



Research on the Influence of High Intensity Interval Training on Physical Quality Based on Data Analysis

Qiuhuai Li ^{*1,a}, Kai He ^{2,b}

¹Department of Basic Courses, Beijing Information Technology College, Beijing, China

²Department of Physical Education, Capital University of Economics and Business, Beijing, China

*^aliqh@bitc.edu.cn, ^b519101739@qq.com

corresponding Author: Qiuhuai Li

Abstract

Improving students' physical health and physical quality through different combinations of training has always been one of the focuses of physical education teachers' research. This paper studies the influence of training on the test data of the *National Student Physical Health Standard*, by carrying out high-intensity intermittent training and medium-intensity aerobic training with different amount of exercise, analyzing and processing the data based on SPSS 12.0 software. It is found that although the exercise time of high-intensity interval training is less, the effect of high-intensity interval training on 50m running, 1000m running, standing long jump and vital capacity is significantly better than that of medium-intensity training. The frequency of high-intensity interval training three times a week has a good effect, which may have the best effectiveness of training.

Keywords: *High intensity interval training; Physical quality; Data analysis*

1. INTRODUCTION

In recent years, high-intensity interval training is one of the key points of various sports training research. Intermittent training method is a common routine method in sports training, which is very popular with coaches at home and abroad. At present, good training results have been achieved in physical dominated speed training and physical dominated endurance training. High intensity interval training is a physical exercise characterized by short-term intermittent and vigorous activities, with rest or low-intensity exercise between them. It is a branch of interval training method. Through this training method, the heart rate of the human body can be increased rapidly during exercise and burn more fat and calories.

Foreign scholars have studied more on the physiological and biochemical significance of high-intensity intermittent training. High intensity intermittent training can increase stroke output and make full use of oxygen. High intensity intermittent training can enhance the aerobic oxidation ability and glycolytic enzyme activity of athletes or ordinary people. High intensity intermittent training can also improve the high-energy phosphate reserve in athletes and the ability

of skeletal muscle to buffer hydrogen ions. The research of Canadian and Japanese scholars shows that systematic high-intensity intermittent training can better improve the maximum oxygen intake of the body compared with fixed cycle training.

A large number of research results show that high-intensity interval training has more advantages than medium-intensity continuous training. By comparing the influence of high-intensity intermittent training and medium-intensity continuous training on the test results of the National Students' Physical Health Standard, this study tries to explore a combination method that is more conducive to improving students' physical health and physical quality training.

2. RESEARCH OBJECT AND METHOD

2.1. Research Object

The subjects are a certain number of college boys in higher vocational colleges. They are ordinary students who have not received sports professional training. Their body mass height index (BMI) ≥ 26 or obesity index (fat%) $\geq 29\%$. The subjects have a deep understanding of the process and purpose of this experiment before comparative training.

2.2. Grouping

60 participants were randomly divided into two groups, namely high-intensity intermittent training group (Group H) and medium intensity continuous training group (group M). Each group was randomly divided into three groups, and finally divided into H1, H2, H3, M1, M2 and M3, a total of six groups with 10 people in each group. After 10 weeks of training, the number of six groups is 10, 8, 7, 9, 9 and 8 respectively.

2.3. Research Scheme

Before the intervention training, 60 subjects were tested according to the *National Students' Physical Health Standard*. After 5 weeks of intervention training, the subjects were retested according to the *National Students' Physical Health Standard*, and a new exercise intensity training scheme was designed according to the test results to guide the exercise training intervention scheme for the next 5 weeks. After 10 weeks of training, 60 subjects were tested for the third time according to the standard, and the test results were recorded and analyzed. During the 10 weeks training experiment, subjects were required to maintain their original daily life and eating habits.

According to the test results of the *Maximum Oxygen Uptake (VO_{2max})* before the intervention training, group H and group M respectively according to the running speed corresponding to the maximum oxygen uptake of 85% and 50%, and the running speed of group H multiplied by 2.5 minutes is the corresponding running training distance.

