

EFFECTS OF RESISTANCE TRAINING ON WEIGHT IN COLLEGE STUDENTS



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EFEITOS DO TREINAMENTO DE RESISTÊNCIA SOBRE O PESO EM UNIVERSITÁRIOS

EFFECTOS DEL ENTRENAMIENTO DE RESISTENCIA SOBRE EL PESO EN ESTUDIANTES UNIVERSITARIOS

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ABSTRACT

*Introduction: Obesity has a great negative impact on college students, affecting their physical and mental health. It is believed that resistance training, as an aerobic exercise that promotes muscle hypertrophy, can promote an obesity-reducing effect in this class of individuals. Objective: Assess the effects of resistance training with loads on weight in college students. Methods: 120 obese college student volunteers were equally and randomly divided into groups for the experiment. The experimental groups A and B received resistance training with different loads, while the control group received only regular aerobic training. For statistical analysis and discussion, body indices such as perimetry and BMI were collected before and after the intervention. Results: After the experiment, the body weight of experimental group A changed from 81.62 ± 4.12 to 76.20 ± 5.49 , BMI from 27.22 ± 1.67 to 25.98 ± 1.74 , waist circumference from 89.11 ± 5.62 to 87.27 ± 6.34 , hip circumference from 101.61 ± 5.43 to 98.45 ± 5.62 , waist/hip ratio from 0.89 ± 2.34 to 0.87 ± 2.13 , and body fat ratio from 27.58 ± 3.83 to 22.61 ± 2.99 . Significant changes were also noticed in the data of experimental group A after resistance training with different loads. These changes were similar to those of the experimental group B, but changes in the control group data were not evidenced. Conclusion: Resistance training with loads can help obese college students improve their body composition and physical quality. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.***

Keywords: Endurance Training; Students; Universities; Obesity; Weight Loss.

RESUMO

*Introdução: A obesidade tem um grande impacto negativo sobre os estudantes universitários, tanto sobre a saúde física, quanto também na saúde mental. Acredita-se que o treinamento de resistência, como um exercício aeróbico promotor de hipertrofia muscular, possa promover um efeito redutor da obesidade nessa classe de indivíduos. Objetivo: Verificar os efeitos do treinamento de resistência com cargas sobre o peso em estudantes universitários. Métodos: 120 estudantes universitários obesos voluntários foram divididos igual e aleatoriamente em grupos para o experimento. Os grupos experimentais A e B receberam treinamento de resistência com cargas diferentes, enquanto o grupo de controle recebeu apenas o treinamento aeróbico comum. Índices corporais como perimetria e IMC foram coletados antes e após da intervenção para análise estatística e discussão. Resultados: Após o experimento, o peso corporal do grupo experimental A alterou de $81,62 \pm 4,12$ para $76,20 \pm 5,49$, o IMC de $27,22 \pm 1,67$ para $25,98 \pm 1,74$, a circunferência da cintura de $89,11 \pm 5,62$ para $87,27 \pm 6,34$, circunferência do quadril de $101,61 \pm 5,43$ para $98,45 \pm 5,62$, relação cintura/quadril de $0,89 \pm 2,34$ para $0,87 \pm 2,13$, e relação de gordura corporal de $27,58 \pm 3,83$ para $22,61 \pm 2,99$. Também foram notadas alterações significativas nos dados do grupo experimental A após o treinamento de resistência com cargas distintas. Essas alterações foram similares às do grupo experimental B, porém as alterações nos dados do grupo controle não foram evidenciadas. Conclusão: O treinamento de resistência com cargas pode efetivamente ajudar aos estudantes universitários obesos a melhorarem a sua composição corporal e qualidade física. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.***

Descritores: Treino Aeróbico; Estudantes; Universidades; Obesidade; Redução de Peso.

