

2014

BioTechnology

An Indian Journal

FULL PAPER

BTAIJ, 10(19), 2014 [10966-10970]

Study on jogging's effects on cardiopulmonary function and load of 200 college students

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ABSTRACT

Serving as a basic measure of human's physical fitness, the cardiopulmonary function also reflects human body's exercise load and affects people's choices of sports exercises. This survey is mainly focused on a jogging test taken by 200 students from Henan Institute of Science and Technology. By measuring the maximal oxygen uptake, heart rate and carbon dioxide output, the cardiopulmonary function and load as well as the physical indexes of the students could be measured. The test fully indicated the effects of jogging on the students' cardiopulmonary function and load, which in turn reflected the value and practicality of this sport. This survey enabled the students to have a further understanding of their own cardiopulmonary load, which would exert a positive influence on the students' choices of sports and their cardiopulmonary function. What mentioned above are the main purpose and aim this study. Meanwhile, by the way of statistics, the effects of jogging on the students' cardiopulmonary function could be illustrated, which laid a solid foundation of this scientific study.

KEYWORDS

Jogging; College students; Cardiopulmonary function; Test survey.



INTRODUCTION

By the way of measurement experiment, this survey explained the effects of jogging on the cardiopulmonary function of 200 students from Henan Institute of Science and Technology and studied the effects on the students' cardiopulmonary workload. Through examining the physical indexes after jogging and analyzing the workloads of fitness walking and jogging, this survey took a close look at the effects on cardiopulmonary function and workload.

THE SUBJECTS AND METHOD OF SURVEY

Subjects

The subjects of this survey were 200 college students (100 males and 100 females) with good cardiopulmonary function and physical development who were from Henan Institute Of Science and Technology. The result of this test could be well illustrated by TABLE 1.

The method

Portable measurement instrument and heart rate measurement meter were used to measure in the test of jogging taken by these 200 college students. The test was carried out on the treadmills. After the pretest, the subjects wearing the portable measurements began the test when all the indexes were in a predictable and stable state. The basic Statistics of Subjects is shown as TABLE 1.

TABLE 1 : Basic statistics of subjects(X±SD)

Gender(n=4)	Age	Height/cm	Weight/kg	Heart Rate/times	Blood Pressure/mmHg
Male(n=2)	21±1	174±4.8	65±4.2	66±5	121±8/72±6
Female(n=2)	20±1	163±2.6	53.4±4.4	71±4	126±10/72±7

The test time was 30 minutes and the treadmill speeds for males and females were 7 km/h and 6km/h respectively. In the process of the test, all the subjects jogged at uniform speeds and meanwhile their physical indexes were collected which included heart rates, oxygen uptakes and etc. As soon as the test was over, the blood pressure of these subjects would be measured.

In the second round of the 30 minutes' jogging test, the treadmill speeds for males and females were set at 8km/h and 7km/h respectively. It was the same that they jogged at uniform speeds and their physical indexes would be collected which included heart rates and oxygen uptakes. The preparing work was done at the last minute of the test and the subjects' blood pressure would be measured when the test was done.

The direct measurement method of laboratory was employed to measure the maximal oxygen uptakes. After the pretest and the physical indexes were stable and normal, the subjects began the test, riding the bicycle ergometer made in Sweden at a uniform speed until they were exhausted. This test adopted the subjective standard, RPE, as the standard of exercise load.

THE TEST RESULTS

The results of physical indexes of jogging

Through the statistics and physical indexes of TABLE 2 and Figure 1, the linear relationship between the oxygen uptakes, carbon dioxide output, pulmonary ventilation per minute and heart rate. After five minutes of the test, the the statistics and its trend graph roses gradually with the time, which could be illustrated by form TABLE 2.

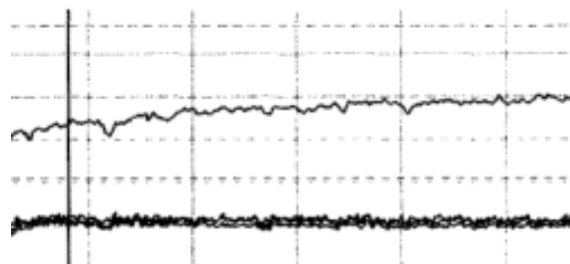
The physical indexes results in jogging

The results of this jogging test taken by 200 college students revealed that the physical indexes were closely interconnected, which could be clearly seen through Figure 1.

