

ANALYSIS OF THE IMPACT OF DIFFERENT EXERCISE METHODS ON THE PHYSICAL HEALTH OF OBESE ADOLESCENTS



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ANÁLISE DO IMPACTO ENTRE DIFERENTES MÉTODOS DE EXERCÍCIO NA SAÚDE FÍSICA DE ADOLESCENTES OBESOS

ANÁLISIS DEL IMPACTO ENTRE DIFERENTES MÉTODOS DE EJERCICIO EN LA SALUD FÍSICA DE ADOLESCENTES OBESOS

Wu Shoujiang¹ 
(Physical Education Professional)

1. Bozhou University, Bozhou,
Anhui, China.

Correspondence:

Wu Shoujiang, Anhui, China,
236800.
wushoujiang0001@sina.com

ABSTRACT

Introduction: The unregulated development in the current life pattern has strengthened obesity among adolescents, and this problem is becoming more serious. **Objective:** Compare the impact of two exercise methods on the physical health of obese adolescents. **Methods:** 24 obese adolescents (12 females; BMI > 30% ± 3%; age concentrated between 10 and 16 years) were selected and divided into group I and group II for a 4-week experimental study, and changes in physical fitness and function were recorded. **Results:** After four weeks of aerobic exercise control (group I), waist circumference, hip circumference, skinfold thickness, and abdominal fold thickness were significantly reduced in boys ($p < 0.05$), and girls' body shape indicators were significantly altered ($p < 0.05$). After four weeks of aerobic exercise combined with resistance training (group II), the effects of weight, BMI, and body size were significant in boys and girls. **Conclusion:** Aerobic exercise can effectively improve the physical problems of obese adolescents. Under the same external conditions, the effect of aerobic exercise was shown to be more effective when combined with resistance training in the physical improvement of the analyzed group. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

Keywords: Exercise; Obesity Management; Adolescent.

RESUMO

Introdução: O desenvolvimento desregrado no padrão de vida atual fortaleceu a obesidade entre os adolescentes e esse problema está se tornando cada vez mais grave. **Objetivo:** Comparar o impacto entre dois métodos de exercício na saúde física de adolescentes obesos. **Métodos:** Foram selecionados 24 adolescentes obesos (12 mulheres; IMC > 30% ± 3%; idade concentrada entre 10 e 16 anos) e divididos no grupo I e no grupo II para um estudo experimental de 4 semanas, sendo registradas as alterações no condicionamento e função física. **Resultados:** Após 4 semanas de controle de exercício aeróbico (grupo I), a circunferência da cintura, circunferência do quadril, espessura da dobra cutânea e espessura da dobra abdominal foram significativamente reduzidas em meninos ($p < 0,05$), e os indicadores de forma corporal das meninas foram significativamente alterados ($p < 0,05$). Após 4 semanas de exercício aeróbico combinado com treinamento de resistência (grupo II), os efeitos do peso, IMC e tamanho do corpo foram significativos em meninos e meninas. **Conclusão:** O exercício aeróbico pode melhorar efetivamente os problemas físicos dos adolescentes obesos. Sob as mesmas condições externas, o efeito do exercício aeróbico demonstrou-se mais eficaz quando aliado ao treinamento de resistência na melhoria física do grupo analisado. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

Descritores: Exercício Físico; Manejo da Obesidade; Adolescente.

