricular Students

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Abstract

This research aims to determine: (1) the effect of interval training on improvement VO2 max; (2) the influence of rope skipping training for increasing VO2 max; (3) Which is more effective between interval training and rope skipping training in increasing VO2 max for MA Nurul Hadid futsal extracurricular students in the Cirebon Region, West Java. This inquire about was conducted utilizing an exploratory strategy with a two-group pretest-posttest plan. The populace in this consider were 26 futsal extracurricular understudies. The examining procedure is purposive inspecting. The test in this think about was 20 futsal extracurricular understudies at MA Nurul Hadid Cirebon with 16 medicines given. The investigate instrument utilized the Multistage Wellness Test. The information examination strategy utilized in this investigate is the t-test to decide the comparison of interim preparing and rope skipping preparing in expanding VO2 max. Based on the inquire about comes about are as takes after. (1) There's an impact of expanding VO2 max for extracurricular futsal understudies at MA Nurul Hadid with interim preparing, which is demonstrated by the calculated t esteem (6.419) > t table (2.262). (2) There's an impact of expanding VO2 max for MA Nurul Hadid futsal extracurricular understudies with rope skipping preparing, which is demonstrated by the calculated t esteem (3.335) > t table (2.262). (3) Interim preparing and rope skipping preparing are similarly great for expanding VO2 max in futsal extracurricular understudies MA Nurul Hadid since there was no critical contrast in comes about, which was demonstrated by the calculated t esteem (1.870) < t table (2.101).

***Keywords**: Interval Training, Rope Skipping Training, VO2 max*

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1. INTRODUCTION

Sports are various institutionalised or organised games that require the demonstration or display of physical skills. Sports are used for all types of physical activities, which can be done on land, in water, or in the air. Sports are said to be a distinct form of games and play and measure ability (competition), but sports have their own characteristics (Mu'arifin, 2009:21). Among these is football, which is widely popular among all segments of society, from children, teenagers, to adults, both in our country and around the world. Football is very easy to play and can be done in any location, adapting to the environmental conditions of the community. The World Cup, held every four years, is a moment eagerly awaited by people worldwide and all participating nations representing their respective continents.

World football has a governing body for the entire world, namely FIFA (Federation International Football Association). FIFA directs all universal football exercises around the world. Over the globe, FIFA has partitioned each landmass into different zones, such as Europe, Asia, Africa, North America, South America, and Oceania. Europe (UEFA) Union of European Football Affiliations, comprising of 53 Part nations, UEFA was established in 1954, and its primary competition is the UEFA European Championship. Asia (AFC) Asian Football Confederation, comprising of 46 Part nations in Asia, AFC was established in 1954 to speak to Asian nations, and its primary competition is the Asian Container. South America (CONMEBOL) Confederación Sudamericana de Fútbol, comprising 10 Part nations, was established in 1916 and speaks to South American nations. Its primary competition is the Copa America. North America (CONCACAF) Confederation of North, Central American and Caribbean Affiliation Football, comprising 40 Part affiliations and built up in 1961, speaks to nations in North America, Central America, and the Caribbean. Its primary competition is the CONCACAF Gold Container. Oceania (OFC) The Oceania Football Confederation, comprising of 11 individuals + 6 associates, was established in 1966 and speaks to the nations of Oceania.

The Asian zone is divided into several regional zones, one of which is Southeast Asia, which is federated by the AFF (ASEAN Football Federation), consisting of 12 members in Southeast Asia. The AFF was established in 1984 to represent countries in Southeast Asia. Of course, its main tournament is the AFF Football Championship. In Indonesia itself, the history of this sport began with the establishment of the Indonesian Football Association (PSSI) in Yogyakarta on 19 April 1930, led by Soeratin Sosrosoegondo, who noted that the sport was introduced during the Dutch colonial period. The round-ball sport has developed rapidly and begun to give rise to new types of games, one example being futsal.

