

# Study on Improving the Cardiopulmonary Function of Undergraduate by Orienteering

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**Abstract**—In 40 different professional college students as the research object, the determination of each research object and quiet after quantitative load exercise reflect cardiovascular function, lung function and aerobic endurance of 20 physiological indexes, attempts to explore the Orienteering influence on College Students' cardiopulmonary function and aerobic endurance and its physiological mechanism. The results showed that the cardiopulmonary function of the Orienteering college students and the physical education majors in different stages were better than those of the ordinary college students, but the Orienteering college students were the best. Conclusion: the Orienteering exercise has a very positive effect on improving and improving the cardiopulmonary function and aerobic endurance.

**Keywords**—Orienteering, Improvement, Undergraduate Cardiopulmonary function Research

## I. INTRODUCTION

The orienteering is a sport which is very popular, interesting, knowledgeable, competitive, entertaining and military. It is not only conducive to students' strong physique, entertainment and physical and mental quality, but also emphasizes the cultivation of personality and personal ability, such as decisiveness, viability and independent thinking ability, which is more conducive to the improvement of comprehensive quality, and it has a certain role in promoting quality education for college students. Orienteering is one of the main events of orienteering. It is also known as walking orientation. It belongs to [1], a long term, endurance and medium intensity sport. The metabolic characteristics of performance for the movement lasted for a long time, training and competition have some moving batch, running for the typical speed run, mainly in the form of aerobic metabolism, the body energy movement of material consumption, sports consumption increased late muscle glycogen, blood glucose decreased significantly. Jia Ping and so on reported that [2], the modern orienteering competition is becoming more and more intense. Athletes consume more energy than before. Competition is not only more intelligent than skills, but also much more physical than physical fitness. However, what is the long-term impact of Orienteering on human cardiovascular system and pulmonary function and aerobic endurance? This study is to investigate the effects of Orienteering on the cardiopulmonary function of college students and their physiological mechanism. The purpose of the study is to make Orienteering become an effective exercise method and means to improve the aerobic endurance of contemporary college students, and to provide scientific theoretical basis and practical support for relevant educational decision-making departments to carry out Orienteering in universities.

## II. RESEARCH OBJECT

A total of 15 college students from Changchun Guanghua University, 13 students in physical education major and 12 students in orienteering sports teams were selected randomly as subjects. The research object will be extracted into ordinary college students majoring in physical education, college students group, group of professional college students Orienteering group of 3 experimental groups, which is referred to as ordinary college students group, college students group, orienteering group, the object of study by examinations showed no disease of respiratory and cardiovascular system.

## III. RESEARCH METHODS

Index testing procedures, instruments and methods. In this experiment, 6 silent physiological indexes including quiet heart rate, blood pressure, VC (vital capacity), FVC (forced vital capacity), FVC1.0 (1 s vital capacity) and MVV (maximum ventilation volume per minute) were tested, and pulse pressure and cardiac work index were calculated. The resting heart rate was measured by the Finland type PolarS610 heart rate telemeter. After entering the lab, the experimental subjects wore and opened the heart rate telemeter. After sitting for 10 min, they read the quiet heart rate directly, and then tested the quiet blood pressure. Pulmonary function was measured by Minato AS505 pulmonary function testing.

In addition, this experiment adopts the ST-1707 type electric treadmill test and heart rate telemetry quantitative exercise immediately after recovery, recovery of 1 min at the end of 2 min at the end of 3 min at the end of recovery and recovery of the 10 min at the end of the heart rate to present cardiovascular system experiment of complex reaction and recovery exercise stimulation. The specific operation is as follows: electric treadmill speed is set to 8 km/h, the slope is 15b, the object running on the stage wearing good and open heart rate telemetry device, then the speed of 5 km/h in preparing activities 3 min (slope before), the rest of the 5 min. At the beginning of the staff to be the fastest running speed to 8km/h, experimental subjects were 5 min running, moving quickly from the table at the end of the heart rate to read the value of heart rate, subjects sat down into a rest state,

and then read the recovery time and heart rate, all of the above experimental data were completed by hand in the laboratory of Physical Education Institute, which reflects in the long-distance running ability of aerobic endurance test in 400 m standard track and field.

