ORIGINAL RESEARCH ARTICLE

Diponegoro International Medical Journal 2024 December, Vol 5, No.2: 73-76
e-ISSN: 2745-5815

The Effect Of Hiit Training (High Intensity Interval Training) On Upper Body Muscle Strength UNDIP FK Students

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Keywords:

High-Intensity Interval Training
Upper body muscle strength

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Article history:

Received 05-03-2024
Accepted 28-07-2024
Availableonline10-12-2024

ABSTRACT

Background: High-Intensity Interval Training (HIIT) is a form of physical training characterized by its high intensity, faster speed than regular physical training, and faster recovery speed. High-Intensity Interval training is often used by athletes because of its potent effect in increasing muscle growth and promoting health. The upper limb muscles are often used on a day to day basis. This research was conducted to find out the effectiveness of HIIT training in developing the upper body muscles.
Objective: T To determine the effectiveness of HIIT in developing the upper body muscles.
Methods: The research is quasi experimental, with pre-test and post-test control group, with 2 participating groups, which are the sample group and the control group. The independent variable of the research is High-Intensity Interval Training, while the dependent variable is upper body muscle strength.
Results: Based on the study, High- Intensity Interval Training that focuses on the upper body muscles has a significant correlation with the upper body strength of Diponegoro University Medical College students. The treatment group showed an increase in throw distance during the SMBT, while the control group showed stagnating and decreasing throw distance.
Conclusion: High-Intensity Interval Training is proven to be an effective exercise to increase upper-body strength on Diponegoro University Students.

DIMJ, 2024, 5(2), 73-76DOI: https://doi.org/10.14710/dimj.v5i2.22210

1. Introduction

High-intensity interval training is high- intensity physical exercise, faster than regular exercise, and has a faster recovery period. High-intensity interval training is often done by athletes because it has a high intensity and shows a great effect on muscle development and health in the human body.[1] High-intensity interval training is considered an efficient type of exercise because it has short sessions.[2] High-intensity interval training is included in the type of anaerobic training because it is short in duration and has a high intensity.[3]

The HIIT protocol should follow the FIIT principle (Frequency, Intensity, time, Type), where frequency is the number of HIIT exercises performed per week, intensity in HIIT refers to the ratio of rest time and work time during exercise,[4] time is the length of 1 training session where there is research with results that say that 10 minutes of HIIT training can show physiological changes5, and Type is the preferred type of exercise performed in the HIIT protocol.[4]

By considering current needs and limitations, HIIT training is an appropriate exercise choice. This is because HIIT exercise does not require a long time, is efficient, does not require equipment that costs a lot of money, and can be done anywhere. Apart from that, various kinds of sports movements can be classified as HIIT training as long as they comply with HIIT training principles so that each individual can adapt to their preferences and desires for the development of their own physical fitness.

Various previous studies have linked HIIT training with various parameters to measure health and fitness, including measurements of VO2 max, agility and leg muscle explosive power. Although the relationship between HIIT training and leg muscle explosive power has been established, the author has not found research that looks for a relationship between HIIT training and upper body muscle strength, even though upper body muscle strength is related to the ability to carry out many daily activities.[6] Researchers are interested in researching this topic because HIIT training can be structured with varied training techniques so that it can focus on upper body muscles. This research was conducted with the aim of finding out the effectiveness of HIIT training as an exercise choice in developing upper body muscles. Amongst college population it is assumed that medical students have greater knowledge about healthy lifestyle such as exercise. Thus this research chose medical students as its subject under the

assumption that the students have experience in exercising thus, and easier process in data gathering.

2. Methods

The research was carried out in a quasi- experimental manner with a pre-test and post- test control group where there were 2 groups, namely the sample group and the control group. Samples were taken using a purposive sampling methodwhere the samples taken were adjusted to the exclusion and inclusion criteria of thesample. Inclusion criteria included being male, aged 18-22 years and a normalBMI, and before becoming a research sample, not doing exercise > 3 times a week, while the exclusion criteria included were experiencing upper body muscle injuries, experiencing conditions that hinder the process of data collectionand treatment, such as illness, and a history of musculoskeletal and cardiovascular disease.

The independent variable in the research is High-Intensity interval training, while the dependent variable in the research is upper body muscle strength. Upper body strength was measured with the Seated Medicine Ball throw test, where the sample throws a medicine ball while seated in an upright position. The further the length of the throw the stronger the upper body strength. The data will be entered into the IBM SPSS Statistics for Windows program and statistical analysis will be carried out in the program. The descriptive test is carried out to find the frequency and distribution of demographic data in the form of mean and frequency. Data normality was tested with Shapiro-Wilk because the sample size was <50. In the normality test, if the data is normally distributed, the paired T-test will be used, if the results are not normally distributed, then the hypothesis test will be carried out using the Wilcoxon signed-rank test. In hypothesis 2, if the distribution is normal, use the unpaired T-test, and if it is not normally distributed, data analysis uses the Mann-Whittney test.

3. Result

The distribution of participating research subjects is listed in the characteristics table with the number of subjects being 35 people and 5 people experiencing dropout. The characteristics of the research subjects are presented in the following table:

Table 1.Subject Characteristics

Characteristics of Research Subjects	Amount	%
Force		
2020	31	88.57%
2021	4	11.43%
Age		
18	1	2.85%
20	7	20%
21	22	62.85%
22	5	14.3%
Gender		
Man	35	100%

Table 1 shows that the majority of research subjects were 31 students from the Class of 2020, namely 88.57%, while most of the subjects were 21 years old, namely 22 students, namely 62.85%. All research subjects were 35 male students.