RESUMEN

Introducción: El desarrollo desordenado en el patrón de vida actual ha potenciado la obesidad entre los adolescentes y este problema es cada vez más grave. **Objetivo:** Comparar el impacto de dos métodos de ejercicio en la salud física de adolescentes obesos. **Métodos:** Se seleccionaron 24 adolescentes obesos (12 mujeres; IMC > 30% ± 3%; edad concentrada entre 10 y 16 años) y se dividieron en el grupo I y el grupo II para un estudio experimental de 4 semanas, y se registraron los cambios en la aptitud física y la función. **Resultados:** Después de 4 semanas de control de ejercicio aeróbico (grupo I), la circunferencia de la cintura, la circunferencia de la cadera, el grosor de los pliegues cutáneos y el grosor de los pliegues abdominales se redujeron significativamente en los niños ($p < 0,05$), y los indicadores de la forma corporal de las niñas se alteraron significativamente ($p < 0,05$). Tras 4 semanas de ejercicio aeróbico combinado con entrenamiento de resistencia (grupo II), los efectos del peso, el IMC y el tamaño corporal fueron significativos en chicos y chicas. **Conclusión:** El ejercicio aeróbico puede mejorar eficazmente los problemas físicos de los adolescentes obesos. En las mismas condiciones externas, el efecto del ejercicio aeróbico se mostró más eficaz cuando se combinó con el entrenamiento de resistencia en la mejora física del grupo analizado. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

Descriptor: Ejercicio Físico; Manejo de la Obesidad; Adolescente.



INTRODUCTION

According to the literature, the most active stage of adipocytes is the end of pregnancy, youth, pre puberty and birth. At this time, obesity is the proliferation and hypertrophy of adipocytes in the body, which creates potential conditions for subsequent obesity and is not easy to control. The subjects in this study are 10-16 years old and in adolescence, which is a high incidence age of obesity. Obese adolescents are at risk of hyperinsulinemia, hypertension, diabetes, hyperlipidemia and atherosclerosis.¹ Obesity may be one of the causes of these diseases and may be harmful to the health and well-being of adults. Research shows that 80% of adolescent obesity will continue to be adult obesity, leading to hyperlipidemia, diabetes, heart disease and so on, and it is difficult to treat.²

Bone is the skeleton of human body and the basis of normal development of teenagers. Bone is a living tissue, which will change the shape and thickness of bones. Literature research shows that swimming and treadmill exercise can prevent and alleviate osteoporosis in mice, maintain and improve BMD in mice, and biomechanics shows that treadmill exercise is more suitable. Research shows that swimming and running have local effects on girls' bones: swimming significantly increases BMD of upper limbs and running significantly increases BMD of lower limbs. Literature review shows that swimming training years are positively correlated with upper limb BMC; Volleyball players' years of training were significantly correlated with lower limb BMC; After considering the potential confounding factors, the lower limb BMC of swimmers and volleyball players showed moderate differences. However, a large number of studies have shown that different exercise plans, exercise frequency, intensity and duration have very different effects on bone health. It is unclear which type of exercise (impact, resistance, weight bearing, mixed exercise), intensity, frequency and duration are effective in increasing bone mineral density.³

Studies have shown that overweight, obesity and heavy obesity in the body, physique, physical fitness and other indicators have decreased in varying degrees, while promoting diabetes, coronary heart disease, hypertension and other diseases, will increase the risk of death. Worse, obese patients suffer from arteriosclerosis and hypertension. The blood vessels are hard and brittle. They are easy to burst under the influence of hypertension, leading to dangerous intracerebral hemorrhage.⁴ Therefore, the problem of adolescent obesity should not be underestimated and should be paid attention to.

METHOD

Research object

In this experiment, 24 subjects (obesity 30% ± 3%, age concentrated in 10-16 years) were divided into age groups, 12 boys and 12 girls. The study and all the participants were reviewed and approved by Ethics Committee of Bozhou University (NO. 2020BU572). The results showed that there was no significant difference in each index. They were randomly divided into experimental group 1 aerobic exercise control group and experimental group 2 aerobic exercise combined with resistance training group, with 12 people in each group.

1. Training methods of experiment group 1:

The aerobic exercise practiced by the experimental group includes brisk walking, lifting dumbbells, supine leg lifting, running, power cycling, swimming and various ball games, which can effectively reduce body weight and body fat. Once a day in the morning and in the afternoon, each time for 90 minutes (5 minutes of preparation, 5 minutes of finishing, 80 minutes of aerobic exercise). Usually, the subjects preferred by the experimenter are selected in the morning, and rope skipping and treadmill are set in the afternoon.

