

# EFFECTS OF SWIMMING ON CARDIOPULMONARY CAPACITY IN COLLEGE STUDENTS

EFEITOS DA NATAÇÃO SOBRE A CAPACIDADE CARDIOPULMONAR EM ESTUDANTES UNIVERSITÁRIOS

EFFECTOS DE LA NATACIÓN EN LA CAPACIDAD CARDIOPULMONAR DE ESTUDIANTES UNIVERSITARIOS



ORIGINAL ARTICLE  
ARTIGO ORIGINAL  
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## ABSTRACT

**Introduction:** It is believed that strengthening cardiopulmonary function can reduce health risks caused by the COVID-19 virus, and swimming is a practice that could benefit its practitioners during the epidemic context. **Objective:** Study the effect of swimming on the cardiopulmonary capacity of college students in the context of COVID-19. **Methods:** A total of 60 volunteers in three groups were trained twice a week for one hour each for 12 weeks. Among them, swimming group A performed freestyle exercises, swimming group B performed breaststroke exercises, and the control group performed reading activities or another study, mainly focusing on staying seated. **Results:** The cardiopulmonary capacity of groups A and B was improved, while the cardiopulmonary capacity of the control group experienced little change. This shows that swimming training can effectively improve cardiopulmonary capacity in college students. **Conclusion:** Appropriate swimming training can improve the cardiopulmonary capacity of college students, and optimize their physical fitness, in the context of COVID-19. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

**Keywords:** COVID-19; Swimming; Physical Fitness.

## RESUMO

**Introdução:** Acredita-se que o fortalecimento da função cardiopulmonar possa reduzir os riscos à saúde causados pelo vírus COVID-19, sendo a natação uma prática que poderia beneficiar seus praticantes durante o contexto epidêmico. **Objetivo:** Estudar o efeito da natação sobre a capacidade cardiopulmonar dos estudantes universitários sob o contexto da COVID-19. **Métodos:** Um total de 60 voluntários em três grupos foram treinados duas vezes por semana durante uma hora cada, durante 12 semanas. Entre eles, o grupo de natação A realizou exercícios de estilo livre, o grupo de natação B realizou exercícios de bruços, e o grupo de controle realizou atividades de leitura ou outro estudo, focando principalmente em manterem-se sentados. **Resultados:** A capacidade cardiopulmonar do grupo A e B foi melhorada, enquanto que a capacidade cardiopulmonar do grupo de controle sofreu poucas alterações. Isto mostra que o treinamento de natação pode efetivamente melhorar a capacidade cardiopulmonar dos estudantes universitários. **Conclusão:** O treinamento adequado de natação pode melhorar a capacidade cardiopulmonar dos estudantes universitários, otimizar sua aptidão física, no contexto da COVID-19. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

**Descritores:** COVID-19; Natação; Aptidão Física.

## RESUMEN

**Introducción:** Se cree que el fortalecimiento de la función cardiopulmonar puede reducir los riesgos para la salud causados por el virus COVID-19, y la natación es una práctica que podría beneficiar a sus practicantes durante el contexto epidémico. **Objetivo:** Estudiar el efecto de la natación sobre la capacidad cardiopulmonar de los estudiantes universitarios en el contexto del COVID-19. **Métodos:** Se entrenó a un total de 60 voluntarios en tres grupos dos veces por semana durante una hora cada uno durante 12 semanas. Entre ellos, el grupo de natación A realizaba ejercicios de estilo libre, el grupo de natación B realizaba ejercicios de braza, y el grupo de control realizaba actividades de lectura u otro tipo de estudio, centrándose principalmente en permanecer sentado. **Resultados:** La capacidad cardiopulmonar de los grupos A y B mejoró, mientras que la capacidad cardiopulmonar del grupo de control experimentó pocos cambios. Esto demuestra que el entrenamiento de natación puede mejorar eficazmente la capacidad cardiopulmonar de los estudiantes universitarios. **Conclusión:** Un entrenamiento de natación adecuado puede mejorar la capacidad cardiopulmonar de los estudiantes universitarios y optimizar su aptitud física, en el contexto del COVID-19. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