Futsal became a new sport in Indonesia in the early 2000s. The governing body for futsal in Indonesia is the AFI (Indonesian Futsal Association), which was established in 2014 and later renamed the FFI (Indonesian Futsal Federation) in 2015. Futsal serves different purposes for different participants; some play for fun, while others pursue it as a competitive sport. Futsal shares characteristics with soccer, but it differs in terms of field size, number of players, and some game rules. As a result, futsal has gotten to be a prevalent don in Indonesia, as evidenced by the numerous futsal events organised by offices, universities, and schools. Futsal is one of the sports disciplines with intriguing characteristics. Besides stamina, speed, and dexterity, it moreover requires mental quality and strategy, especially in dribbling the ball, passing, and maintaining defence while quickly and accurately attacking the opponent's territory.

Futsal diversions must be bolstered by great participation between players and must

moreover be backed by great strategy, physical wellness, strategies and mental quality in arrange to play well. Physical wellness may be a component that futsal players must have. Agreeing to Mochamad Sajoto (1988: 57), physical condition is one of the foremost vital necessities within the exertion to progress an athlete's execution, indeed as the establishment for the begin of competitive sports. In this setting, physical capacity is fundamental to back an athlete's psychomotor developments. Physical condition is an indivisible component of both enhancement and upkeep. This implies that in endeavors to progress physical condition, all components must be created, one of which is continuance.

Futsal could be a amusement characterised by quick discontinuous concentrated and ideal cardiac yield, as great cardiac work empowers the productive exchange of oxygen to dynamic muscle tissue, in this manner improving vitality continuance and quickening recuperation forms. Typically based on the truth that a futsal coordinate keeps going 2 x 20 minutes with five players per group, requiring players to always move, make space, create openings, and stamp rivals. These requests can be met by players on the off chance that they have great physical condition, especially oxygen consuming perseverance. Usually since in case oxygen consuming capacity is sweet, vitality yield is expanded, empowering players to perform physical work ideally (Suharjan, 2013: 52). This high-impact capacity can moreover be alluded to as oxygen consuming perseverance. As clarified by Sukadiyanto (2011: 65), great high-impact capacity permits players to recuperate rapidly, empowering them to preserve tall concentrated for amplified periods.

The physical prerequisite of oxygen consuming continuance isn't ideally prepared to be made strides for the futsal extracurricular understudies at MA Nurul Hadid Cirebon. Typically since, agreeing to the researcher's perceptions in a few competitions, the players showed up to tire exceptionally rapidly, driving to a decay in their execution, such as as often as possible losing the ball and making inaccurate passes. The challenges confronted incorporate a need of preparing offices and scenes, coaches, and preparing programs to move forward physical condition, especially oxygen consuming continuance.

Based on the comes about of an meet with the coach when the creator inquired almost the preparing program for the futsal extracurricular understudies at MA Nurul Hadid Cirebon, each preparing session as it were centered on strategy and methodology. This was not without reason, as preparing time was restricted to as it were twice a week. In this manner, the coach's choice in planning each preparing session organizes procedure and procedure, with exceptionally constrained physical preparing escalated. This ought to be based on preparing hypothesis and strategy, which prescribe 3 to 4 preparing sessions per week. The problematic physical preparing program for moving forward VO2 max postures a challenge for improving athletes' physical condition and execution amid competitions. Subsequently, in this think about, the analyst planned a physical preparing program to progress oxygen consuming perseverance, which can affect the increment in VO2 max. Among various physical training methods for improving VO2 max, the researcher selected interval training and rope skipping. Interval training is the most appropriate method for improving physical fitness, as it prioritises rest periods between sets with the primary goal of energy fitness. Energy fitness is defined as the process of rapidly generating energy when oxygen supply is sufficient. This method is often used as a training variation to prevent athletes from becoming bored and is implemented during the preparation period.

Based on the above description, the author felt compelled to conduct research with the aim of determining which exercise is more effective in increasing VO2 max in futsal

extracurricular students at MA Nurul Hadid Cirebon. and this was realised in the form of a scientific study titled 'The Effect of Interval Training and Rope Skipping on VO2 max Improvement in Futsal Extracurricular Students at MA Nurul Hadid Cirebon.' Based on the background of the problem, the issues that arise can be identified as follows: Training facilities, locations, and times are limited to one or two sessions per week, Coaches focus solely on technical and tactical training, Training programmes do not align with established theories and methodologies, Interval training and rope skipping exercises have never been incorporated into the programme. Cardiorespiratory fitness levels remain low.

