

# REFLECTIONS OF YOGA PRACTICE ON THE PHYSICAL PERFORMANCE OF OBESE STUDENTS



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REFLEXOS DA PRÁTICA DE IOGA NO DESEMPENHO FÍSICO DE ESTUDANTES OBEOSOS

REFLEJOS DE LA PRÁCTICA DEL YOGA EN EL RENDIMIENTO FÍSICO DE ESTUDIANTES OBEOSOS

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## ABSTRACT

**Introduction:** Yoga practice is an activity recently implemented in the content of school physical education to guide students to participate actively in sports activities. Its impacts on the body and psychological health of students are constantly evaluated. **Objective:** Study the effect of yoga practice on the heart rate and cardiopulmonary capacity of obese students. **Methods:** 40 obese students from a high school were selected as volunteers for the experiment, randomly divided into an experimental group and a control group, with no change in location or duration of intervention between the groups. The students in the control group participated in regular school activities during physical education classes, while the experimental group performed yoga training during the same schedule. The duration was eight weeks. **Results:** After the experiment, the heart rate and lung function indexes of the students in the experimental group showed a statistical increase, without significant weight changes, but body fat and visceral fat were reduced, with improvement in their body composition and muscle lines. **Conclusion:** Yoga practice reflected a positive effect on the physical performance of obese students, positively impacting on heart rate and cardiopulmonary resistance of the students. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

**Keywords:** Yoga; Heart Rate; Physical Functional Performance.

## RESUMO

**Introdução:** A prática de ioga é uma atividade recentemente implementada no conteúdo da educação física escolar com o objetivo de orientar os estudantes a participarem ativamente das atividades esportivas, e seus impactos sobre a saúde corporal e psicológica dos estudantes são constantemente avaliados. **Objetivo:** Estudar o efeito da prática de ioga sobre a frequência cardíaca e a capacidade cardiopulmonar dos estudantes obesos. **Métodos:** 40 estudantes obesos de uma escola secundária foram selecionados como voluntários para o experimento, divididos aleatoriamente em grupo experimental e grupo de controle, sem alteração de local ou duração de intervenção entre os grupos. Os alunos do grupo de controle participaram das atividades regulares da escola durante as aulas de educação física, enquanto os alunos do grupo experimental realizam treinamento de ioga durante o mesmo horário. A duração foi de 8 semanas. **Resultados:** Após o experimento, os índices de frequência cardíaca e função pulmonar dos alunos do grupo experimental mostraram um aumento estatístico, sem alterações significativas no peso, mas a gordura corporal e a gordura visceral foram reduzidas, com melhora de sua composição corporal e linhas musculares. **Conclusão:** A prática de ioga refletiu um efeito positivo sobre o desempenho físico dos estudantes obesos, repercutindo positivamente sobre a frequência cardíaca e a resistência cardiopulmonar dos estudantes. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

**Descritores:** Yoga; Frequência Cardíaca; Desempenho Físico Funcional.

## RESUMEN

**Introducción:** La práctica de yoga es una actividad recientemente implementada en el contenido de la educación física escolar con el objetivo de orientar a los alumnos a participar activamente de las actividades deportivas, y sus impactos sobre la salud corporal y psicológica de los alumnos son constantemente evaluados. **Objetivo:** Estudiar el efecto de la práctica de yoga sobre la frecuencia cardíaca y la capacidad cardiopulmonar de estudiantes obesos. **Métodos:** 40 estudiantes obesos de un instituto de secundaria fueron seleccionados como voluntarios para el experimento, divididos aleatoriamente en grupo experimental y grupo de control, sin cambios en el lugar ni en la duración de la intervención entre los grupos. Los alumnos del grupo de control participaron en las actividades escolares habituales durante las clases de educación física, mientras que los del grupo experimental realizaron el entrenamiento de yoga en el mismo horario. La duración fue de 8 semanas. **Resultados:** Tras el experimento, los índices de frecuencia cardíaca y de función pulmonar de los alumnos del grupo experimental mostraron un aumento estadístico, sin cambios significativos en el peso, pero se redujeron la grasa corporal y la grasa visceral, con una mejora de su composición corporal y de las líneas musculares. **Conclusión:** La práctica de yoga reflejó un efecto positivo en el rendimiento físico de los estudiantes obesos, incidiendo positivamente en la frecuencia cardíaca y la resistencia cardiopulmonar de los estudiantes. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