During the training, the subjects were supervised by the coach to complete the corresponding running training distance within the specified time (2.5 minutes); during the interval training, the subjects must walk through the track and field to the original starting point in a straight distance and prepare for the next high-intensity run. The whole high-intensity interval training is divided into four exercise interval cycle training, with a total exercise time of 20 minutes.

In the moderate intensity continuous training group, the running distance of the subjects was calculated by multiplying the running speed by 40 minutes. During the training, the subject was supervised by the coach to complete the corresponding running training distance within 40 minutes of the specified time. The supervised coach reminded the subject every 200 meters that the speed of the subject was appropriate, too slow or too fast, and trained in strict accordance with the predetermined exercise intensity to ensure the quality of the experiment.

2.4. Test Index and Method

The *Maximum Oxygen Uptake Test (VO_{2max})* and the *National Students' Physical Health Standard*.

2.5. Data Processing

SPSS 12.0 software was used to analyze and process the data. The intra group differences of different groups after 10 weeks of intervention training were analyzed, and paired samples were used for significant sample t-test. The differences between different groups after 10 weeks of intervention training were analyzed by independent sample t-test. $P < 0.05$ was Significant, $P < 0.01$ was Extremely Significant.

3. RESULTS AND ANALYSIS

3.1. Normal Distribution Test of Experimental Results of Subjects

Most of the indexes of each group before intervention training, after 5 weeks of intervention training and after 10 weeks of intervention training are normally distributed. The test results of each group show that the experimental data meet the conditions of adoption and analysis.

3.2. Intra Group Comparison of Changes in Different Experimental Groups Before, After 5 Weeks and 10 Weeks of Exercise Intervention

Table 1: List of index measurement results before, after 5 weeks and after 10 weeks of exercise intervention in different groups

G	Stage	BMI	Vital Capacity (ml)	Standing Long Jump (cm)
M1	Before	28.8±2.0	4743±586	201.9±21
	5Weeks	29.0±3.2	4802±729	204.2±29
	10Weeks	28.4±2.1	4843±738	207.1±30
M2	Before	29.3±2.6	4673±792	200±23.6
	5Weeks	28.9±3.5	4722±887	201.3±21
	10Weeks	28.3±3.2	4804±653	203.0±22
M3	Before	28.8±1.9	4337±764	199.3±23
	5Weeks	27.9±2.7	4444±659	203.1±29
	10Weeks	27.0±3.4	4612±604	202.9±25
H	Before	30.0±2.3	4812±716	199.5±22

	5Weeks	29.0±3.6	4955±669	200.9±21
	10Weeks	27.9±2.1	5011±749	204.9±22
H2	Before	29.2±2.1	4357±719	201.6±19
	5Weeks	28.1±3.7	4442±678	205.3±20
	10Weeks	28.4±2.2	4588±709	207.6±16
H3	Before	28.6±1.6	4202±567	201±19.9
	5Weeks	27.0±2.1	4343±727	205.9±21
	10Weeks	27.2±1.5	4569±779	209.7±16
G	Stage	Pull-up	Sitting body flexion (cm)	50 Meter Run
M1	Before	0.7±1.1	9.5±5.1	8.5±0.6
	5Weeks	0.9±1.2	10.2±2.0	8.5±0.7
	10Weeks	1±1.0	10.9±5.1	8.4±0.7
M2	Before	0.2±0.4	12.4±8.2	8.8±0.9
	5Weeks	0.4±0.5	14.0±4.2	8.7±0.9
	10Weeks	0.5±0.6	14.6±6.5	8.6±0.9
M3	Before	1.0±1.1	11.8±4.1	8.5±0.8
	5Weeks	1.1±1.2	12.3±6.9	8.3±0.6
	10Weeks	1.1±1.1	13.4±5.3	8.1±0.9
H	Before	0.6±0.8	11.9±6.0	8.5±0.8
	5Weeks	0.6±1.0	12.6±5.4	8.3±0.6
	10Weeks	0.7±1.0	13.0±7.1	8.3±0.4
H2	Before	0.9±1.1	13.7±6.1	8.4±0.5
	5Weeks	1.1±1.4	13.7±7.0	8.1±0.6
	10Weeks	1.2±1.5	14.6±7.7	7.9±0.5
H3	Before	0.7±0.9	16.2±6.2	8.4±0.5

