IMPACT OF DIFFERENT SPORTS ON BODY MASS OF FEMALE UNIVERSITY STUDENTS

IMPACTO DE DISTINTOS ESPORTES SOBRE AS MASSAS CORPORAIS DE UNIVERSITÁRIAS

IMPACTO DE DIFERENTES DEPORTES EN LA MASA CORPORAL DE ESTUDIANTES UNIVERSITARIAS

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ABSTRACT

Introduction: A healthy body depends on several factors, and physical exercise is one of the main factors. Research results on the physical health of female university students show that although the general health status of Chinese female students is good, the quality of physical performance at university continues to show a slow downward trend. Objective: To explore the effects of different exercises on the fat mass and lean weight indices of female university students. Methods: 60 female students who participated in aerobics and ball games training in the Physical Education Department of a university were randomly divided into a control group and a training group, with 30 volunteers in each group. The experimental group performed intensive aerobics training and ball training. In contrast, no intervention was performed in the control group, and indicators were collected and analyzed according to current literature. Results: After eight weeks of the intervention protocol, the body weight, body fat weight, lean weight, body surface area, and body fat ratio of the control group had no significant changes from the period before the experiment ($P > 0.05$). In the training group, fat weight decreased significantly ($p<0.01$), lean mass weight increased significantly ($p<0.01$), body fat ratio decreased ($p<0.01$), and body weight and body surface area had no significant changes ($p>0.05$). PTH and FSH in the training group were significantly higher than in the control group ($P < 0.05$). As the aerobic exercise level improved in the experimental group, the weight and abdominal skinfold thickness in the exercise group showed a downward trend. Conclusion: There is a general correlation between BMI and body fat content and its body distribution in college women. Compared to men, BMI is better suited to describe the fat metabolism of college women. ***Level of evidence II; Therapeutic studies - investigation of treatment outcomes.***

Keywords: Sports; Body Mass Index; Body Weight Maintenance; Women's Health.

RESUMO

Introdução: Um corpo saudável depende de vários fatores e o exercício físico é um dos principais. Os resultados de pesquisa na saúde física das estudantes universitárias mostram que apesar do estado de saúde geral das estudantes chinesas serem bons, a qualidade no desempenho físico na universidade continua a mostrar uma lenta tendência de queda. Objetivo: Explorar os efeitos de distintos exercícios sobre os índices de gordura e massa magra de universitárias. Métodos: 60 alunas que participaram de treinamento de aeróbica e jogos de bola no Departamento de Educação Física de uma universidade foram divididas aleatoriamente em grupo de controle e grupo de treinamento, com 30 voluntárias em cada grupo. O grupo experimental realizou treinamento intensivo de aeróbica e treinamento com bola, enquanto nenhuma intervenção foi executada no grupo controle, a coleta e análise dos indicadores foi executada segundo a literatura corrente. Resultados: Após 8 semanas do protocolo de intervenção, o peso corporal, peso da gordura corporal, peso magro, área de superfície corporal e relação de gordura corporal do grupo controle não tiveram alterações significativas em relação ao período anterior ao experimento ($P > 0,05$). No grupo de treinamento, o peso da gordura diminuiu significativamente ($p<0,01$), o peso da massa magra aumentou significativamente ($p<0,01$), a relação de gordura corporal diminuiu ($p<0,01$), o peso corporal e a superfície corporal não sofreram alterações significativas ($p>0,05$). O PTH e FSH no grupo de treinamento foram significativamente maiores do que os do grupo controle ($P < 0,05$). Com a melhora do nível de exercício aeróbico no grupo experimental, o peso e a espessura da dobra cutânea abdominal no grupo de exercício apresentaram uma tendência de queda. Conclusão: Há uma correlação geral entre o IMC e o teor de gordura corporal e a sua distribuição corporal em universitárias. Em comparação com os homens, o IMC é mais adequado para descrever o metabolismo de gordura de universitárias. ***Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.***

Descritores: *Esportes; Índice de Massa Corporal; Manutenção do Peso Corporal; Saúde da Mulher.*