RESUMEN

Introducción: La obesidad tiene un gran impacto negativo en los estudiantes universitarios, tanto en la salud física como mental. Se cree que el entrenamiento de resistencia, como ejercicio aeróbico promotor de hipertrofia muscular, puede promover un efecto reductor de la obesidad en esta clase de individuos. Objetivo: Verificar los efectos del entrenamiento de resistencia con cargas sobre el peso en estudiantes universitarios. Métodos: 120 estudiantes universitarios obesos voluntarios fueron divididos equitativa y aleatoriamente en grupos para el experimento. Los grupos experimentales A y B recibieron entrenamiento de resistencia con diferentes cargas, mientras que el grupo de control sólo recibió entrenamiento aeróbico regular. Se recogieron índices corporales como la perimetría y el IMC antes y después de la intervención para su análisis estadístico y discusión. Resultados: Tras el experimento, el peso corporal del grupo experimental A pasó de $81,62 \pm 4,12$ a $76,20 \pm 5,49$, el IMC de $27,22 \pm 1,67$ a $25,98 \pm 1,74$, la circunferencia de la cintura de $89,11 \pm 5,62$ a $87,27 \pm 6,34$, el perímetro de la cadera de $101,61 \pm 5,43$ a $98,45 \pm 5,62$, el cociente cintura/cadera de $0,89 \pm 2,34$ a $0,87 \pm 2,13$, y el cociente de grasa corporal de $27,58 \pm 3,83$ a $22,61 \pm 2,99$. También se observaron cambios significativos en el grupo experimental A tras el entrenamiento de resistencia con diferentes cargas. Estas alteraciones fueron similares a las del grupo experimental B, sin embargo, no se evidenciaron alteraciones en los



Descriptor: Entrenamiento Aeróbico; Estudiantes; Universidades; Obesidad; Pérdida de Peso.

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INTRODUCTION

With the gradual improvement of people's living standards, it has also brought a variety of health problems, especially obesity, which is one of many serious problems.¹ People's excessive obesity can cause many metabolic diseases, which can cause great harm to human health. And now the obesity problem exists in all age groups, especially in children and the elderly. In order to treat various diseases caused by obesity, a large amount of medical expenses have been spent and the related costs are increasing year by year.² With the gradual improvement of people's awareness of health, more and more people have begun to realize that only by using a reasonable diet and scientific exercise methods can they keep fit and stay away from the problem of obesity.³ This has also led many urban people to rush into the gym and start physical exercise. Now some simple aerobic training such as routine running can no longer meet people's need for weight loss. In order to meet the need for weight loss, strength training and aerobic exercise have been added to many fitness training.⁴ Now some gyms have gradually added resistance training to lose weight, which has been loved by more and more people. Today's resistance training is a new way to lose weight, which has been proved to be safe and effective in many studies.⁵ Nowadays, the health problems of college students have also been concerned by the public. Being obese will not only have a negative impact on the physical and mental health of college students, but also may bring many chronic diseases, which will bring a lot of troubles to the graduates in employment and life.⁶ In the face of the fact that the number of obese individuals in contemporary college students is increasing rapidly year by year, how can obese students quickly understand scientific and efficient fat burning methods? For this reason, this paper will study the weight loss effect of obese college students under different load resistance training.⁷

METHOD

Research object

In this study, 120 obese college students were selected for the experiment. In the selection of the subjects, the measurement standards were strictly implemented. The weight and other indicators of the subjects were in line with the Hefei obesity standard. At the same time, the indicators of these college students were relatively close, which would not cause unnecessary error to the experimental results. The study and all the participants were reviewed and approved by Ethics Committee of Shandong Sport University (NO.SDSUSYFD157). Before the start of the experiment, the physical condition of 120 obese college students in the school was also measured, and the

physical condition was good, so as to ensure that the body of the subjects participating in the experiment could carry out continuous resistance training with different loads. During the experimental period, the 120 college students kept the same habits of diet and rest as usual.