2. Training methods of Experiment 2:

The experimental group is different from the experimental group I. The rope skipping and fitness treadmill classes in the afternoon of this experimental group are resistance strength training classes. The principle of resistance training load is to use "RM" (repetition maximum). RM represents the maximum weight that can be repeated a certain number of times. The specific kg of 10rm used by different subjects is different. Before resistance training, 1RM measurement was carried out on the subjects before resistance training. After testing the bearable load, the subjects would carry the weight for rope skipping and treadmill training.

Data analysis

Use SPSS 12.0 to draw the indicators of each sample before and after the test, and use t-test to calculate and compare the differences of each sample before and after the exercise. T-test of samples is based on the measurement and test data.

RESULTS

Physical fitness test results

The results showed that Table 1: before and after 4 weeks of training, there were very significant differences in the changes of body weight, BMI, waist circumference, scapular skinfold thickness and abdominal skinfold thickness of boys in the experimental group ($P < 0.01$), and the hip circumference was significantly improved ($P < 0.05$). The water content and lean body weight showed an upward trend compared with that before exercise, but it was not particularly obvious ($P > 0.05$).

Figure 1 the results showed that before and after the experiment, the weight, BMI, waist circumference, hip circumference, scapular skinfold thickness and abdominal skinfold thickness of girls in experimental group I decreased significantly ($P < 0.05$), and the waist circumference increased significantly ($P < 0.01$). Water content and lean body weight showed an upward trend compared with that before exercise, but it was not obvious ($P > 0.05$).

Table 1. Physical fitness test results of boys in experimental group I before and after the experiment (n = 6).

Index	Before (M±S)	After (M±S)	Δd	Sd	t	P
BMI (kg / m ²)	30.41±1.8	26.83±2.0	3.58	1.65	5.23	0.003
Abdominal pleat thickness (mm)	41.68±1.9	28.61±2.8	13.06	2.18	14.41	0
Scapular pleat thickness (mm)	35.14±3.5	23.27±1.6	11.87	2.79	10.30	0
Skin weight (kg)	47.32±1.2	47.97±1.3	56.43	1.05	-1.31	0.245
Water moisture (%)	47.42±2.1	47.62±2.2	15.84	0.40	967	0.374
Weight (kg)	92.76±2.9	79.30 ±3.0	13.39	2.30	14.06	0
Hip circumference (cm)	104.94±5.1	91.50±7.7	7.47	5.28	0.342	0.018
Waist (cm)	100.09±2.3	91.77 ± 2.4	8.17	1.57	12.71	0

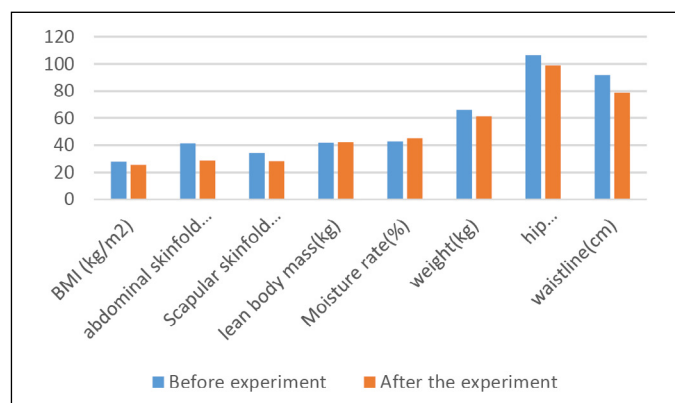


Figure 1. Test results of girls' physique before and after the experiment in group I (n = 6).

The results of Table 2 show that there are significant differences in physical fitness indexes of boys in experimental group II before and after exercise ($P < 0.05$), among which there are very significant differences in body weight, BMI, circumference and subcutaneous fat thickness ($P < 0.01$). Compared with the weight before the experiment, the body weight of boys in experimental group II has decreased by nearly 20kg, hip circumference has decreased by about 5cm, and the change of waist circumference is the smallest, about 2cm.