RESUMEN

Introducción: Un cuerpo sano depende de varios factores y el ejercicio físico es uno de los principales. Los resultados de la investigación sobre la salud física de las estudiantes universitarias muestran que, aunque el estado de salud general de las estudiantes chinas es bueno, la calidad del rendimiento físico en la universidad sigue mostrando una lenta tendencia a la baja. Objetivo: Explorar los efectos de diferentes ejercicios sobre los índices de grasa y peso magro de estudiantes universitarias. Métodos: 60 alumnas que participaban en el entrenamiento de aeróbic y juegos de pelota en el Departamento de Educación Física de una universidad fueron divididas aleatoriamente en un

grupo de control y un grupo de entrenamiento, con 30 voluntarias en cada grupo. El grupo experimental realizó un entrenamiento aeróbico intensivo y un entrenamiento con balón, mientras que en el grupo de control no se llevó a cabo ninguna intervención; la recogida y el análisis de los indicadores se realizaron de acuerdo con la literatura actual. Resultados: Tras 8 semanas del protocolo de intervención, el peso corporal, el peso de la grasa corporal, el peso magro, la superficie corporal y la proporción de grasa corporal del grupo de control no presentaron cambios significativos en comparación con el periodo anterior al experimento (P > 0,05). En el grupo de entrenamiento, el peso de la grasa disminuyó significativamente (p<0,01), el peso de la masa magra aumentó significativamente (p<0,01), la proporción de grasa corporal disminuyó (p<0,01), el peso corporal y la superficie corporal no tuvieron cambios significativos (p>0,05). La PTH y la FSH en el grupo de entrenamiento fueron significativamente mayores que las del grupo de control (P < 0,05). Con la mejora del nivel de ejercicio aeróbico en el grupo experimental, el peso y el grosor del pliegue cutáneo abdominal en el grupo de ejercicio mostraron una tendencia a la baja. Conclusión: Existe una correlación general entre el IMC y el contenido de grasa corporal y su distribución en las estudiantes universitarias. En comparación con los hombres, el IMC es más adecuado para describir el metabolismo de las grasas de las estudiantes universitarias. ***Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.***

Descriptores: *Deportes; Índice de Masa Corporal; Mantenimiento del Peso Corporal; Salud de la Mujer.*

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INTRODUCTION

Metabolic syndrome with glucose and lipid metabolism as its core has become a chronic epidemic disease that seriously affects people's health. At present, people are used to using the index of body mass index to predict and measure the risk of metabolic syndrome. The results show that bone metabolism is an important part of body metabolism, and both bone mass and bone density are related to bone metabolism, so the result of bone metabolism directly affects the incidence of osteoporosis.[1,2] Therefore, it is of great significance to study the effects of long-term over training on bone mineral density and hormones related to bone metabolism.[3,4]

At present, bone density measurement is the main means to evaluate bone loss, diagnose osteoporosis and predict fracture.[5] Early detection of osteoporosis by measuring bone density and timely and symptomatic treatment can effectively prevent fracture. This paper studies the effects of long-term aerobics and ball training on fat mass and lean body mass of adult girls, in order to understand the changes of bone density and bone metabolism after over training has damaged bones.

Experimental part

Taking 60 students who participated in aerobics and ball training in the physical education department of a college as the research object, they were randomly divided into control group and training group, with 30 students in each group. The study is. Purely observational studies which no need to registry ID of ICMJE, and all the participants were reviewed and approved byHebei Sport University of China (NO. HBSU2021013). All the subjects were healthy and free from metabolic diseases, and they all volunteered to participate in the experiment. The basic information of the subjects is shown in Table 1 below:

Research technique

Literature data method refers to a method of collecting data by using literature. Some important texts related to this study were collected through the library of Nanjing Normal University and the reference room of School of Physical Education Science of Nanjing Normal University. In the full-text database of CNKI Chinese journals, "aerobics" is the first key word, "physique" is the second key word, and the full-text database of CNKI Chinese excellent doctoral and master's degree thesis is searched with the same key words and order, and a large number of electronic materials related to this research are collected. By analyzing these data, the starting point of this paper is established, which lays a foundation for the smooth progress of this paper.