Research methods

In the experiment, 120 college students were divided into three groups: experimental group A, experimental group B and control group. During the experiment, the experimental group A and B were given professional resistance training with different loads, while the control group was given ordinary aerobic training, and the relevant indexes of the body shape and physical quality of the three groups of experimental subjects were measured and recorded.

RESULTS

Effect of different load resistance training on body shape of obese college students

As shown in Table 1, the changes of various indexes of body shape of obese college students in experimental group A and B after resistance training with different loads.

By comparing the changes of body shape data of obese college students in experimental group A and experimental group B before and after different load resistance training, we can see that the changes of data indicators in each group are very obvious, especially the BMI indicators, waist circumference indicators, waist to hip ratio indicators in experimental group A, as well as the weight indicators and hip circumference indicators in experimental group B. Therefore, it can be seen that resistance training with different loads has a great effect on improving the body shape of college students, especially those who are obese.

After measuring the body shape indexes of obese college students in experimental group A and B, the body shape indexes of obese college students in control group before and after general aerobic training were further measured and recorded. The specific results are shown in Table 2.

According to the change of body shape index and P value difference standard of obese college students in the control group, it can be seen that ordinary aerobic training has certain effect on the improvement of college students' body shape, for example, the change in hip circumference index is particularly significant, but the change in other indicators is not significant. From this, we can see that compared with different load resistance training, ordinary aerobic training has less influence on the body shape of obese college students than load resistance training.

Table 1. Effects of different load resistance training on body shape of obese college students.

Option	Experiment Group A			Experiment Group B		
	Before experiment	After experiment	P	Before experiment	After experiment	P
Weight	81.621±4.1285	76.205±5.4907	0.0204	80.862±3.6248	75.450±4.3396	0.0027
BMI	27.224±1.6701	25.986±1.7482	0.0134	27.793±2.0547	26.331±1.5605	0.0380
Waist circumference	89.118±5.6226	87.270±6.3463	0.0065	89.345±6.2218	87.117±5.7086	0.0264
Hip circumference	101.613±5.4397	98.450±5.6242	0.0204	100.779±5.3175	97.591±5.2367	0.0044
Waist to hip ratio	0.896±2.3451	0.870±2.1372	0.0083	0.907±3.0506	0.881±4.1445	0.0390
Body fat rate	27.586±3.8302	22.610±2.9960	0.0188	27.773±3.4839	23.049±4.3321	0.0391
Vital capacity	4,466.524±842.6935	4,832.170±726.7240	0.0294	4,326.339±546.6058	4,832.170±494.6389	0.0344

Effect of different load resistance training on the physical quality of obese college students

As shown in Table 3, the physical quality indicators of obese college students were further measured before and after the experiment, including the measurement of six indicators, including standing long jump, sit-ups, left hand grip, right hand grip, sitting forward bending and step experiment.

Before the resistance training with different loads, the distance of standing long jump in experimental group B was 214.073 ± 28.4846 cm, and changed to 217.784 ± 35.4500 cm after the experiment. The number of sit-ups in experimental group B was 33.625 ± 8.4111 before the experiment and 41.976 ± 7.2199 after the experiment. The weight of the left hand grip force of group B was 41.166 ± 3.1458 kg before the experiment, and changed to 44.384 ± 4.6762 kg after the experiment. The weight of the right hand grip in group B was 47.448 ± 7.3243 kg before the experiment, and changed to 50.433 ± 5.3321 kg after the experiment. The forward flexion distance of the sitting position in the experimental group B was 15.606 ± 6.5881 cm before the experiment, and changed to 17.784 ± 5.7424 cm after the experiment. The number of step experiments in experimental group B was 44.613 ± 6.0204 before the experiment and 46.938 ± 5.8301 after the experiment.

Through the changes of various physical quality indicators of obese college students in experimental group A and experimental group B before and after the experiment, it can be seen that the P value of various physical quality indicators of obese college students is less than 0.05, even close to 0.01, indicating that the data change is very significant. Especially in the distance of standing long jump and the number of sit-ups, the P value of both items is less than 0.01. Therefore, it can be concluded that different load resistance training can significantly improve the physical quality of obese college students.

