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The Effect of Crossfit Training on Increasing The Strength Endurance of Middle Distance Athletics Athletes

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Abstract

Introduction: Strength endurance is an important role in supporting the performance of middle-distance athletic athletes, which can be improved through CrossFit training. Objectives: This study aims to determine the effect of CrossFit training on increasing the strength endurance of middle-distance athletic athletes. Research method: This study uses experimental methods with a quantitative approach, the design used is pre-test post-test control group design. The sample consisted of 20 members of UPI athletic student activity units. Data was collected using an assessment sheet and analyzed using Test Of Homogeneity and Independent T-test. Results and Discussion: The results showed that there were significant differences before and after training in the experimental post-test and control post-test groups with a significant value (2-tailed) of 0.030 (<0.05) or H0 was rejected, which means that CrossFit training has a significant effect on strength endurance. Conclusion: training using CrossFit training is one solution to increase muscle strength endurance in middle-distance athletic athletes.

How to Cite

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INTRODUCTION

CrossfitTraining is considered as functional movement training that is varied, high intensity, and carried out consistently, aiming to improve physical work capacity, especially in terms of body endurance, strength, and flexibility through various functional movements.(Tibana et al., 2021). Therefore, different types of training sessions known as Workout of the Day (WOD) combine different exercises and activities, such as cycling, running, rowing, weight lifting, and other types of exercises.(Tibana et al., 2021).

CrossFitCompetitive events often consist of two stages, namely online qualifiers (a series of previously unknown training challenges completed over a period of weeks), where the top performers advance to territorial events (such as South America, North America, Africa, Asia, etc.). The CrossFit Open is an official competition organized by CrossFit Inc. that is part of one of the largest sports competitions on a global level, with over 239,106 participants in 2020.

Specific training for CrossFit Open usually varies by region (such as South America, North America, Africa, Asia, etc.), depending on the competency characteristics of each region. Endurance training generally uses light loads and involves tasks with longer durations. In addition, only the rowing ergometer is traditionally recommended as a repetitive training tool, usually with a low training volume.

Despite its growing popularity, the literature on this topic is still limited. Several previous studies have explored the relationship between variables such as anthropometric profile, cardiovascular capacity, muscular strength, and explosive power with CrossFit athlete performance. For example, MartSayanez-GHaimez et al evaluated the relationship between muscular strength (full squat) and performance at the 2017 CrossFit Open, showing that strength and power indices measured in the squat test were positively associated with CrossFit. However, according toButcher et al., (2015), states that performance in CrossFit is different from most other sports, which allow athlete performance to be predicted and assessed through testing of muscle strength, physiological variables, and aerobic and anaerobic capacity (testing conducted on a treadmill and Wingate respectively). In CrossFit, although some performance evaluation is done through several types of tests (such as the CrossFit Open and other standardized tests), these trials do not have clear specifications regarding the variety of movements and the number of repetitions during the exercise, whether related to strength, calisthenics, or endurance.

The previous year's (2020) training did not show any specific characteristics related to muscular strength endurance or cardiovascular system. On the other hand, the athletes performed several repetitions of exercises that included calisthenics elements such as burpees, handstand push-ups or handstand-walks, chest to bar pull-ups, toes-to-bar, and bar muscle-ups. These exercises were combined with the use of light weights, such as wall balls, thrusters, clean snatches, overhead lunges with dumbbells, and box step-ups with dumbbells. However, it is not yet known for certain whether muscular strength endurance tests have a direct relationship with performance in the CrossFit Open. Evaluation of previous physical performance can provide efficient information for analysis and feedback, which is very important for athletes and coaches in determining the primary performance metrics in a particular competition. Such information can also be useful in developing evidence-based strategies during the competition and identifying potential suboptimal performance.

Thus, the purpose of this study was to determine the effect of CrossFit training on increasing strength endurance in middle-distance track and field athletes. The results of this study are expected to provide information for coaches and athletes in designing more effective training programs to improve the performance of track and field athletes.