Because the subjects had to jog at a uniform speed, as a result, the maximal oxygen uptake and carbon dioxide output had a linear relationship. The physical indexes and the trend gradually entered a stable state after 5 minutes of the test and rose gradually with the time. But in this process, all the physical indexes were relatively stable, and all the indexes were a little higher than normal level. (refer to TABLE 3)

TABLE 2 : Physical indexes of subjects in fitness walking and jogging

	Fitness walking		Jogging	
	Males(n=20)	females(n=20)	Males(n=20)	females(n=20)
oxygen uptake	1.74±0.34	1.20±0.16	1.94±0.37	1.55±0.23
maximal oxygen uptake	53.18±14.55	54.70±17.76	59.11±13.70	70.93±15.83
heart rate/times	126.00±15.00	139.00±14.00	152.00±14.00	158.00±13.00
heart rate of maximal oxygen uptake	63.2±7.75	69.3±7.1	76.49±7.28	78.97±6.58
breathing frequency	29.72±4.96	28.66±3.95	37.49±6.46	35.81±5.90
cardiopulmonary ventilation per minute	38.52±8.04	28.19±3.68	53.92±8.91	38.60±5.96
carbon dioxide output	1.38±0.24	1.00±0.13	1.65±0.30	1.35±0.20
breathing rate	0.80±0.05	0.84±0.04	0.86±0.08	0.87±0.07
relative oxygen uptake	27.35±4.93	22.70±2.35	29.87±5.83	29.41±4.19
pulse	13.88±2.13	8.43±0.98	12.86±2.58	9.72±1.67
systolic hypertension after exercise	133.00±12.10	126.00±9.50	136.00±15.00	131.00±12.50
diastolic hypertension after exercise	76.00±12.00	71.80±7.29	73.00±15.00	71.00±10.00
REP after exercise	10.90±1.29	11.19±1.66	12.3±1.45	12.95±1.50

**Figure 1 : Pretest indexes in jogging of a student****TABLE 2 : T-test of oxygen uptake in fitness walking and fitness running**

Gender	Oxygen Uptake of Fitness Walking	Oxygen Uptake of Fitness Running	Oygen uptake	Heart Rate of Fitness Walking	Heart rate of Fitness Running	Heart rate
Males	1.74±0.34	1.94±0.37	0.056	126±15	152±14	1.42
Females	1.20±0.16	1.55±0.23	1.38	139±14	198±13	0.0015

*The oxygen uptakes of males in fitness running and fitness walking were almost the same.(P>0.05)

** The oxygen uptakes of females in fitness walking and fitness running were different.(P<0.05)

The test results of maximal oxygen uptake

In the jogging test taken by 200 college students from Henan Institute of Science and Technology, the results of the maximal oxygen uptake and heat rate were closely related which could be clearly seen through the statistics of TABLE 3 and the trend in Figure 2.

Table 3 : Physical indexes of maximal oxygen uptake of a subject

	Males(n=20)	Females(n=20)
Maximal Oxygen Uptake/L·min ⁻¹	3.32±0.39	2.23±0.35
Relative Maximal Oxygen Uptake	51.32±.31	42.34±6.07
Heart rate of Maximal Oxygen Uptake/times·min ⁻¹	187.00±9.00	186.00±6.00
REP after exercise	19.15±0.75	19.10±0.70

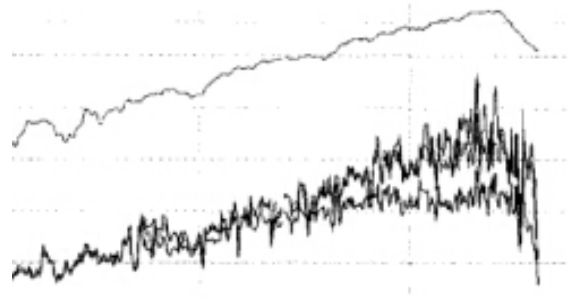


Figure 2 : Pretest indexes of maximal oxygen uptake

When increasing the exercise load gradually, the heart rates and oxygen uptake of the subjects increased continuously to the maximal oxygen uptake level, then decreased.