2. METHOD

2.1 Research Methods

This think about may be a quantitative consider employing a quasi-experimental design according to Dwiyogo (2010:45), which states that the quasi-experimental strategy may be a inquire about strategy that perceives that not all factors (rising indications) and test conditions can be completely controlled, and is utilized to recognize which factors may not be completely controlled and directed. The inquire about plan employments a two-group pretest-posttest plan. Agreeing to Endang Mulyatiningsih (2013: 96), this two-group pretest-posttest test plan has two sets of estimation information: pretest (O1) and posttest (O2). The information investigation procedure chosen is, of course, the two-sample t-test. The speculation being tried is that there's a distinction between the cruel pretest score and the cruel posttest score.

2.2 Participants

Freangkel & Wallen (2009: 90) Population is a larger group than the group from which data will be collected in a study. Population is the entire subject of research that will be selected as a sample in a study (Suharsimi Arikunto, 2010: 173). According to Sugiyono (2013: 81), a test may be a portion of the populace that offers the same characteristics as the populace. In case the populace is huge and the analyst cannot consider the complete populace, for case due to restrictions in financing, labor, and time, the analyst can utilize a test taken from the populace.

According to Dwiyogo (2010: 92), purposive sampling is a technique used when the researcher has specific considerations in selecting the sample according to the research objectives. The determination of the sample is based on several considerations, namely: a. Students of MA Nurul Hadid Cirebon, b. Registered as members of the futsal extracurricular activity at MA Nurul Hadid Cirebon, c. Actively participate in training three times a week, d. Willingness to be a research subject, e. Maximum age of 18 years.

In this technique, the selection of samples is entirely at the discretion of the researcher, making it highly subjective in nature. From the over examining method, the test in this think about comprised of 20 members, which were at that point separated into two bunches: one bunch for interim preparing and the other for rope skipping preparing. These groups were divided into two balanced groups using matched-pair. According to Fajar Ibnu Shaleh (in Setyo, 2006: 34), matched-pair is dividing subject pairs based on the principle of balance and then randomly assigning them to research groups. The division of the experimental groups is illustrated as follows:

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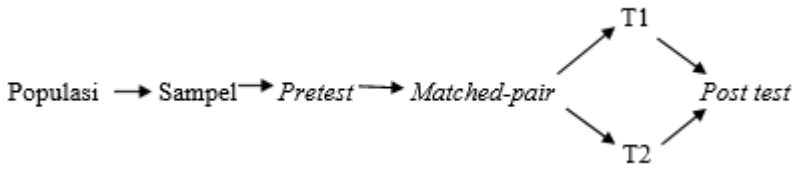
Tabel 1. Determination of groups with matched pairs;

Interval training group	Rope skipping training group
Ranking	Ranking
1	2
4	3
5	6
8	7
etc	etc

2.3 Research Design

This two-group pretest-posttest investigate plan compares two strategies: interval training and rope skipping. In this study, the test was conducted twice: before and after the treatment. The distinction between the pretest and posttest is expected to be effect of the treatment, and the results of the treatment are expected to be more accurately determined because there is a comparison between the conditions before and after the treatment, and it is known which method is more effective for VO2 max improvement training. The research design is illustrated in the following figure:

Figure 1. Research Design



Explanation:

Pretest : Initial test measuring reaction speed conducted before subjects receive treatment.

Matched-Pair : Dividing subject pairs based on the principle of balance and then randomly assigning them to research groups.

T1 : First treatment using the interval training method.

T2 : Second treatment using the rope skipping training method.

Post-Test : A final test conducted after the subjects receive the treatment.

2.4 Instruments

An instrument could be a measuring apparatus utilized to gather data. Concurring to Suharsimi

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Arikunto (2010: 198), tests are utilized to degree the nearness or nonattendance of, as well as the degree of, the capacities of the objects being considered. These test-based disobedient can be utilized to degree fundamental capacities, accomplishments, or execution. Based on the over portrayal, the instrument utilized in this think about could be a test instrument. The instrument utilized is the Multistage Wellness Test (MFT). The analyst utilized the instrument with the test parameter rules from the Service of Youth and Sports to decide VO2 max.