**Descriptorios:** COVID-19; Natación; Aptitud Física.



## INTRODUCTION

The outbreak of novel coronavirus in December 2019 began to affect all industries in the world. College students are seriously affected. The novel coronavirus mainly affects the course arrangement and school time of college students. Most colleges and universities adopt the closed management mode, which is followed by the reduction of outdoor sports time for college students.<sup>1</sup> The form of online courses has gradually become a regular teaching form under the epidemic situation. The lack of outdoor sports will threaten the health of college students, reduce their physical functions and increase their obesity. Therefore, colleges and universities should make in-depth research on students' physical education under the epidemic situation.<sup>2</sup> With the goal of improving college students' physical and mental health, relevant curriculum plans are formulated. The specific effects of exercise on college students' body indexes were studied in depth. Effectively reduce the impact of the epidemic on college physical education.<sup>3</sup> As we all know, long-term participation in swimming can help improve the human heart and lung function. Swimming is mainly participated in by aerobic sports. Long term participation in swimming will help shape college students' bodies and improve their physical fitness. Moreover, aerobic exercise is the main activity. The respiration under high-intensity exercise and the special environment in water will help to improve the vital capacity. Therefore, in the form of epidemic, the improvement of cardiopulmonary function has long-term benefits for the health of college students.<sup>4</sup> Strengthening the cardiopulmonary function can effectively reduce the health risks caused by COVID-19 virus. According to the epidemic situation, colleges and universities can analyze the specific impact of swimming on the improvement of cardiopulmonary function by offering swimming related courses or updating the content of curriculum arrangement. Referring to the analysis results, it is helpful to the arrangement of swimming related courses in colleges and universities.<sup>5</sup> It can effectively improve college students' physical health index and improve their physical quality. Effectively reduce the potential safety hazards of the epidemic situation for college students' health problems.

## METHOD

From the universities interviewed, according to the form of volunteer recruitment, 60 research subjects were selected from the students registered in the swimming pool. The study and all the participants were reviewed and approved by Ethics Committee of Shenyang Institute of Engineering (NO.SYITE19-Z066). These students are freshmen and sophomores of universities, who have certain swimming skills, but do not belong to swimming majors, nor are they sports majors, so that the research results are closer to the actual situation of current college students. The basic information of the three groups of volunteers is shown in Table 1.

It can be seen from the early swimming training and basic cardiopulmonary endurance that there is no significant difference between the three groups of athletes in terms of their sports level and physical function ( $P>0.05$ ), so as to reduce the interference of different levels of research objects on the experimental results. A total of 60 volunteers in the three groups conducted the experiment twice a week, one hour each time, during the 12-week training process. Among them, swimming group A

**Table 1.** Basic information of three groups of volunteers.

Group	Control	Swimming group A	Swimming group B
Age	19.9625±0.9259	20.1117±0.8708	19.8130±0.9698
Height (cm)	160.7601±5.2520	159.3196±5.5825	160.2399±4.8785
Weight (kg)	80.8555±8.5724	80.0092±8.5624	81.0404±8.5473
BMI	30.9792±2.5986	30.9541±2.5186	31.0039±2.6683

carried out freestyle exercises that they are good at, swimming group B carried out breaststroke exercises, and the control group carried out reading or self-study activities mainly focusing on sitting in the same time.

In order to comprehensively analyze the impact of swimming on college students' cardiopulmonary capacity under the influence of COVID-19 epidemic, the changes of college students' body shape and cardiopulmonary capacity were selected as the judgment indicators.

## RESULTS

### The influence of swimming on college students' body shape

The impact of the COVID-19 epidemic has been closed to many colleges and universities. Students have fewer opportunities to exercise, leading to a gradual decline in their physical fitness. It is mainly shown in the increase of weight, BMI, waist circumference and hip circumference. The decline of these physical functions will gradually have some adverse effects on college students' physical quality, heart and lung conditions, etc., and it is also easy to induce some chronic diseases, resulting in factors that are not conducive to students' health. Therefore, swimming training can effectively alleviate the decline of physical functions of college students under the influence of COVID-19. Specific data are shown in Table 2 and Table 3.

As shown in Table 2, the body shape of the three groups of college students before the experiment is compared. It can be seen from the table that the three groups of college students all present the problem of high BMI values. In the delineation standard of BMI, the range of  $>24$  can be classified as obesity. It can also be seen from the measurement of waist to hip ratio that the waist to hip ratio of the current three groups of college students is on the high side, showing a state of obesity. Therefore, before the experiment, the three groups of college students are in poor health, and there is a common obesity problem among current college students. Therefore, it needs to be adjusted through relevant sports training.