Data processing. The test data of all indicators were expressed by mean standard deviation ( $\bar{x} \pm sd$ ). All data were processed on computer by SPSS 12 statistical software. The data between two groups were analyzed by variance analysis and t test, with a significant level of 0.05 and a very significant level of 0.01.

#### IV. RESULTS

Comparison of biological and physical morphological indexes of college students in each group. The age, weight and height of all the experimental groups were all in the normal range of human body. There was no significant difference between the data of each group by analysis of variance and t test ( $P > 0.05$ ). The results showed that the biological characteristics and physiological functions of all groups were normal before the experiment, and their basic conditions had no significant difference.

TABLE 1 EFFECT OF ORIENTEERING ON HEART RATE, BLOOD PRESSURE, PULSE PRESSURE AND HEART FUNCTION INDEX IN COLLEGE STUDENTS ( $\bar{x} \pm sd$ )

Group	Number	HRrest $/(b \cdot \min^{-1})$	Systolic pressure / $mmHg$	Diastolic pressure / $mmHg$	Pulse pressure / $mmHg$	LCWI—
Ordinary students group	15	$75.48 \pm 3.59$	$121.27 \pm 7.46$	$72.09 \pm 6.53$	$54.31 \pm 3.27$	$143.94 \pm 8.75$
Sports majors group	13	$69.78 \pm 3.42^{##}$	$116.43 \pm 5.98$	$68.72 \pm 7.04$	$48.28 \pm 2.39^{\#}$	$126.17 \pm 9.83^{##}$
Orienteering group	12	$65.73 \pm 2.98^{##}$	$114.71 \pm 6.73^{\#}$	$69.63 \pm 5.87$	$45.91 \pm 2.51^{##}$	$117.52 \pm 7.93^{##}$

Note: # said have significant differences, and college students group  $P < 0.05$ ; ## comparison showed a significant difference with the ordinary college students group,  $P < 0.01$ .

TABLE 2 EFFECT OF DIRECTIONAL CROSS-COUNTRY EXERCISE ON THE HEART RATE OF COLLEGE STUDENTS AT IMMEDIATE AND CONVALESCENT PERIODS OF QUANTITATIVE EXERCISE ( $\bar{x} \pm sd$ )

Group	Number	Movement time $/(b \cdot \min^{-1})$	Recovery 1min $/(b \cdot \min^{-1})$	Recovery 2min $/(b \cdot \min^{-1})$	Recovery 3min $/(b \cdot \min^{-1})$	Recovery 10min $/(b \cdot \min^{-1})$
Ordinary students group	15	$163.25 \pm 8.14$	$145.36 \pm 6.27$	$127.69 \pm 5.02$	$92.38 \pm 4.85$	$84.61 \pm 4.17$
Sports majors group	13	$149.62 \pm 7.53^{##}$	$127.82 \pm 5.83^{##}$	$105.26 \pm 4.73^{##}$	$81.53 \pm 4.37^{\#}$	$73.84 \pm 3.85^{##}$
Orienteering group	12	$145.73 \pm 6.98^{##}$	$122.63 \pm 5.49^{##}$	$101.83 \pm 4.29^{##}$	$76.26 \pm 4.52^{##}$	$68.79 \pm 3.26^{##}$

Note: # said have significant differences, and college students group  $P < 0.05$ ; ## comparison showed a significant difference with the ordinary college students group,  $P < 0.01$ .

Effect of directional cross-country exercise on cardiovascular function of College Students. Seen from table 1, table 2, orienteering group rest, exercise immediately, restore 1 min at the end of recovery, recovery of 2 min at the end of 3 min at the end of 10 min at the end of the recovery of heart rate and heart function index and college students group there was a significant difference ( $P < 0.01$ ); Orienteering systolic blood pressure and body teach the group pulse pressure and recovery of 3 min at the end of the heart rate was significantly lower than that of ordinary college students group ( $P < 0.05$ ); group diastolic blood pressure had no significant difference ( $P > 0.05$ ); Physical Education College Students Group rest, exercise immediately, restore 1 min at the end of 2 min at the end of 3 min at the end of the recovery of heart rate and heart function index and orienteering group pulse pressure and ordinary college groups had significant difference ( $P < 0.01$ ), but the college Orienteering groups were significantly better than the group of college students in physical education.