2.4 Procedures

This research was conducted in the field at Panawuan Village. The population in this study consisted of 26 futsal extracurricular students at MA Nurul Hadid Cirebon, the sample size was set at 20 people. Purposive sampling was used, and a pretest was conducted using a multi-stage test, after which the test was partitioned into two bunches, each gather was at that point alloted either interim preparing or rope skipping preparing. Group A received interval training, while Group B received rope skipping training, After the intervention with interval training and rope skipping training, a post-test was conducted using the Multi-Stage Test, Data analysis was performed to compare the introductory and last test results for both groups, followed by data analysis and discussion of the research findings. Drawing conclusions based on the results obtained from data analysis.

Freangkel and Wallen (2009: 148) Instrument validity is an important consideration when preparing or selecting instruments for use. Measurement instruments to be used in research must undergo validity and reliability testing before being used in data collection. The validity value of the Multi - stage fitness/Bleep/Beep test instrument is 0.744 (valid), with the validity decision based on the calculated esteem > table esteem with $\alpha = 0.05$. The reliability value is 0.697 (high reliability).

2.5 Data Analysis

The information investigation strategy utilized in this think about was the t-test to decide the comparison between interim preparing and rope skipping preparing in expanding VO2 max. By comparing the normal treatment sets, the t-test was utilized (Sudjana, 2002: 36). Considering that the information investigation of the consider was conducted utilizing the t-test, it was vital to conduct prerequisite tests, which included: (1) typicality test (2) homogeneity of change test and (3) theory test. The examination strategy utilized to test the inquire about speculation was the t-test utilizing SPSS 16 program, which compared the implies between bunch 1 and bunch 2. On the off chance that the calculated t-value was littler than the table t-value, Ha was rejected. In case the calculated t-value was more noteworthy than the table t-value, Ha was acknowledged. Agreeing to Sugiyono (2013: 197), the equation utilized for the t-test is as takes after:

Figure 2. The formula used for the t-test

$$t = \frac{X_1 - X_2}{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}$$

Description:

X1: Average sample 1 $S^2$2: Standard deviation sample 2

X2: Average sample 2 n : Number sample members

S21: Standard deviation sample1

3. RESULTS

3.1. Data Description

To determine the increase in VO2 max in futsal extracurricular students at MA Nurul Hadid Cirebon in this study, a percentage increase formula was used. Regarding the percentage increase formula, an expert argues that the percentage increase usually indicates the increase in a certain thing. The percentage result will be relatively higher than before. Rate Increment Equation = (Last Esteem – Starting Esteem) / Starting Esteem x 100% (Ghina, 2024).

$$\text{Percentage Increase} = \frac{mean\ different}{mean\ pretest} X\ 100\%$$

Table 2. Percentage Increase in VO2 max

Variable	Pretest	Posttest	Difference	Percentage Increase
Effect of Interval Training on Students	35,99	39,22	3,23	8,97 %
Effect of Rope Skipping Training on Students	35,71	37,72	2,01	5,62 %

Based on the research results in the table above, the percentage increase in VO2 max in futsal extracurricular students at MA Nurul Hadid Cirebon with interval training was 8.97%. Meanwhile, the research results in the table above showed that the percentage increase in VO2 max in futsal extracurricular students at MA Nurul Hadid Cirebon with rope skipping training was 5.62%.

3.2. Analysis Requirements Test (Normality Test)

The typicality test in this ponder was utilized to decide whether a conveyance was ordinary or not. The typicality test in this think about utilized the Kolmogorov-Smirnov test. The criteria utilized to decide whether a dissemination is ordinary are as takes after: in the event that $p > 0.05$ (5%), the dissemination is considered ordinary, and on the off chance that $p < 0.05$ (5%), the conveyance is considered non-normal. The comes about of the typicality test can be seen within the table underneath;

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Table 3. Comes about of the Typicality Test:

Variabel.	Test Statistic.	Asymp. Sig. (2-tailed).	Information
VO2 max Pre-test Results with Interval Training	0.292	.015[c]	Normal
VO2 max Post-test Results with Interval Training	0.122	.200[c,d]	Normal
VO2 max Pre-test Results with Rope Skipping Training	0.232	.0135[c]	Normal
Posttest VO2 max Results with Rope Skipping Training	0.215	.200[c,d]	Normal.