As shown in Table 3, the body shape of the three groups of college students after the experiment is compared. It can be seen from the table that the weight values of both groups, whether freestyle group A or breaststroke group B, have decreased to a certain extent, the BMI values have also decreased to a certain extent, and the waist hip ratio has gradually decreased. Although it is still within the range of overweight, it has shown a good posture. As long as you can persist in training, you

**Table 2.** Comparison of body shape of three groups of college students before the experiment.

Group	Control	Swimming group A	Swimming group B
Height (cm)	165.7601±5.2520	166.3196±5.5825	165.2399±4.8785
Weight (kg)	80.8555±8.5724	80.0092±8.5624	81.0404±8.5473
BMI (kg/m <sup>2</sup> )	26.9792±2.5986	26.9541±2.5186	26.0039±2.6683
Waist circumference (cm)	98.0600±4.1568	99.0054±4.7499	97.1138±3.5129
Hip around (cm)	107.8571±7.6017	106.2197±6.8616	108.1790±8.2796
Waist and hip ratio	0.9110±0.0996	0.9222±0.0996	0.8924±0.0992

**Table 3.** Comparison of body shape of three groups of college students after the experiment.

Group	Control	Swimming group A	Swimming group B
Height (cm)	165.4411±5.2449	166.3394±5.5428	165.5836±4.7895
Weight (kg)	80.7457±8.6087	78.1252±6.8300	79.8307±7.4962
BMI (kg/m <sup>2</sup> )	27.1104±2.5951	25.2373±2.0327	25.5459±2.3298
Waist circumference (cm)	97.9269±4.1744	95.8194±4.2155	95.4809±2.7609
Hip around (cm)	107.7107±7.5914	105.1905±5.7907	107.5358±7.1492
Waist and hip ratio	0.9149±0.1000	0.9023±0.0797	0.8825±0.0793

can adjust your body shape, make the BMI value within the normal range, and further optimize your body shape. Through the observation of the control group, it can be found that the value of the control group has almost no change before and after the experiment, and some values have even risen, which indicates that in the context of the COVID-19 epidemic, long-term meditation will have a certain impact on the physical function of college students. If you do not pay attention to diet control, you will also have obesity and other behaviors, further reducing physical fitness. Therefore, under the COVID-19 epidemic situation, we should actively carry out sports training represented by swimming training, so as to keep our BMI normal and prevent a series of problems due to obesity.

### The influence of swimming on college students' cardiopulmonary capacity

The cardiopulmonary capacity of college students is closely related to their cardiovascular and cerebrovascular health and physical quality. If the cardiopulmonary capacity is weakened, it is easy to cause chest distress and asthma in daily life, affecting the quality of daily life of college students, and a series of cardiovascular and cerebrovascular problems will be caused in serious cases, endangering the health of college students. Therefore, in the context of COVID-19 epidemic situation, it is necessary to enhance the level of college students' cardiopulmonary capacity, as shown in Table 4 and Table 5.

As shown in Table 4, it is a comparison of the cardiopulmonary capacity of the three groups of college students before the experiment. It can be seen from the table that the ability level of the heart and lungs of the students in freestyle group A, breaststroke group B and the control group is in a relatively general state, which indicates that under the influence of the COVID-19 epidemic, the heart and lung functions of the students are also affected to some extent.

Table 5 shows the comparison of the cardiopulmonary capacity of the three groups of college students after the experiment. It can be seen from the table that the cardiopulmonary capacity of freestyle group A and breaststroke group B has improved, while the cardiopulmonary capacity of the control group has not changed much. This shows that swimming

**Table 4.** Comparison of cardiopulmonary capacity of three groups of college students before the experiment.

Group	Control	Swimming group A	Swimming group B
Validation (mL)	2749.0669±561.2842	2744.7700±483.4988	2819.2566±641.3585
Maximum oxygen volume ml/(kgmin)	26.7410±2.2896	26.8296±2.4681	26.5148±2.2142
Shu Detting Pressure (mmHg)	84.2723±5.7192	84.4480±5.0381	85.5166±6.5613
Septic pressure (mmHg)	124.2589±6.8173	126.9290±6.3073	127.1829±7.4257
Heart rate when quiet (times/min)	83.9914±4.9964	82.6404±4.9534	85.5097±5.0932