METHODS

The number of volunteers or samples is a portion of the population being studied.(Asrulla et al., 2023). In this study, the number of volunteers recruited was 20 people (10 men and 10 women) with an average age of 19 years, from a total population of 49 members. Population is defined as a group of subjects or objects that have certain characteristics determined by researchers to be studied and conclusions drawn.(Subhaktiyasa, 2024). The characteristics of volunteers in this study include:

1. Active Students of Indonesian Education University.
2. Active member of the Student Activity Unit (STUDENT ACTIVITY UNITS) for athletics.
3. 19 years old.
4. Not taking performance enhancing drugs.
5. Have experienceactive sports for at least six months.

Participants or volunteers are advised to rest for 6-8 hours the night before the test, maintain a good diet and adequate hydration, avoid heavy physical activity in the 48 hours before the testing session, and not consume cigarettes, alcoholic beverages, and caffeine in the 24 hours before the session.

The method used in this study is an experiment with a quantitative approach. The research process was carefully designed to examine the influence of independent variables, namely CrossFit training and dependent variables, namely increasing strength endurance in middle-distance athletes. In the quantitative approach, data are analyzed systematically using statistical procedures. Through this approach, significant information can be obtained regarding differences between groups and the relationship between independent and dependent variables.(Hardani et al., 2020). The research design used was a pre-test post-test control group design, in which all participants underwent an initial assessment (pre-test) and a final assessment (post-test) conducted before and after the CrossFit program. The CrossFit program in this study consisted of five training sessions carried out for five weeks, in the period from March to April. The methodological steps in this study are as follows **Figure 1.**

Participants take a pre-test prepared by the researcher. Research instruments are tools used in the learning and research process to collect accurate and relevant data and information. In general, research instruments function as tools to collect data in a study.(Saefuddin et al., 2023). The basic assessment used in this study was the Wall Squat Test, which aims to monitor the development of quadriceps muscle strength endurance.

The five-week WOD (Workout of the Day) training program in this study consisted of progressively varied formats. In Week 1, participants performed a 16-minute AMRAP (as many rounds as possible) session composed of four 4-minute rounds alternating between two exercises every 30 seconds, including air squat & burpee, squat thrust & step-up, one-leg squat & squat jump, and burpee & climber run. Week 2 was a 10-minute AMRAP involving five movements: air squat, back lunges, burpee, squat jump, and step-up. Week 3 followed an EMOM (every minute on the minute) format for 10 minutes, combining shuttle runs with bodyweight exercises such as squats, lunges, burpees, squat jumps, and step-ups. Week 4 repeated the structure from Week 1. Week 5 featured a 25-minute AMRAP including ten exercises: air squat, back-to-back, glute bridge, mountain climber run, reverse crunch, heel raise, burpee, vertical jump & broad jump, high knees, and shoulder tap.

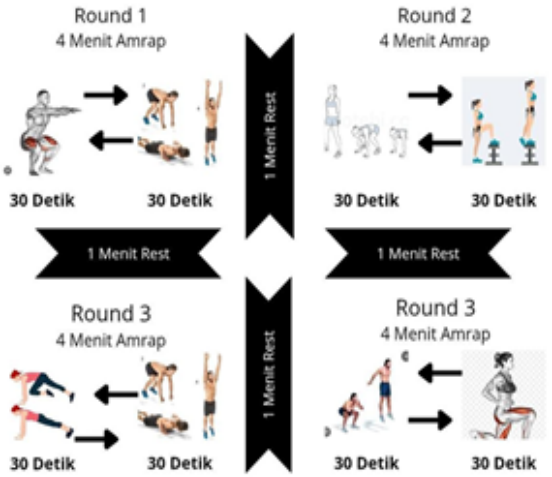

Figure 2. Exercise Description

Figure 2 shows the training description, namely in round 1, participants did 4 minutes of training with squat and burpee movements, each for 30 seconds. Followed by a 1-minute rest. In round 2, participants did 4 minutes of training