	5Weeks	0.8±1.0	16.5±6.1	8.1±0.6
	10Weeks	1.0±0.9	16.5±6.8	7.9±0.5
G	Stage	1000 Meter Run	Total test score	
M1	Before	287±23	56.9±10.1	
	5Weeks	277±25	57.5±8.0	
	10Weeks	270±21	60.0±7.9	
M2	Before	298±30	57.6±6.0	
	5Weeks	293±32	59.0±6.2	
	10Weeks	284±28	62.4±5.8	
M3	Before	289±19	53.6±8.4	
	5Weeks	273±27	57.2±7.8	
	10Weeks	267±25	61.1±6.6	
H	Before	279±20.1	57.9±7.0	
	5Weeks	271±19	59.5±7.3	
	10Weeks	260±18	64.4±6.9	
H2	Before	281±22	54.8±8.0	
	5Weeks	269±20	57.0±7.2	
	10Weeks	258±25	62.8±6.2	
H3	Before	288±22.4	59.1±7.2	
	5Weeks	267±29	64.7±7.0	
	10Weeks	259±17	69.2±7.2	

3.3. Multiple Comparisons of the Percentage Changes of Each Index in Different Experimental Groups Before and After 10 Weeks of Intervention

According to the analysis of variance of 8 indexes in different experimental groups, multiple comparisons were made with the change of 8 indexes after 10 weeks of intervention as the dependent variable and the intervention schemes of different experimental groups as the independent variable.

Table 2: List of percentage changes of various indexes in different experimental groups before and after 10 weeks of exercise intervention

G	BMI	Vital Capacity (ml)	Standing Long Jump (cm)	Pull-up
M1	-1.9%	1.7%	2.5%	10.5%
M2	-3.6%	2.5%	1.8%	40.0%
M3	-6.0%	5.9%	2.2%	0.0%

H1	-7.3%	4.8%	3.0%	40.0%
H2	-3.9%	5.1%	3.2%	22.6%
H3	-4.7%	8.1%	4.8%	65.7%
G	Sitting body flexion (cm)	50 Meter Run	1000 Meter Run	Total test score
M1	9.9%	-1.0%	-3.3%	4.6%
M2	1.6%	-1.2%	-4.2%	5.7%
M3	0.9%	-5.7%	-5.3%	12.1%
H1	1.5%	-4.9%	-5.8%	10.9%
H2	-1.9%	-8.8%	-7.4%	16.7%
H3	-1.7%	-7.6%	-9.9%	17.9%

Table 3: List of multiple comparisons of percentage changes in each group after 10 weeks of exercise intervention

Index	G(I)	G (J)	(I-J)	P
BMI	H3	M1	-3.4%	0.031
		M2	-2.9%	0.036
	H1	M1	-5.3%	0.036
		M2	-3.4%	0.032
	M3	M1	-4.4%	0.015
		M2	-2.6%	0.026
Vital Capacity	H3	M1	6.1%	0.000
		M2	5.1%	0.000
		M3	1.1%	0.036
		H1	3.6%	0.042
	H2	M1	3.2%	0.030
		M2	2.2%	0.019
	H1	M1	2.8%	0.027
		M2	1.7%	0.037
	M3	M1	4.7%	0.027
		M2	3.5%	0.034
Standing Long Jump	H3	M1	3.3%	0.007
		M2	3.4%	0.007
		H1	2.2%	0.040
	H2	M1	1.5%	0.028
		M2	1.5%	0.028
50 Meter Run	H3	M1	-5.8%	0.000
		M2	-5.1%	0.000
		M3	-1.5%	0.004
		H1	-3.7%	0.027
	H2	M1	-7.3%	0.000
		M2	-7.2%	0.000
		M3	-2.5%	0.034
		H1	-4.6%	0.007