**Table 5.** Comparison of cardiopulmonary capacity among three groups of college students after the experiment.

Group	Control	Swimming group A	Swimming group B
Validation (mL)	2745.4260±567.8375	2880.0905±459.2709	2935.7207±624.3663
Maximum oxygen volume ml/(kgmin)	27.0532±2.2866	26.9207±2.2853	26.6045±2.0923
Shu Detting Pressure (mmHg)	83.9079±5.6945	82.3308±3.7735	83.8288±4.7747
Septic pressure (mmHg)	124.0943±6.8969	124.4812±3.9104	124.1223±5.2202
Heart rate when quiet (times/min)	84.9720±4.9898	80.5532±4.1445	83.8542±4.1845

training can effectively improve the cardiopulmonary capacity of college students, thus bringing more convenience to college students' daily life, and can also effectively prevent the emergence of some chronic diseases, thus promoting the healthy growth of college students.

## DISCUSSION

As we all know, swimming can not only help college students shape their own bodies, but also help them keep healthy. In particular, it has a great positive effect on the improvement of their own cardiopulmonary function. The improvement of heart and lung function plays a positive role in the self respiration of human body. The strengthening of the ability of the respiratory system can effectively improve the self immunity and resistance of college students. The improvement of immunity can effectively improve the probability of avoiding infection. And swimming is mainly participated by aerobic exercise, which helps college students burn fat and effectively improve various diseases caused by obesity. Therefore, long-term swimming can significantly improve the cardiopulmonary function and physical problems of college students. The temperature of the conventional swimming pool is about 26 °C, so the students' body heat dissipation in the water is greater, and the body energy consumption is also increased. The body's nervous system responds. Through the function of the nervous system, the body can adapt to the underwater environment. The rapid energy production in the body accelerates the rate of human metabolism. Make college students have higher cold tolerance. So as to improve their own immunity and resistance. By looking up the calories consumed by different sports, it is found that the energy consumption of swimming at the same speed is three times that of jogging. Moreover, compared with other land sports, swimming is less likely to suffer from sports injuries of bones. College students who often participate in swimming events. Can get good heart exercise. When the human body is exercising, all tissues and organs of the body need the heart to provide blood function. Swimming is mainly participated by aerobic exercise, which can make college students' hearts get good exercise. Make the heart function of college students develop gradually, and the developed heart function can provide stronger cardiac contractility. It can effectively prevent various vascular diseases. Because of the particularity of swimming, it is more difficult to breathe underwater than on land. The difficulty of breathing is affected by the type of swimming and the water pressure environment. Long term swimming training can provide good training opportunities for respiratory muscles. College students can obtain higher vital capacity. It can provide a long pause time after each breath. Strong vital capacity can make college students feel less tired when exercising. This can effectively reduce the hidden danger of respiratory diseases.

## CONCLUSION

The impact of COVID-19 epidemic on colleges and universities is not only the online teaching and closed management of schools, but also the sports and psychological level of students. The long-term closed management greatly increases the students' static time and reduces their exercise time, which is not conducive to the improvement of students' physical quality and the progress of their cardiopulmonary capacity. Therefore, by discussing the influence of swimming training on college students' cardiopulmonary capacity, the paper analyzes the effect of appropriate sports training on the improvement of students' physical fitness under the background of COVID-19. The results show that proper swimming training can effectively enhance the level of college students' cardiorespiratory ability, optimize their physical fitness, and thus improve their physical fitness in the context of COVID-19. Therefore, the physical

education teachers and managers of colleges and universities should carry out swimming training for college students in batches under the condition of ensuring safety, and integrate swimming training into physical exercise, so as to provide more opportunities for college students under closed management under the COVID-19 epidemic situation,

so as to improve their physical fitness, enhance their resistance, and better face the challenges brought by the COVID-19 epidemic situation.

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The author declare no potential conflict of interest related to this article

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**AUTHORS' CONTRIBUTIONS:** The author has completed the writing of the article or the critical review of its knowledge content. This paper can be used as the final draft of the manuscript. Every author has made an important contribution to this manuscript. Jun Hao: writing and execution.

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