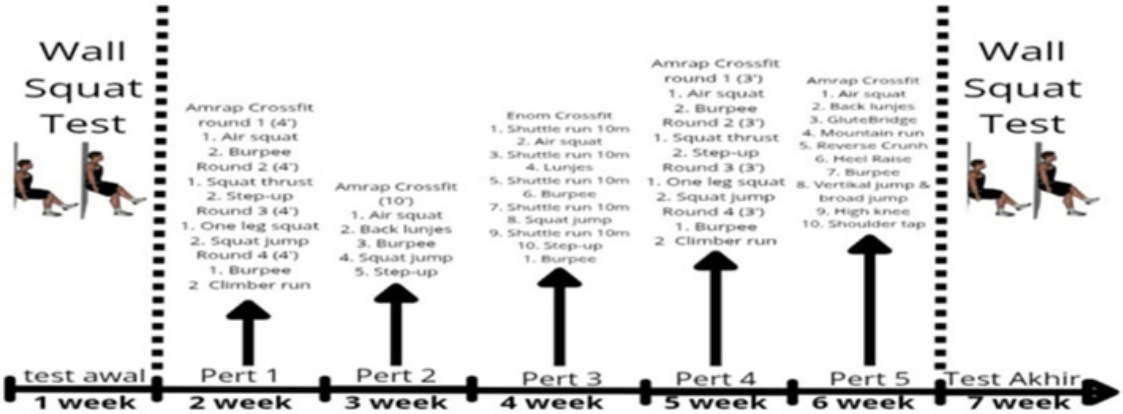

Figure 1. Description of Study Timeline

with squat thrust and step up movements, each for 30 seconds. Followed by a 1-minute rest. In round 3, participants did 4 minutes of training with one leg squat and squat jump movements, each for 30 seconds. Followed by a 1-minute rest. In round 4, participants did 4 minutes of training with burpee and climber run movements, each for 30 seconds.

Processing, analyzing, and interpreting research data is done using SPSS software. Furthermore, researchers compile conclusions and suggestions from the results of the analysis (Fadluloh et al., 2024).

RESULTS AND DISCUSSION

Table 1. Descriptive Statistics

	N	Min	Max	Mean	Std. Deviation
Pre-TestExperiment	10	24	67	42.05	14,784
Post-TestExperiment	10	32	72	49.60	13,882
Pre-testControl	10	14	62	32.95	15.134
Post-TestControl	10	15	63	34.20	15,252
Valid N (listwise)	10				

Table 1 shows the pre-test and post-test results of the experimental group and the control group. The average pre-test score in the experimental group was 42.05, while the post-test score increased to 49.60. Meanwhile, the control group had an average pre-test score of 32.95, and a post-test score of 34.20.

The standard deviation of the pre-test score in the experimental group was 14.784, and for the post-test it was 13.882. In the control group, the standard deviation of the pre-test was 15.134, and the post-test was 15.252.

The lowest pre-test score in the experimental group was 24, while in the control group it was 14. For the lowest post-test score, the experimental group reached 32, while the control group achieved 15.

The highest pre-test score in the experimental group was 67, and in the control group 62. The highest post-test score in the experimental group reached 72, while in the control group 63.

The number of participants (N) in each measurement, both pre-test and post-test, was 10 people.

Presents the results of the data normality test based on the Wall Squat Test. The pre-test statistical value in the experimental group is 0.931 with df = 10 and a significance value (Sig.) of 0.200. Meanwhile, the post-test results of the experimental group show a statistical value of 0.945, df = 10, and Sig. = 0.200.

In the control group, the pre-test statistical value was 0.952, with df = 10 and Sig. = 0.200. While the post-test statistical value in the control group was 0.951, with df = 10 and Sig. = 0.200.

Based on the results of the normality test, all significance values (Sig.) > 0.05. Therefore, it can be concluded that the data in each group is normally distributed. Therefore, the author uses a parametric approach in hypothesis testing. The results of the hypothesis test are presented in Table 4.

The test results on the dataThe pre-test and post-test of the experimental and control groups showed a significance value (Sig.) of 0.728. Because this value is greater than 0.05, it can be concluded that the data is normally distributed.

There is a significant difference between the post-test results of the experimental group and the post-test of the control group, with a significance value (Sig. 2-tailed) of 0.030. Because this value is smaller than 0.05, it can be concluded that there is a statistically significant difference between the two groups after the intervention.