Table 1. Basic information of research objects.

Sports event	Age	Height (cm)	Weight (kg)
Aerobics	22.13±1.66	162.17±2.21	52.67±1.92
Ball	21.81±1.28	160.33±2.72	53.71±1.55

The Achilles Insight ultrasonic bone densitometer produced by LUNAR Company of the United States was used, and the Japanese bone strength database was randomly attached. The peak bone strength data was used to automatically calculate the T value. The strength value of the right calcaneus bone of the subjects was tested uniformly. Before the test, the subjects disinfected the right heel with alcohol cotton ball and coated it with ultrasonic special conductive gel, and then put the foot in the measuring tank for measurement. The accuracy error of STI calculated by this instrument is 2%.

In this experiment, the total body weight (TM), bone mineral content (BMC), LEAN body weight (lean) and Fat content (fat) of 22 students from two majors were measured by American HologicQDR4500 dual-energy X-ray scanner (DEXA).

Experimental result

Influence of sports intervention on body composition of adult girls

It can be seen from Table 2 that after 8 weeks of exercise, the body weight, fat weight, lean body weight, body surface area and body fat ratio of the control group did not change significantly compared with those before exercise (P > 0.05). In the training group, fat body weight decreased significantly (p<0.01), lean body weight increased significantly (p<0.01), body fat ratio decreased (p<0.01), and body weight and body surface area did not change significantly (p>0.05).

Table 2. Each index of body composition before and after exercise intervention ($M \pm SD$).

Group	Time	BM (kg)	FM (kg)	LBM (kg)	BSA (m 2)	BF%
Control group (n=30)	Before intervention	81.66±7.11	30.14±5.62	51.24±6.87	1.89±0.27	36.52±5.57
	After intervention	82.37±6.63	28.01±6.28	53.41±6.33	1.93±0.12	34.81±6.74
Training group (n=30)	Before intervention	78.92±10.25	27.41±4.36	51.28±7.86	1.77±0.12	32.87±3.61
	After intervention	77.53±11.02	23.78±5.26**	54.96±8.77**	1.81±0.24	30.24±4.28*

Note: comparison before and after exercise*: significant level p < 0.05; * *: significance level p<0.01. BM: body weight; FM: fat weight; LBM: lean body weight; BSA: body surface area; BF%: body fat ratio.

Effects of Aerobics and Ball Training on Bone Metabolism Related Hormones of Adult Girls

Table 3 describes the changes of bone metabolism of girls in control group and training year.

The analysis of table 3 shows that the 25(OH)D of the training group is significantly lower than that of the training group, and the difference is very significant ($p < 0.01$). PTH and FSH in training group were significantly higher than those in control group ($P < 0.05$). E_2 in training group was lower than that in control group, and the difference was significant ($p < 0.05$).

Analysis of body shape index before and after experiment

The results in table 4 show that before and after the experiment, there is no significant difference in body shape indexes of the control group: height, weight, abdominal skin fold, fat content and fat-free weight ($p < 0.05$). Body shape indexes of training group: height, weight and fat--free weight had no significant difference ($p < 0.05$), but abdominal skin folds and fat content changed ($p < 0.05$). The results show that aerobics and ball training have little effect on the height of college adult girls. With the continuous improvement of internal organs, the two height growth peaks of college students aged 19 to 24 have passed. Once the epiphysis is closed and ossified, the height growth almost stops.

With the increase of aerobics level in the experimental group, the weight and abdominal skin fold thickness of the exercisers have a downward trend. Therefore, it can be inferred that the higher the level of aerobics and ball training, the more the weight of the exerciser will be reduced, the fat content will be effectively reduced, and the degree of influence on the body shape will be greater.