**Descriptores:** Yoga; Frecuencia Cardíaca; Rendimiento Físico Funcional.



## INTRODUCTION

Excessive fat accumulation destroys normal body metabolism, increases the risk of chronic diseases and cardiovascular diseases, and seriously damages mental health.<sup>1</sup> In order to promote students' physical health, the school stimulates students' interest and love in sports by enriching the content and form of physical education, and guides students to actively participate in sports activities.<sup>2</sup> With the increasing popularity and rapid development of yoga, some schools have incorporated yoga into their physical education teaching plans, giving full play to its potential and role in improving students' physical quality.<sup>3</sup> Compared with other sports, the concept and form of yoga practice are very specific and different.<sup>4</sup> This article takes the influence of yoga on students' health and physical fitness as the research object, and uses experimental methods to study whether yoga exercise can improve the health and physical fitness of high school students, especially in the aspects of heart rate and cardiopulmonary endurance, so as to put forward suggestions for students to participate in sports and improve their physical fitness level, give full play to the positive role of yoga exercise on health and physical fitness, and provide more comprehensive intervention and exercise prescription for improving students' physical fitness level.<sup>5,6</sup>

## METHOD

### Research object

According to the experimental requirements of this paper, 40 overweight or obese students in the first grade of a high school in a city were selected as the experimental objects of this paper. The study and all the participants were reviewed and approved by Ethics Committee of Tongling University (NO.21TOUNI-079PT). According to the principle of equal quantity, 40 students were randomly divided into experimental group and control group. Before the experiment, ensure that students participate in the experiment on the principle of knowing and voluntariness, and ensure that the BMI of male subjects is not less than 22.5 and that of female subjects is not less than 22.2. The basic information of the research objects is shown in Table 1, and all indicators meet the experimental requirements of this paper.

### Research methods

40 students were divided into experimental group and control group for an 8-week experiment. The experimental group included 10 boys and 10 girls, and the control group also included 10 boys and 10 girls. Before the experiment, the students in the experimental group were introduced to basic yoga exercises, and the physical indicators were recorded. At the beginning of the experiment, the training of the experimental group and the control group was carried out according to the normal frequency of the school physical education class. In the same time, the experimental group carried out professional yoga training, and the control group participated in regular light sports activities in physical education class. During the 8-week experiment, the students' work and rest habits remained the same, reducing the interference of external factors. The data of the whole experiment process shall be carefully processed and recorded to ensure the smooth progress of the experiment and the accuracy of the experimental data.

The specific data measurement methods in the experiment are as follows:

**Table 1.** Basic information of the experimental group and the control group.

Group	Age (years)	Height (cm)	Weight (kg)
Experience group	16.01±0.52	164.72±7.54	68.81±4.53
Control group	16.36±0.34	165.33±8.01	67.24±5.02

In the test of heart rate and other indicators, KM1-HW-600B heart rate and blood pressure measuring instrument is used to measure the students' heart rate function related indicators such as quiet heart rate, systolic blood pressure and diastolic blood pressure in quiet state. In the step test index, the male students use 40 cm high steps and the female students use 35 cm high steps. Before the test, the subjects need to make light preparations. Electronic spirometer was used in the measurement of lung function related indicators, including vital capacity, forced vital capacity, maximum ventilation volume, etc.

## RESULTS

### Effect of yoga on heart function of obese students

Firstly, the heart rate changes of students after yoga training are compared and analyzed, as shown in Table 2.

It can be seen from the data in Table 2 that after the 8-week experiment, the quiet heart rate of the tested students did not change significantly, with P values greater than 0.05, but the heart rate of the experimental group decreased from  $83.56 \pm 11.33$  beat/min to  $82.78 \pm 11.05$  beat/min, and the control group did not have a significant downward trend; The change of systolic blood pressure in the quiet state was also not obvious, P values were greater than 0.05, but the systolic blood pressure and diastolic blood pressure in the experimental group showed a downward trend, the systolic blood pressure changed from  $108.26 \pm 7.01$  mmHg to  $107.31 \pm 3.89$  mmHg, and the diastolic blood pressure changed from  $71.22 \pm 4.89$  mmHg to  $69.07 \pm 3.54$  mmHg, and the change in the control group was not obvious; In addition, the step index of the experimental group changed significantly, from  $50.73 \pm 7.22$  times before the experiment to  $54.42 \pm 6.97$  times after the experiment, P. It can be concluded from the data in Table 2 that, although the changes of relevant indexes of heart rate function are different, yoga exercise has a positive effect on improving the oxygen transport capacity of obese students and stabilizing their heart rate.

### Effect of yoga on cardiorespiratory endurance of obese students

The influence indicators of yoga exercise on the cardiopulmonary endurance of obese students mainly include vital capacity, forced vital capacity, dyspnea and peak flow rate of respiration. Among them, vital capacity is the main indicator reflecting the changes of students' cardiopulmonary endurance and plays an important role in the analysis of experimental results.