	H1	M1	-2.5%	0.032	
		M2	-2.3%	0.027	
	M3	M1	-4.5%	0.025	
		M2	-4.6%	0.019	
	1000 Meter Run	H3	M1	-6.5%	0.000
			M2	-6.6%	0.001
M3			-3.3%	0.005	
H1			-4.8%	0.001	
H2		M1	-3.9%	0.000	
		M2	-3.9%	0.001	
		H1	-1.9%	0.001	
H1		M1	-2.1%	0.027	
		M2	-1.8%	0.037	
M3		M1	-2.9%	0.031	
	M2	-2.7%	0.029		
Total test score	H3	M1	12.2%	0.000	
		M2	10.3%	0.001	
		M3	8.5%	0.001	
		H1	9.8%	0.001	
	H2	M1	10.8%	0.000	
		M2	8.7%	0.001	
		M3	6.6%	0.001	
	H1	M1	8.3%	0.001	
		M2	2.6%	0.027	
	M3	M1	3.2%	0.031	

4. CONCLUSIONS

By comparing the exercise training frequency of higher vocational college students, which are high-intensity intermittent training and medium intensity continuous training twice, three and four times a week, this paper tries to find the optimal exercise effect of different exercise methods and different exercise doses, so as to provide an effective reference for the fitness practice of college students. The experimental results show that:

The timeliness of high-intensity interval training on the change of body shape is significantly better than that of medium intensity continuous training. For 10 weeks, high-intensity interval training twice, three or four times a week can significantly improve the body shape; Moderate intensity continuous training twice or three times a week did not cause significant improvement in body shape. Among them, the effect of high-intensity interval training 3 and 4 times a week on the improvement of body shape is similar, while the effect of medium-intensity continuous training 4 times a week is similar to that of high-intensity interval training 2 times a week. Therefore, from the perspective of time efficiency ratio, high-intensity interval training three

times a week should be the best choice to improve students' body shape.

High intensity interval training is significantly better than medium intensity continuous training in improving the physical quality of 50m running, standing long jump and 1000m running. For 10 consecutive weeks, the high-intensity interval training group trained 3 or 4 times a week significantly improved the performance of three physical fitness tests, and the improvement range was significantly higher than that of the medium intensity continuous training group. However, there was no significant difference between the standing long jump and the 50 meters performance of the high-intensity interval training group trained 3 or 4 times a week, indicating that the high-intensity interval training 3 times a week should be one of the best choices in improving the timeliness of physical fitness.

After 10 weeks of exercise intervention, the test was conducted again according to the national student physical health standard, and the total scores of the six groups were significantly improved. However, the timeliness of high-intensity interval training group was significantly higher than that of medium intensity continuous training group. The total score of national students' physical health standard in the high-intensity intermittent training group trained 3 and 4 times a week was significantly higher than that in the medium intensity continuous training group. Therefore, from the perspective of time effect ratio, high-intensity intermittent training, which is trained three times a week, is the best choice to improve the total score of the national student physical health standard.

It can be concluded from the data analysis that although the exercise time of high-intensity interval training is less, the effect of high-intensity interval training on 50m running, 1000m running, standing long jump and vital capacity is significantly better than that of medium-intensity training. The frequency of high-intensity interval training three times a week has a good effect, which may have the best effectiveness of training.

In the training process, it is necessary to choose the high-intensity intermittent training method that best meets the physical conditions based on the students' physical quality and endurance, so as to improve the students' physical quality and sports ability step by step. For students with relatively low physical quality, teachers should take safety and efficiency as the premise and formulate reasonable exercise intensity and duration, so as to effectively improve students' physical quality.

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