TABLE 3 EFFECTS OF ORIENTEERING ON COLLEGE STUDENTS' VC, FVC, FVC1.0 AND MVV ( $\bar{x} \pm sd$ )

Group	Number	VC/L	FVC/L	FVC1.0/L	MVV/L
Ordinary students group	15	$3.19 \pm 4.82$	$3.17 \pm 4.67$	$2.65 \pm 0.29$	$113.59 \pm 13.52$
Sports majors group	13	$3.87 \pm 4.59^{##}$	$3.86 \pm 4.81^{##}$	$3.19 \pm 0.23^{##}$	$132.42 \pm 14.83^{##}$
Orienteering group	12	$4.03 \pm 3.84^{##}$	$4.02 \pm 3.79^{##}$	$3.35 \pm 0.21^{##}$	$136.28 \pm 11.64^{##}$

Note: # said have significant differences, and college students group  $P < 0.05$ ; ## comparison showed a significant difference with the ordinary college students group,  $P < 0.01$ .

Effect of directional cross-country exercise on pulmonary ventilation function of College Students. Table 3 shows that the Orienteering group VC, FVC, FVC1.0 and MVV have a very significant difference compared with the general college student group ( $P < 0.01$ ). The VC, FVC, FVC1.0 and MVV of the physical education group have a very significant difference compared with the ordinary college student group ( $P < 0.01$ ). However, the targets of college students in all groups were better than those of all the college students in the sports education.

TABLE 4 THE INFLUENCE OF ORIENTEERING ON THE ABILITY OF COLLEGE STUDENTS' MIDDLE DISTANCE RUNNING

$$(\bar{x} \pm sd)$$

Group	Number	1500m/min	3000m/min	5000m/min
Ordinary students group	15	$6.57 \pm 0.26$	$14.83 \pm 0.53$	$25.28 \pm 0.62$
Sports majors group	13	$6.14 \pm 0.28^{\#}$	$13.59 \pm 0.47^{##}$	$23.37 \pm 0.56^{##}$
Orienteering group	12	$5.82 \pm 0.23^{##}$	$12.47 \pm 0.48^{##}$	$22.61 \pm 0.53^{##}$

Note: # said have significant differences, and college students group  $P < 0.05$ ; ## comparison showed a significant difference with the ordinary college students group,  $P < 0.01$ .

The influence of Orienteering on the ability of College Students' middle distance running. From table 4, it can be seen clearly that the middle and long distance running ability of the Orienteering group and the college student group is obviously better than that of the ordinary college students, and the goal of the orienteering is the best. Orienteering group 3000 m and 5000 m scores and M scores of 5000 groups of college students of physical education and college students group there was a significant difference ( $P < 0.01$ ); Orienteering group 1 500m and group 3000 m body to teach college students grades and college students group there was a significant difference ( $P < 0.01$ ); group of 1500 college students of Physical Education M scores and college students groups had significant difference ( $P < 0.05$ ).

## V. ANALYSIS AND DISCUSSION

Effect of directional cross-country exercise on cardiovascular function of College Students. The effect of directional cross-country exercise on the heart rate of college students in silence, immediate exercise and recovery period. At the same time, the decrease of heart rate and the increase of heart rate are important signs of heart function. The study found that the quiet heart rate of the college students of Orienteering was significantly lower than that of the normal college students. After the quantitative load exercise, the end heart rate of the Orienteering group was significantly lower than that of the ordinary college group at the end of the exercise and the recovery period, and the heart rate of the Orienteering group and the physical education college group returned to a quiet level at the end of 10 min. Studies have shown that [3], if the body regularly, with a goal in exercise, strengthen the role of vagal control of heart activity, and the function of sympathetic nerve decreased, adaptive changes in cardiovascular system will gradually have a durable, so that improve the cardiovascular function. It is suggested that regular training in orienteering can lead to decreased heart rate when the body is quiet, which is consistent with the principle that aerobic exercise and training can increase the stroke volume of the body to compensate for the decline of heart rate, thereby increasing the heart pump function center rate reserve. That is, the reserve increases in the quiet state, while the quantitative load is mobilized quickly, the reaction is low, and the recovery is fast.