It can be seen intuitively from Table 3 that before and after yoga exercise, the vital capacity of the experimental group showed very obvious changes, from  $2522.31 \pm 368.52$  ml before the experiment to  $2784.35 \pm 402.10$ ,  $P < 0.01$ ; The forced vital capacity changed from

**Table 2.** Heart rate changes of two groups of students before and after training.

Index	Group	Before training	After training	P value
Quiet heart rate (beat/min)	Experience group	$83.56 \pm 11.33$	$82.78 \pm 11.05$	0.115
	Control group	$83.01 \pm 12.24$	$83.22 \pm 11.87$	0.153
Quiet systolic blood pressure (mmHg)	Experience group	$108.26 \pm 7.01$	$107.31 \pm 3.89$	0.065
	Control group	$109.25 \pm 5.76$	$108.44 \pm 6.23$	0.121
Diastolic blood pressure at rest (mmHg)	Experience group	$71.22 \pm 4.89$	$69.07 \pm 3.54$	0.058
	Control group	$70.58 \pm 6.01$	$69.23 \pm 6.32$	0.093
Step test index (times)	Experience group	$50.73 \pm 7.22$	$54.42 \pm 6.97$	0.007
	Control group	$51.21 \pm 7.14$	$51.89 \pm 7.76$	0.121

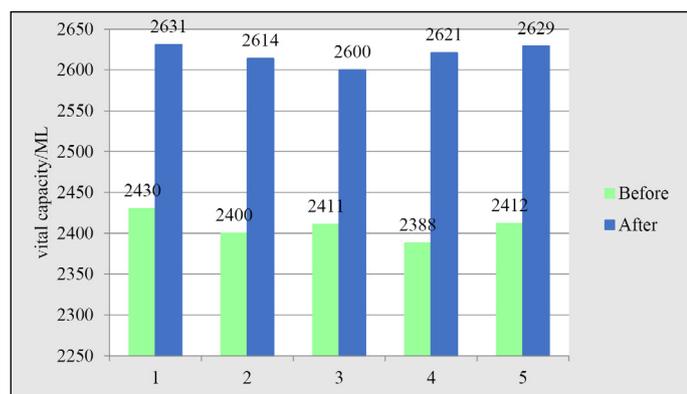
3.74 ± 0.11L before the experiment to 3.87 ± 0.21, P<0.01, and the change was also significant; The difference of respiration changed from 3.23 ± 1.25 cm to 4.30 ± 1.38 cm before the experiment, P<0.01, with significant changes; However, the change of relevant indicators in the control group was not obvious, indicating that yoga exercise has a positive effect on the improvement of the body's oxygen uptake capacity. At the same time, the maximum ventilation and oxygen uptake of the experimental group did not show significant changes before and after the experiment, P was greater than 0.05, which was not statistically significant, but the two indicators showed an overall upward trend, indicating that yoga exercise had a certain role in promoting the maximum ventilation and oxygen uptake of students, but the effect was weak due to the long training period and other reasons.

Then select the five specific changes of vital capacity of the experimental group students before and after the experiment for statistical analysis. The data are shown in Figure 1.

It can be seen intuitively from the data change trend in Figure 1 that the five times of vital capacity of the students in the experimental group before the yoga exercise fluctuated slightly and the overall trend declined slowly, while the average value of the test data after the yoga training showed a significant increase. At the same time, the overall change of the five times of vital capacity was relatively stable and the fluctuation was small, indicating that the 8-week yoga exercise had an obvious effect on improving students' lung endurance.

**Table 3.** Changes of pulmonary function indexes of two groups of students before and after training.

Index	Group	Before training	After training	P value
Vital capacity (ml)	Experience group	2522.31±368.52	2784.35±402.10	0.004
	Control group	2543.54±578.20	2548.71±451.23	0.158
Forced vital capacity (L)	Experience group	3.74±0.11	3.87±0.21	0.005
	Control group	3.71±0.20	3.73±0.12	0.078
Respiratory difference (cm)	Experience group	3.23±1.25	4.30±1.38	0.000
	Control group	3.27±1.08	3.28±1.47	0.123
Maximum ventilation volume (L)	Experience group	134.69±5.88	141.21±5.34	0.050
	Control group	135.21±5.02	135.72±5.87	0.256
Peak respiratory velocity (L)	Experience group	482.30±21.25	508.65±22.58	0.025
	Control group	478.65±24.21	480.89±25.66	0.177
Maximum oxygen uptake (ml/kg/min)	Experience group	35.56±1.14	36.77±1.25	0.068
	Control group	36.01±1.02	36.87±1.21	0.098



**Figure 1.** Mean value of five changes in vital capacity of students in the experimental group before and after the experiment.

## Effects of yoga training on physical and mental health of obese students

In the process of yoga training, besides the changes of heart rate and lung function, students' physical and mental health also showed more positive changes than before. For the obese student group, the change of yoga exercise is also reflected in the body composition, and the specific data are shown in Table 4.