From the comes about within the table over, it is known that the VO2 max information of futsal extracurricular understudies at MA Nurul Hadid Cirebon gotten p > 0.05. The comes about can be concluded that the inquire about information are ordinarily conveyed.

3.3. Homogeneity Test

The homogeneity test is valuable for testing the closeness of tests, i.e., whether they are uniform or not, of tests taken from a populace. The homogeneity test is expecting to test the likeness of change between each work out. The homogeneity test in this ponder is the Levene Test. The comes about of the homogeneity test are displayed within the table underneath:

Table 4. Homogeneity Test Comes about

Test	Levene Statistic	df1	df2	P	Description
VO2 max Results in the Pretest with 2 Training Methods	0.780	1	18	0.389	Homogeneous
VO2 max Results in the Posttest with 2 Training Methods	0.127	1	18	0.726	Homogeneous

Based on the comes about of the homogeneity test over, the VO2 max information for futsal extracurricular understudies at MA Nurul Hadid Cirebon gotten a esteem showing that P > 0.05, so it can be concluded that the fluctuation is homogeneous.

3.4. Test of t-Test

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The t-test in this study was intended to answer the hypothesis that had been proposed. The results of the hypothesis test (t-test) can be seen in the table below:

Table 5. Independent Sample t-test

	Mean.	df.	t table.	t calculated	*P*	Sig.5 %	Note
Posttest Interval.	39,52	18	2,101	1870	0,726	0,05	No difference/equally good
Posttest Rope skipping	37,72	18					

Based on the results of the Independent Sample Test analysis, if the Sig P value is t table, it means there is a difference or an improvement. The calculated t-value (1.870) is more prominent than the t-table esteem (2.101), and the Sig P esteem is more noteworthy than 0.05. These comes about show that the calculated t-value is littler than the t-table esteem, meaning that Theory 3, which states that "interval preparing is way better for moving forward.

4. DISCUSSIONS

Based on the comes about of the t-test of the three speculations, the taking after talk will be conducted:

The Impact of Interim Preparing on the Increment in VO2 Max in Futsal Extracurricular Understudies at MA Nurul Hadid Cirebon. Based on the t-test comes about in Table 11, the increment in VO2 max among futsal extracurricular understudies at MA Nurul Hadid Cirebon through interim preparing yielded a calculated t-value (6.419) > table t-value (2.262).

In this way, it can be concluded that interval training has an effect on the increment in VO2 max among futsal extracurricular understudies at MA Nurul Hadid Cirebon. Interval training is one of the training methods to make strides continuance, especially high-impact perseverance. Interim preparing can be conducted in open or closed spaces, depending on person needs. Interim preparing is carried out through a dynamically planned program, which includes occasionally expanding the workload, counting the escalated of the preparing, to permit competitors to adjust viably. Interim preparing starts with competitors situated at markers and holding up for the coach's flag to begin the work out and recuperation time, in this manner fortifying the body for theanother work out. This condition must be kept up through persistent preparing, which includes preparing conducted ceaselessly over 16 sessions. In each session, the escalated of the preparing is expanded, and the recuperation time per set is decreased, subsequently making a preparing impact that upgrades perseverance and advances heart and lung work when circulating oxygen all through the body to its most extreme capacity.

Interval training requires athletes to move optimally during sprints, which indirectly improves heart and lung performance, thereby increasing VO2 max. This enhances heart

performance during the training programme with a heart rate of 128-138 beats per minute at 60% intensity. Interval training has the effect of increasing VO2 max, ensuring that the body's oxygen requirements are met. Based on these research discoveries, it can be concluded that interim preparing can increment VO2 max in futsal athletes.