After measuring and analyzing the relevant data of Group A and Group B in the experiment, we further compared and analyzed the physical fitness of obese college students in the control group before and after general aerobic training. The specific data index changes are shown in Table 4. Before the general aerobic training, the standing long jump distance of the control group was 218.770 ± 33.7884 cm, and the data changed to 204.409 ± 38.3939 cm after the experiment. Before the experiment, the number of sit-ups in the control group was 35.383 ± 7.0346 , and after the experiment, this data changed to 33.719 ± 8.0891 .

Table 2. Effect of general aerobic training on body shape of obese college students.

Control group			
Option	Before experiment	After experiment	P
Weight	81.540 ± 3.6643	78.391 ± 3.2801	0.0371
BMI	27.693 ± 1.3057	26.648 ± 2.0050	0.0188
Waist circumference	89.335 ± 6.5114	89.908 ± 5.5366	0.0375
Hip circumference	100.987 ± 5.4194	99.139 ± 4.8988	0.0046
Waist to hip ratio	0.907 ± 2.7227	0.891 ± 2.7563	0.0138
Body fat rate	27.714 ± 3.7793	25.826 ± 4.2713	0.0322
Vital capacity	$4,687.349 \pm 789.5339$	$4,832.170 \pm 706.7172$	0.0272

Table 3. Effect of different load resistance training on physical fitness of obese college students.

Option	Experiment Group A			Experiment Group B		
	Before experiment	After experiment	P	Before experiment	After experiment	P
Standing long jump	203.780 ± 18.6868	207.132 ± 16.6146	0.0032	214.073 ± 28.4846	217.784 ± 35.4500	0.0360
Abdominal curl	36.122 ± 5.4151	39.013 ± 5.2939	0.0087	33.625 ± 8.4111	41.976 ± 7.2199	0.0202
Left hand grip strength	39.537 ± 4.6438	42.428 ± 3.4110	0.0185	41.166 ± 3.1458	44.384 ± 4.6762	0.0325
Right hand grip strength	43.622 ± 3.9932	45.859 ± 2.6829	0.0189	47.448 ± 7.3243	50.433 ± 5.3321	0.0277
Sitting forward flexion	13.212 ± 5.2764	17.257 ± 4.6638	0.0200	15.606 ± 6.5881	17.784 ± 5.7424	0.0230
Step experiment	44.939 ± 2.3939	47.267 ± 2.7632	0.0341	44.613 ± 6.0204	46.938 ± 5.8301	0.0313

Before the experiment, the left hand grip weight of the control group was 38.776 ± 4.1645 kg, and after the experiment, the data changed to 37.080 ± 4.5750 kg. Before the experiment, the right hand grip weight of the control group was 41.705 ± 4.1664 kg, and after the experiment, this data became 40.377 ± 4.1734 kg.

According to the change of the physical quality of obese college students in the control group, it can be seen that the change of various indicators in the control group is not obvious, only the P value of the standing long jump indicator is less than 0.01. Although there are certain changes in other indicators, it is not obvious compared with the data change in the experimental group A and B. It can be concluded that resistance training with different loads can effectively improve the physical quality of obese college students.

DISCUSSION

When it comes to resistance training, it may not be well known. In fact, it is also known as strength training. It is to increase the weight of fat-free body and further improve the resting metabolic rate of the body by improving the muscle strength and muscle circumference of the body. According to some research and analysis, resistance training can also cause an increase in RMR while consuming energy, which can also improve the energy consumption of the body. RMR refers to the energy consumed in a day in a quiet state. Muscle mass accounts for a large part of the decreased body weight. Some studies have confirmed that the decreased body weight can account for about 22% of the RMR in terms of energy consumption. By studying the influence of contemporary college students on the body's RMR value and lipolysis after strength training, the research results show that after 15 hours of strength training, in a quiet state, the metabolism of fat has increased by about 60%; After resistance training, I found that I was in a quiet state. The metabolism of fat also increased by about 63%. After consulting a large number of data, many studies believe that the combination of resistance training and aerobic exercise can produce a good weight loss effect. Therefore, according to the needs of weight loss exercise methods, we can formulate corresponding strength exercises, which is also one of the key points to be explored in the future.