	Group		**P**
	Treatment	Control	
Pre-test	390.90 ± 55.74	385.33±70.7	0.798§
Post test	444.55±65.33	379.28±71.86	0.008§*
Difference	53.65 ± 25.72	-6.06 ± 43.49	<0.001§*

Table 2. Normality Test

	Group	Mean ± SD	Median	P£(min-max)
Pretest	Treatment	390.90 ±55.74	349.33(302.67-498)	0.589*
	Control	385.33 ±70.77	377(267.67-492)	0.313*
Posttest	Treatment	444.55 ± 65.33	453.33(326-577.33)	0.787*
	Control	379.28 ± 71.86	398.5(237-486)	0.309*
Difference	Treatment	53.65 ± 25.72	42.33(22.67-98.33)	0.066
	Control	-6.06 ± 43.49	-18.67(-64-109)	0.193

Description: * Normal (p > 0.05); £ Shapiro-wilk

Table 2 shows the distribution of research subjects' throwing data. All throwing results from both the treatment and control groups had results of p>0.05, indicating that the data distribution of the research subjects was normal.

Table 3. Effects of HIIT on muscles strength of the upper body

	Group	
	Treatment	Control
Pre-test	390.90 ± 55.74	385.33±70.77
Post test	444.55±65.33	379.28±71.86
P	<0,001¶*	0,562¶

Notes: * Significant (p < 0.05); § Independent t; ¶ Paired t

Table 3 is a hypothesis test of the effect of HIIT training on upper body muscle strength, where p<0.001 was obtained in the treatment group, indicating that there was a significant increase before and after training, whereas in the control group, p>0.005 was obtained, indicating there was no significant increase.

Table 4. Difference of Seated Medicine Ball Throw in Treatment and Control

	Group		**p**
	Treatment	Control	
Pre test	390,90 ± 55,74	385,33 ± 70,77	0,798§
Post test	444,55 ± 65,33	379,28 ± 71,86	0,008§*
Difference	53,65 ± 25,72	-6,06 ± 43,49	<0,001§*

Notes: * Significant (p < 0.05); § Independent t; ¶ Paired t

Table 4 is the result of the hypothesis testof the difference in SMBT results for the control and treatment

groups, where the difference in the throwing results of the two groups during the pre-test and post- test was <0.001, which shows that there is a significant difference between the group that took part in the training and the control group

4. Discussion

Based on the results of research on both major and minor hypotheses, there was an increase in SMBT throwing results which measure upper body muscle strength including the pectoralis, shoulder and elbow flexor muscles[7] in the treatment group as indicated by an and posttest results which were proven to be significant. .In the control group there was no significant increase in SMBT throwing results. In addition, some control subjects experienced decreased SMBT throwing results. A decrease in muscle strengthcan occur if a person does not exercise for 3 weeks.[8] In this study, control subjects did not exercise for 6 weeks, so it is in accordance with previous research, where there will be a decrease in muscle strength. The results of this study show that HIIT has an influence on upper body muscle strength. In previous research, it was found that the HIIT protocol could improve various fitness parameters according to the type of exercise chosen, including increasing leg muscle power and agility, leg muscle strength, and upper body performance,[1,9,10] whereas in this study the protocol was used. HIIT focuses on upper body muscle strength with push- ups, planks, mountain climbers and tricep dips. These exercises target the upper body muscles [11,12] which work in SMBT as a parameter assessing upper body muscle strength.[7]

Linda's (2021) research results show that a HIIT training protocol that focuses on lower body muscles influences increases in leg muscle power and agility[1], while Turner's (2018) research shows that a HIIT training protocol that focuses on the upper body influences an increase in player performance in cricket[10]. This is in line with the findings in this study, where the HIIT protocol which focuses on bodyweight training of upper body muscles causes an increase in muscle strength according to the muscles targeted during training. HIIT training is carried out for 6 weeks, where the training length is in accordance with the theory of Powers (2018), which states that there is an increase in physical fitness after carrying out anaerobic training for 4-10 weeks.[13] The HIIT training protocol has been adapted to the principles of overload physical training by setting the frequencyof HIIT training to 3 times a week, using progressive loads by increasing the ratio of training to rest every 2 weeks of training, as well as specificity where the muscles trained are adjusted to the needs, namely the upper body muscles in this research.

5. Conclusion

Based on the research results, it can be concluded that HIIT training can increase upper body muscle strength. In the treatment group, there was a significant increase, while in the control group there was no significant increase, which shows the effectiveness of HIIT as an exercise choice for increasing upper body muscle strength.

Ethical Approval

This research was approved by the Health Research Ethics Committee of the Faculty of Medicine, Universitas Diponegoro (Protocol Numbers: 123/EC-H/KEPK/FK-UNDIP/X/2023).

Conflicts of Interest

The authors declare no conflict of interest.

Funding

No specific funding was provided for this article.

Author Contributions

Conceptualization, Sutriono, Endang, Eriawan, Yora, Sofyan; Methodology, Sutriono, Endang, Yora; software, Sutriono; validation, Sutriono, Endang; formal analysis, Sutriono; investigation, Sutriono; resources, Sutriono; data curation, Sutriono, Endang; writing—original draft preparation, Sutriono; writing—review and editing, Sutriono, Endang, Eriawan, Yora, Sofyan; visualization, Sutriono; supervision, Sutriono, Eriawan, Sofyan; project administration, Sutriono; funding acquisition, Sutriono".

Acknowledgments

We would like to thank the animal laboratory staffs that helped in taking care the animals used in this study.

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