DISCUSSION AND ANALYSIS

Analysis of fitness walking load

The cardiopulmonary function reflects one's basis state when doing sports exercises and serves as a crucial measure of one's capability in sports. The different cardiopulmonary functions of different people decide one's choice of sports to some extent. The results of the 12-minute jogging test taken by 200 college students from Henan Institute of Science and Technology revealed that jogging has a positive effect on people's cardiopulmonary function. While the results of the Taijiquan test taken by the same 200 college students fully suggested that jogging was a relatively low-load aerobic exercise for college students and had a positive effect. In the studies regarding cardiopulmonary function and exercise load, researchers from home and abroad had done a great deal of experiments, the results of which showed that medium-load exercises were beneficial to the improvement of cardiopulmonary function. With isotope measurement techniques applied in tests, the cycle of lactic acid and the intake of lactic acid in cardiac muscle could be calculated. According to the calculating results, when people were exercised with 40% load, the intake of lactic acid in cardiac muscles accounted for 3%-9% of the total lactic acid in human bodies. But this exercise intensity could have a continuously positive effect on cardiac muscle's ability against lactic acid and thus improve the cardiopulmonary function. However, some other researchers suggested another view in their process of studies that when human's heart rate could be maintained at 60% of the normal rate, then the corresponded exercise intensity was the most appropriate. In this survey, the oxygen uptake and the level of taking in oxygen of the college students in the jogging test were explored to find out the proper exercise load based on the statistics. In the test, the oxygen uptakes of males were sustained at 1.74 ± 0.34 per minute; while that of females were concentrated on the level of 1.20 ± 0.16 per minute. The males' oxygen uptake amounted for 53.18% of the total oxygen uptake of subjects, and that of females was 46.82%. The males' heart rates were in the range of 126 ± 15 per minute, females 139 ± 14 per minute. Based on these statistics, the proportion of males reaching the heart rate of maximal oxygen uptake was 63.2% of the total number of males, and that of females was 69.3%. From these statistics, it can be seen that jogging is in the range of medium-load sports, and it can have a positive effect on fitness for college students.

The jogging test results showed that the exercise load was not large, so the oxygen uptake of the college students could be remained stable and there were no big disparities of oxygen uptakes between the males and females. From the results of heart rates, the disparity between males and females was marked which may be resulted from the outer environment's effects on the students' psychology.

Analysis of jogging load

In this test, the time of jogging is set at 30 minutes, during which the speeds of the subjects were remained uniform. By adjustment, the speeds of treadmills were set at 7km/h for males and 6km/h for females. The statistics of the test results were in line with other tests regarding the cardiopulmonary function and load and revealing. In the jogging test, the calculation of maximal oxygen uptake by the college students were more scientific and specific than the traditional step tests and the running results of 12 minutes by Kubor. Therefore, the test was of some practical significance in improving the maximal oxygen uptake and exercise intensity for college students. From the test, it could be seen that the heart rate sustained at 130-150 per minute was the most ideal, because cardiopulmonary load was acceptable by most of the college students, which would effectively push forward the improvement of the cardiopulmonary function of college students.

The average oxygen uptakes of males were 1.94 ± 0.37 liters per minute, while the maximal oxygen uptake of females were 1.55 ± 0.23 liters per minute. As for the maximal oxygen uptake, males accounted for 59.11% of all the subjects, while females took up 40.89%. In the test measurement of heart rates, males' heart rates were maintained at 152 ± 14 per minute, while that of females were in the range of 158 ± 13 per minute. For males, the heart rate of maximal oxygen uptake could reach 76.94%, while that of females could get to 78.97%. These statistics suggested that in the process of college students' exercises, the exercise load had reached above-the-average level.

Many previous studies had focused on the effects of the process of getting exhausted on people's cardiopulmonary function in a range of ages and genders. The heart rate and exercise time had some relations with the total oxygen uptake when getting exhausted, which had also been studied. By examining the physical measures, it could be seen that different ages and genders generated differences in cardiopulmonary functions. From the test results, the physical measures, such as exercise time, heart rate, were on the decline when one's age increased. Generally, males' exercise time was longer than that of females and their oxygen uptake was markedly higher than females'. But when the subjects were exhausted, the oxygen uptake and exercise time were closely related. In the process of this test, the final result (t) of the oxygen uptake in jogging was 0.0002, which is smaller than 0.05 and the gap between males and females were big. From this result, when the exercise load of jogging was increased, the cardiopulmonary functions of males and females were different and the two genders' abilities of exercise were differentiated. From this result, the choices of exercises should be based on genders.

From the statistics of form 3, the test results of heart rate and oxygen uptake showed that the differences between the two sports were small, and a conclusion could be made that although the exercise loads of these two sports were different, the indexes of cardiopulmonary function could be maintained at a proper level in line with these sports which were both aerobic exercises. However, the heart rates of females were different which were probably resulted from the fact that different understandings of these two sports by males and females caused some internal disturbing factor to influence the test results. But the results and comparison analysis would evaluate the effects of aerobic exercises based on the statistics.

CONCLUSION

What discussed above were the main study on jogging' effect on cardiopulmonary function of 200 college students from Henan Institute of Science and Technology. In the test, physical indexes and maximal oxygen uptake were collected and analyzed. In addition, the effects of jogging and fitness walking's exercise load on students' cardiopulmonary function were also revealed. This study would offer solid statistics for further studies and practices by other researchers.

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