Figure 2 shows that the physical indexes of girls in experimental group II show very obvious differences before and after exercise ($P < 0.01$), and the increase of lean weight is not obvious ($P > 0.05$). Compared with the weight before the experiment, after the experiment, the weight of girls in group II decreased by nearly 7kg, the hip circumference decreased by about 20cm, and the waist circumference changed by about 14cm.

Physical function test results

It can be seen from Table 3 that the basic heart rate, basic metabolic rate and vital capacity of boys in experimental group I changed significantly before and after exercise ($P < 0.01$), while the changes of systolic and diastolic blood pressure were not obvious. Compared with that before exercise ($P > 0.05$), their vital capacity increased by about 600ml compared with that before the experiment, and the change was amazing. The systolic blood pressure was less obvious, only about 3mmHg. (Figure 3)

DISCUSSION

Under 4-week dietary control, aerobic exercise plus impedance training can significantly improve the physical function of girls and boys in experimental group II. There is a significant difference in basic heart rate and metabolic rate before and after exercise, and there is no significant difference in systemic blood pressure, diastolic blood

Table 2. Physical fitness test results of boys in experimental group II before and after the experiment (n = 6).

Index	Before (M±S)	After (M±S)	xd	Sd	t	P
BMI (kg / m ²)	32. 68±1. 2	25. 3±2. 68	7.75	2.1	9.01	.000
Abdominal pleat thickness (mm)	39. 4±1. 7	25. 1±2.2	14.66	3.04	11.80	.000
Scapular pleat thickness (mm)	37. 1±1.9	20. 8±1.4	16.15	2.80	14.12	.000
Skin weight (kg)	45. 3±2. 4	49. 4±2. 5	-3.69	2.89	-3.12	.026
Water moisture (%)	46. 7±1.8	50. 1±2. 3	-2.8	2.36	-2.98	.031
Weight (kg)	89. 6±1.9	70. 1±1.2	20.4	2.3	20.96	.000
Hip circumference (cm)	104. 9±2. 1	97. 9±2. 4	8.08	2.80	7.06	.001
Waist (cm)	99. 6±2. 9	97. 0±1.8	12.29	1.99	15.10	.000

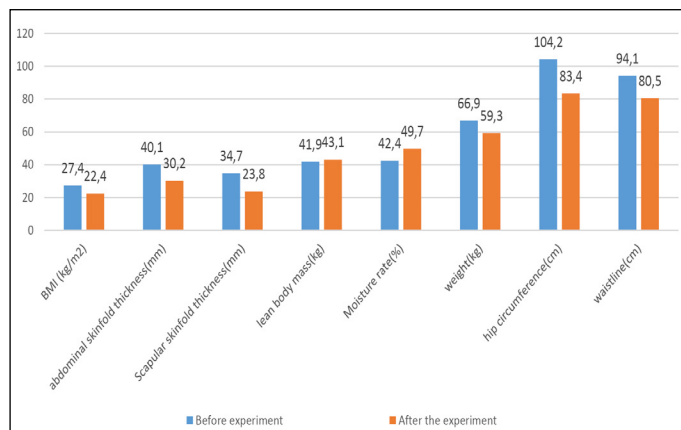


Figure 2. Test results of physical fitness of girls in experimental group II before and after the experiment (n = 6).

Table 3. Test results of physical function of boys in experimental group I before and after the experiment (n = 6).

Index	Before (M±S)	After (M±S)	xd	Sd	t	P
Pneumatic capacity (ml)	2116. 2±134. 3	2767. 2 ±142. 8	-629.5	168.9	-9.12	.000
Basic metabolic rate (kcal)	1631. 3 ±79. 8	1743. 1±85. 5	-95.4	28.97	-8.16	.000
Basal heart rate (B / min)	87. 6±1.6	83. 1±1.4	5.41	1.15	11.4	.000
Sealing pressure (mmHg)	124. 2±2. 2	121. 8±3. 1	7.41	4.04	1.49	.103
Shuxo pressure (mmHg)	81. 4±2. 8	79. 0±2. 0	3.23	3.68	2.15	.084