As a new type of exercise in recent years, the effect of resistance training on weight loss has been verified. After a large number of studies, it has been confirmed that long-term moderate intensity aerobic exercise can help people reduce weight and improve cardiopulmonary function, reduce blood lipids and improve visceral fat content, but there is still a certain difference between moderate intensity aerobic exercise and resistance

Table 4. Effect of general aerobic training on physical fitness of obese college students.

Control group			
Option	Before experiment	After experiment	P
Standing long jump	218.770 ± 33.7884	204.409 ± 38.3939	0.0076
Abdominal curl	35.383 ± 7.0346	33.719 ± 8.0891	0.0341
Left hand grip strength	38.776 ± 4.1645	37.080 ± 4.5750	0.0158
Right hand grip strength	41.705 ± 4.1664	40.377 ± 4.1734	0.0146
Sitting forward flexion	13.711 ± 9.0126	10.223 ± 9.5673	0.0383
Step experiment	45.720 ± 3.5654	44.371 ± 3.0871	0.0213

training. Medium-intensity aerobic exercise provides energy in the way of complete aerobic metabolism during the whole training process. For resistance training, during high-intensity exercise, because the energy supply of aerobic metabolism can not completely meet the energy required by the body during exercise, it will be supplemented by anaerobic metabolism. With the same amount of exercise, most studies believe that the weight loss effect of resistance training is much better than that of moderate intensity aerobic exercise. In the future clinical application, the optimal exercise program can be formulated according to the function of different obese college students. In addition, because the exercise intensity of resistance training is relatively large, it is necessary to analyze the individual situation of students before formulating the exercise mode of resistance training, improve the adaptability of students by gradually increasing the intensity of training, do a good job of warm up and relaxation activities before training, and pay attention to avoid injuries caused by sports during training, and carry out safe, scientific and effective resistance training.

CONCLUSION

Through the comparative analysis of the body shape and physical quality of obese college students in the control group, the experimental group A and the experimental group B before and after the experiment, it can be seen that the changes of various indicators in the experimental group A and the experimental group B after different load resistance training are more obvious. The physical quality and body shape of college students are crucial to their weight loss, and standard physical quality and body shape can better promote the fat reduction effect of college students. Therefore, resistance training with different loads can be widely promoted for college students. It is hoped that resistance training with different loads can help college students, especially obese college students, to lose weight healthily and effectively.

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REFERENCES

1. Hruby A, Manson JAE, Qi L, Malik VS, Rimm EB, Sun Q, et al. Determinants and consequences of obesity. *Am J Public Health.* 2016;106(9):1656-62.
2. Cao H. Adipocytokines in obesity and metabolic disease. *J Endocrinol.* 2014;220(2):T47-59.
3. Blüher M. Obesity: global epidemiology and pathogenesis. *Nat Rev Endocrinol.* 2019;15(5):288-98.
4. Stanley EA, Schaldach JM, Kiyonaga A, Jha AP. Mindfulness-based mind fitness training: A case study of a high-stress predeployment military cohort. *Cogn Behav Pract.* 2011;18(4):566-76.
5. Westcott WL. Resistance training is medicine: effects of strength training on health. *Curr Sports Med Rep.* 2012;11(4):209-16.
6. Dorn R, Laho H. Anesthetic challenges in the obese patient. *J Anesth.* 2012;26(5):758-65.
7. Primeau V, Coderre L, Karelis AD, Brochu M, Lavoie ME, Messier V, et al. *Int J Obes (Lond).* 2011;35(7):971-81.