The Impact of Rope Skipping Preparing on Expanding VO2 Max in Futsal Extracurricular Students at MA Nurul Hadid Cirebon. Based on the t-test comes about in Table 3.6, the increase in VO2 max among futsal extracurricular students at MA Nurul Hadid Cirebon through rope skipping training yielded a calculated t-value (3.335) > table t-value (2.262). Thus, it can be concluded that rope skipping training has an effect on increasing VO2 max among futsal extracurricular students at MA Nurul Hadid Cirebon. Rope skipping training is one of the training methods to improve endurance, particularly aerobic endurance. Rope skipping training can be done individually or with a coach's programme. Rope skipping training can be conducted in open or closed spaces, depending on individual needs. Rope skipping training is conducted through a progressively structured programme, which involves periodically increasing the load, including intensifying the training intensity, so that students can adapt effectively. It can be performed by jumping with both feet simultaneously, using a rope with both ends held in both hands and swung over the head. This condition must be maintained through continuous training, which involves 14 consecutive sessions. In each session, the escalated of the preparing is expanded, resulting in training effects such as improved endurance and optimised heart and lung function when circulating oxygen throughout the body.

In rope skipping training, athletes are required to move optimally when jumping over the rope with both feet, so that the continuous activity indirectly improves heart and lung performance, thereby increasing VO2 max. Rope skipping training has the effect of increasing VO2 max, ensuring that the body's oxygen requirements are met. Based on the investigate discoveries, it can be concluded that rope skipping preparing can increment VO2 max in futsal competitors.

Interval Training is More Effective for Increasing VO2 Max in Futsal Extracurricular Students at MA Nurul Hadid Cirebon. Based on the research results, hypothesis 3 was rejected. This is because, based on the examination of the autonomous tests t-test for VO2 max advancement in futsal extracurricular students at MA Nurul Hadid Cirebon, both interval training and rope skipping training yielded a calculated t-value (1.870) > table t-value (2.101). This result shows that the calculated t-value is littler than the table t-value, subsequently, it is translated that there's no critical contrast between interim preparing and rope skipping preparing, or both exercises are equally effective in improving VO2 max in students participating in the futsal extracurricular activity at MA Nurul Hadid Cirebon.

5. CONCLUSIONS

Based on the comes about of the past investigate and talk, the taking after conclusions can be drawn: There's an impact of expanding VO2 max in MA Nurul Hadid Cirebon futsal extracurricular understudies with interim preparing, as prove by the t-value (6.419) > t-table (2.262). There's an impact of expanded VO2 max on futsal extracurricular understudies at MA Nurul Hadid Cirebon through rope skipping preparing, as prove by the calculated t-value (3.335) > table t-value (2.262). Interim preparing and rope skipping preparing are similarly viable in making strides VO2 max in futsal extracurricular understudies at MA Nurul Hadid Cirebon since

there's no significant contrast within the comes about of the two preparing strategies, as prove by the calculated t-value (1.870) < t-table (2.101).

Based on the over conclusions, the comes about of this consider have suggestions for: A valuable reference for futsal extracurricular coaches at MA Nurul Hadid Cirebon regarding VO2 max data for futsal extracurricular students at MA Nurul Hadid Cirebon, The study found that interval training and rope skipping training have an effect on VO2 max in MA Nurul Hadid Cirebon futsal extracurricular students, thereby serving as a reference for coaches to develop effective training programs to improve VO2 max in MA Nurul Hadid Cirebon futsal extracurricular students.

This study was conducted to the best of our ability, but it still has limitations and shortcomings, including: The researchers did not conduct further follow-up after the study was completed, so the results may be temporary, and regular training is necessary, the researchers were unable to control the subjects' activities during data collection, so some subjects were in good physical condition at the time of the test, while others were not. However, the data obtained was still used to save time and research costs.

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For futsal athletes who still have low VO2 max, it can be improved through interval training or rope skipping exercises. For coaches, interval training and rope skipping can be used as a training program to improve endurance for all players. For future researchers, it is recommended to consider conducting this study using different subjects, both in terms of quantity and quality of players. For researchers intending to continue or replicate this study, it is advised to implement stricter controls within the experimental series.

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