According to the data results in Table 4, yoga training did not significantly change the weight and BMI of students in the experimental group (P>0.05), but the weight and BMI showed a small downward trend, in which the weight changed from 65.81 ± 7.53kg before the experiment to 64.55 ± 5.21kg, the BMI changed from 21.01 ± 2.31 before the training to 20.15 ± 2.01, and there was no significant change in the control group. At the same time, the body fat and visceral fat area of the students in the experimental group showed significant changes, the body fat decreased from 16.02 ± 3.55kg to 14.11 ± 3.87kg, and the visceral fat area changed from 66.32 ± 20.15kg to 58.87 ± 21.54kg.

Obese students usually face more serious psychological problems due to the particularity of their body shape. Therefore, this paper conducts a correlation analysis on the mental health factors of experimental subjects before and after sports. The main index results are shown in Table 5.

It can be seen from the data in Table 5 that yoga training has a significant effect on relieving interpersonal tension, poor psychological endurance, emotional disorders and other psychological problems. Among them, the index of interpersonal tension in the experimental group has decreased from 1.66 ± 0.22 to 1.52 ± 0.12, the index of poor psychological endurance has decreased from 2.22 ± 0.56 to 1.67 ± 0.33, and the index of emotional disorders has changed from 2.22 ± 0.18 to 1.68 ± 0.22, P values are less than 0.05, with significant differences, It shows that yoga has a positive effect on reducing interpersonal tension, poor psychological endurance and emotional disorders faced by obese students. At the same time, the index of psychological imbalance also decreased from 1.62 ± 0.25 to 1.51 ± 0.18, showing a certain downward trend, indicating that although yoga has not significantly alleviated the psychological imbalance of obese students, it has a positive effect on improving the psychological health of obese students as a whole.

**Table 4.** Changes of body composition of two groups of students before and after training.

Option	Group	Before training	After training	P value
Weight (kg)	Experience group	65.81±7.53	64.55±5.21	0.087
	Control group	66.24±8.02	62.87±6.89	0.157
Body mass index (BMI)	Experience group	21.01±2.31	20.15±2.01	0.079
	Control group	20.88±2.15	20.56±2.32	0.166
Body fat (kg)	Experience group	16.02±3.55	14.11±3.87	0.000
	Control group	15.65±4.01	15.22±4.11	0.100
Area of visceral fat (cm <sup>2</sup> )	Experience group	66.32±20.15	58.87±21.54	0.000
	Control group	65.77±21.32	63.21±22.33	0.092

**Table 5.** Changes of mental health factors of subjects before and after the experiment.

Option	Group	Before training	After training	P value
Interpersonal tension	Experience group	1.66±0.22	1.52±0.12	0.041
	Control group	1.58±0.31	1.57±0.20	0.121
Poor psychological endurance	Experience group	2.22±0.56	1.67±0.33	0.001
	Control group	2.31±0.42	2.27±0.21	0.084
Psychological imbalance	Experience group	1.62±0.25	1.51±0.18	0.054
	Control group	1.60±0.18	1.58±0.21	0.076
Emotional disorders	Experience group	2.22±0.18	1.68±0.22	0.033
	Control group	2.14±0.25	2.13±0.27	0.102

## DISCUSSION

After 8 weeks of training, the students in the experimental group also gradually improved their heart rate, lung function and other related indicators, especially their vital capacity and maximal oxygen uptake. This shows that yoga for a period of time can improve alveolar tension, strengthen breathing muscles, and effectively improve students' lung function. Because in yoga practice, breathing plays a very important role. Yoga uses a combination of chest and abdominal breathing. Each inhalation should be slow and long, and exhalation should be subtle and long; When you exhale, you should not be too hasty or hold your breath. You should not be too hasty or hold your breath. You should gradually adapt to the natural principles of physiology. In the process of yoga training, students need to be taught the correct method of breathing regulation while mastering the movements, so that the rhythm of breathing and movements can naturally coincide. When inhaling, the chest can be fully opened, the alveoli can be expanded, and more oxygen can be inhaled. When exhaling, the chest can be fully compressed, expel more carbon dioxide, improve lung compliance, reduce bronchial smooth muscle resistance, mobilize the joints, bones and muscles of the whole body to participate in sports, massage the microvessels of the muscle itself, improve the metabolism and gas exchange of tissues and cells, and increase vital capacity and oxygen consumption. Research shows that regular and persistent yoga exercise can effectively improve vital capacity, gradually make respiratory muscles stronger, and improve lung reserve capacity and respiratory function.

## CONCLUSION

Adhering to yoga can effectively shape the body lines, and the movements can be designed according to the characteristics of the human body, which is more friendly to obese students. After a period of yoga, the cardiorespiratory function and physical and mental health of obese students can be significantly improved, which also plays a positive role in regulating students' psychological imbalance and emotional disorder. The application of yoga in school physical education at this stage is of great significance for promoting students' interest in physical exercise, establishing a positive sense of movement, and improving the overall level of physical and mental health.

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