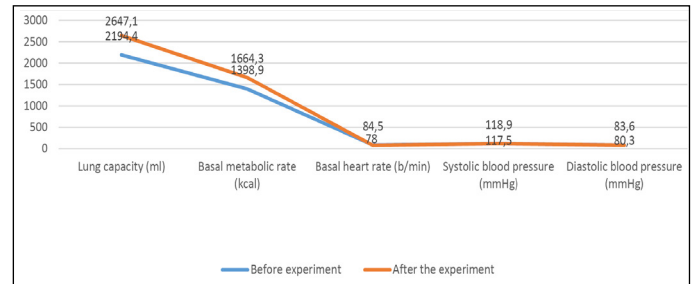


Figure 3. Test results of physical function of girls in experimental group I before and after the experiment (n = 6).

pressure and main symptoms. Before and after exercise, the boy's heart rate, systemic blood pressure and diastolic blood pressure decreased by 7.0 B / min, 3.9 mmHg and 3.6 mmHg respectively. The heart rate, systolic blood pressure and diastolic blood pressure of girls decreased by 9.0 B / min before and after exercise 9.8 mmHg and 6.8 mmHg. The data show that the decline of heart rate and blood pressure in girls is greater than that in boys, and the effect of controlling aerobic nutrition is better for girls than boys. This shows that under the same training time and training load, girls' heart rate and blood pressure are more likely to be stimulated by training intensity, while boys' changes are not easy to detect. This coincides with the effect of male and female students. The basic metabolic rate and vital capacity of girls increased significantly before and after training, while only the basic metabolic rate of boys increased significantly. Among them, the average increases of basal metabolic rate and vital capacity in boys were 280 kcal and 156.3 MML respectively, and the average increases of basal metabolic rate and vital capacity in girls were 320.0 kcal and 423.85 MML respectively. It can be seen that the increase of metabolism and vital capacity of girls is greater than that of boys, indicating that under dietary control, aerobic exercise and impedance training have a more obvious impact on girls. This may be due to the fact that girls are more efficient in coping with exercise load. The higher the efficiency, in order to meet the body's demand for oxygen during exercise, the heart expands the chest cavity, increases vital capacity and oxygen uptake, so as to accelerate the body's energy oxidation and ensure the body's energy supply.⁵

BMI, waist circumference, shoulder blade index, abdominal fold fat thickness and hip circumference of girls and boys were significantly correlated with the way of resistance training. Considering that the subjects in this experiment are young, the type of resistance training is mainly to use light equipment and carry out with their own weight. The deep squat and vertical jump of dumbbell in place and supine leg lifting can effectively mobilize the abdominal muscles, gluteus maximus, scapula and upper arm muscles, promote the friction and reorganization between muscle fibers, accelerate the combustion of abdomen and the fat of hip and back.⁶ There was no significant difference in hip circumference between the two groups, which was related to the poor natural abdominal muscle strength of the girls. The hydrating effect of girls in experimental group II highlights that resistance training can improve the speed of systemic circulation and accelerate the level of microcirculation metabolism.

CONCLUSION

After 4 weeks of various aerobic exercise training, the physical fitness of the participants has improved. Due to the deviation of their physical characteristics, some performance is more obvious and some improvement is slight. The whole experiment showed that exercise had an effect on increasing lean weight and reducing body fat composition. There were significant differences in height, weight and BMI index before and after the experiment, and physical fitness was improved, such as vital capacity ($P < 0.01$). After 4 weeks of aerobic exercise, we found that

the average physical function indexes of students improved rapidly, and there were significant differences in vital capacity and BMI before and after exercise. The physical function data also show that various exercise methods have a positive impact on improving the cardiovascular function of obese adolescents, and further prove that they have a positive impact on the physical health of obese adolescents.

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

AUTHORS' CONTRIBUTIONS: Every author has made an important contribution to this manuscript. VS: writing and execution.

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