This study aims to analyze the relationship between muscle strength endurance of middle-distance track and field athletes with CrossFit training performance.Endurance is the body's ability to carry out activities or work for a long period of time without experiencing significant fatigue, and is accompanied by the ability to recover quickly.(Mustofa & Sukamti, 2024).The results of this studyconfirmed the initial hypothesis that specific tests of muscular strength endurance had a strong relationship with CrossFit 2025 performance. ForTo increase the strength and endurance of athletes, various training methods have been applied, ranging from traditional weight training, plyometric training, to high-intensity interval training.(Warni et al., 2017). Endurance Leg muscle strength is the result of physical activity that is done routinely. The more often someone does physical exercise that involves leg muscles, the stronger and better the endurance of the muscles.(Astuti, 2020).

Muscular strength endurance has a strong relationship with athletic performance in CrossFit 2025. SportsMiddle distance running athletics demands a complex combination of speed, strength and endurance.(Trengginas et al., 2023). This finding may be related to the specificity of

the test used in this study.

If the leg muscle strength is weak, the risk of injury increases. This is because the leg muscles are one of the main points of support for the body in various physical activities.(Hananingsih, 2017). To keep leg muscles from becoming weak points and avoid potential injuries, a structured and effective strength training program is needed. One relevant approach is CrossFit training, a fitness training program that combines various elements such as weight training, gymnastics training, and metabolic conditioning.(Schlegel, 2020).

In the previous review, these findings were in line with research conducted byTibana et al., (2021)entitled "Local Muscle Endurance and Strength Had Strong Relationship with CrossFit Open 2020 in Amateur Athletes". One of the important characteristics associated with CrossFit is the variation in intensity, duration, and skill. High-Intensity Interval Training (HIIT) aims to improve cardiovascular endurance and anaerobic capacity, both of which contribute to increased strength endurance(Kuswari & Gifari, 2020).

CrossFit trainingemphasizes functional training that involves many muscle groups simultaneously, so it can help improve movement efficiency and reduce the risk of injury in athletes. (Jacob et al., 2020). In other types of training, the most common characteristic is a high number of repetitions with relatively light loads, which emphasizes the muscular endurance aspect. Therefore, the correlation between muscular strength endurance and performance in CrossFit Open is highly dependent on the characteristics of the training performed, and cannot be fully measured based on the results of only one type of test.

The results of the study showed that there was a significant difference between the experimental post-test group and the control post-test group, with a significance value (2-tailed) of 0.030 (<0.05). Thus, H_0 was rejected. This shows that CrossFit training has a significant effect on increasing strength endurance(Yimeng, 2023).

One important aspect of the practical application of this research is to emphasize that organizers and coaches must understand how to organize training programs taking into account the different physical demands of each competition. For example, if a competition has many events with high weight loads, then it will be more advantageous for athletes with greater muscular strength. Therefore, the findings of this study can help sports coaches and practitioners in assessing the effectiveness of current training programs and directing training strategies for upcoming competitions. For example, if an athlete's muscular strength endurance is significantly lower than the competitive athlete's value in that modality, then training can be focused on improving that physical capacity, while maintaining other physical capacities.

Although the findings of this study are interesting, there are some limitations that need to be addressed. First, this study used a relatively small sample (N=20) with specific athlete characteristics and within a limited time frame. Second, the test used, namely the Wall Squat Test, did not cover all aspects that are usually tested in CrossFit Open competitions. Third, the results of this study only apply to amateur athletes from a specific region. Therefore, these findings cannot be directly generalized or applied to elite athletes or athletes with different experiences, thus affecting the scope of generalization and extrapolation of the results of the study.

CONCLUSION

This study shows a significant relationship between CrossFit training and increased strength endurance in middle-distance athletes. This indicates that CrossFit training is very influential in increasing muscle strength endurance that supports athlete performance when training or competing in athletics. Thus, regular training using CrossFit can be an effective solution to increase muscle strength endurance in middle-distance athletes.

From a practical perspective, coaches and sports practitioners can utilize these findings to assess athletes' physical fitness and to adjust the distribution of training sessions based on underdeveloped physical needs, in order to ensure optimal physiological adaptations ahead of a particular competition. For further research, it is recommended to conduct studies with larger sample sizes and include athletes with varying levels of training to enhance the generalizability of the findings. In addition, it is important to examine whether the training method used has a significant effect when compared directly to athletes who do not undergo the same training method—for example, by conducting match simulations over the same distance to determine which group performs better. Since this aspect has not yet been tested in the current study, it can be considered a limitation and also a suggestion for future research.

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