The effect of directional cross-country exercise on blood pressure, pulse pressure and heart function index of College Students. Hansen[4] was traced to children aged 9-11 and found that people who often participated in the exercise were significantly lower in blood pressure than those who did not participate in the exercise. This study found that long-term exercise training of college students had a downward trend in blood pressure, but only directional cross-country college students systolic blood pressure was significantly lower than that of college students. Medical statistics show that [5], for people with high blood pressure, the most common increase of pulse pressure is high systolic blood pressure, and the high pulse pressure will increase the risk of cardiovascular disease. The normal range of cardiac function index is 110-160, and if more than 200, it may suffer from cardiovascular disease. In the range of normal values, the lower the heart function index, the better the heart function. This study found that the pulse pressure and heart function index of the college students were significantly lower than that of the normal college students. It indicates that directional cross-country exercise has a good physiological function on vascular function, which is the result of the comprehensive influence of this exercise on systolic and diastolic blood pressure, which enhances the overall function of cardiovascular system and promotes the healthy level of cardiac function.

Effect of directional cross-country exercise on pulmonary ventilation function of College Students. The effect of directional cross-country exercise on vital capacity and forced vital capacity of College Students. VC (vital capacity) is not only an important index [3,6] for evaluating the lung function of human body. The greater the vital capacity of the body, the better the body's aerobic metabolism is, and the people who often take part in physical exercise are higher than the average person. FVC (forced vital capacity) refers to the amount of gas that is exhaled at the fastest speed and maximum force after inhaling at the fastest speed

and maximum force. The results showed that the VC and FVC of the Orienteering group were significantly higher than that of the ordinary college students. Although the VC and FVC of the physical education group also improved significantly, but no Orienteering group had a significant effect. Research reports [3], middle and long distance runners and swimmers can reach a vital capacity of more than 6000 ml. It indicates that long-term directional cross-country exercise can effectively increase the strength of respiratory muscle, improve the elasticity of the lung, increase and deepen the breathing depth, and improve the vital capacity of the body.

The effect of directional cross-country exercise on the time vital capacity and the maximum lung ventilation volume of College Students. Time vital capacity is considered to be one of the most significant indicators in the study and evaluation of lung function. If the volume of air or gas volume exhaled in the first second of the body, the lung ventilation function will be better [3]. MVV is also one of the important indexes to measure lung ventilation function. It can evaluate the reserve capacity of lung ventilation at the same time of [6]. The study found that [7], 2-3 months of short-term exercise had a significant impact on most athletes' VC and MVV values, and showed that MVV value increased more significantly than that of VC. It is found that the number of FVC1.0 and MVV in orienteering group is significantly higher than that in common college student group ( $P < 0.01$ ), while FVC1.0 in physical education group is lower than that in orienteering group. That, through Orienteering Training can effectively improve the lung and thoracic elasticity, improve human respiratory muscle function, respiratory muscle strength increased, reduce the airway resistance when breathing, unobstructed degree increased, so that the body of the MVV and FVC1.0 values increased, possibly related to the increased Orienteering have some moving and intermittent running there a plurality of transmission ran on.

The influence of Orienteering on the ability of College Students' middle distance running. For a long time, the ability of middle distance race is often used to test and evaluate the aerobic endurance of the body. Its performance can indirectly reflect the level of the body's cardiorespiratory function and aerobic endurance. The study found that the better the sports performance in the running sports with the longer distance in the Orienteering group, there were significant differences compared with those of the ordinary college students. It is suggested that the training of long, cyclical, endurance and medium - intensity Orienteering can effectively improve the aerobic endurance of the body.

## VI. CONCLUSION

(1) through long-term directional cross-country exercise training, we can effectively improve the lung ventilation function level, vital capacity, time and vital capacity and maximum ventilation volume of each point has been significantly improved. Directional cross-country exercise can improve the health level of lung function of the body.

(2) the directional off-road movement can increase the quiet heart pump reserve of the college students, and the cardiovascular system is mobilized quickly, the reaction is low, and the recovery is fast in the exercise of quantitative load.

(3) long distance running ability of college students with long-term participation in the training of orienteering is obviously improved. Orienteering can improve the body's cardiorespiratory function, the capacity of cardiovascular transport oxygen and the ability of skeletal muscle to use oxygen, and the level of aerobic endurance is significantly improved.

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