DISCUSSION

Obesity is associated with diabetes, hyperlipidemia and heart disease. Abdominal obesity is the core manifestation of metabolic syndrome, which represents abnormal fat metabolism and distribution. Because height has an important influence on body weight, body weight is not an ideal index to describe abnormal fat metabolism.[6] In fact, although some people's appearance conforms to typical abdominal obesity, their body weight does not exceed the standard, and their body mass index is also in the normal range, which indicates that the abnormality of body weight and body mass index cannot accurately represent the body's fat metabolism. Under normal circumstances, the fat-free body weight has a certain proportion with the body fat content. Measuring fat-free body weight is of great significance for promoting energy conversion and oxygen consumption, and regulating water and salt metabolism. Higher fat-free body weight is very beneficial to improve aerobic endurance and exercise ability.

The total amount of fat and the percentage of fat in total body matter reflect the synthesis and storage of fat, while the percentage of trunk fat in total fat content reflects the distribution of fat. These indexes can be used to describe the body fat metabolism. When people inhale quietly, the diaphragm contracts and descends, and the external intercostal muscles contract and lift up the ribs, which enlarges the chest, increases the negative pressure in the chest, and air enters the lungs through the respiratory tract.[7,8] When exhaling, the diaphragm relaxes and rises, the external intercostal muscles relax and the ribs sink, so that the thorax shrinks and the negative pressure decreases, and the gas in the lungs is discharged from the body through the respiratory tract. According to the research, if people with normal weight have abdominal obesity, they also have a higher probability of suffering from the above-mentioned diseases, but if obese people also belong to abdominal obesity, the probability of the above-mentioned diseases will be higher. Therefore, reducing the accumulation of fat in the body is a positive aspect to prevent many civilized diseases. Bone morphology will change to a certain extent, and corresponding force, that is, stress, will be formed inside. Under the condition of stress and load balance, bone deformation stops; When the load is greater than a certain value, the bone density, bone mineral content and projection area will decrease.

Different levels of mass aerobics have certain influence on the body shape of exercisers. Among them, the control group's mass exercise standard has little influence on the physical shape of the exercisers, while the training group's mass exercise standard has relatively great influence on the physical shape of the exercisers. Long-term and regular implementation of "Mass Exercise Standard" can effectively reduce the fat content and weight of adult girls and shape good body shape.

Body mass index of adult girls has a moderate correlation with the amount of body fat and its distribution in trunk. Compared with men, BMI is more suitable to describe the fat metabolism and distribution of adult girls.

25(OH)D can stimulate the activity of bone cells and promote the formation of bone matrix. After long-term over training, the 25(OH)D of subjects decreased significantly, which led to an increase in bone resorption and an increase in bone loss rate. PTH can increase blood calcium concentration and decrease blood phosphorus concentration. After long-term over training, the increase of bone mass loss rate destroys the balance of bone metabolism, promotes the secretion of PTH, and leads to a great increase in osteoclast activity and a corresponding decrease in osteoblast activity. E2 is the most physiologically active hormone in estrogen. After long-term aerobics and ball training, the estrogen level of the subjects decreased, which made the bone metabolism in a negative balance state.

CONCLUSION

From the analysis of experimental results, it can be seen that "Mass Exercise Standard" of middle and high level has a better effect on improving the body shape, motor function and physical quality of the exercisers. Therefore, it is suggested that when colleges and universities choose "Mass Exercise Standard" as the teaching content, they can take the primary "Mass Exercise Standard" as an introductory study and add aerobics light equipment appropriately to strengthen the upper limb strength exercise, and at the same time, they should carry out various forms of aerobics activities to increase students' practice time.

Table 3. Changes of bone metabolism in two groups of adult girls.

Index	Control group	Training group
25(OH)D/(ng · mL^{-1})	36.74±8.21	28.77±9.36
PTH/(ng · mL^{-1})	33.96±8.14	39.84±8.78
E_2/(pmol · mL^{-1})	140.21±51.93	101.41±40.01
FSH/(IU · mL^{-1})	44.86±10.23	50.23±11.62

Table 4. Comparison of body shape of each group before and after experiment.

Group	Time	Height /cm	Weight /kg	BMI	Abdominal skin fold/mm	Fat content /km	Fat-free weight/kg
Control group (n=30)	Before the experiment	160.21±2.01	50.28±2.63	19.83±1.37	18.21±3.37	12.88±1.79	39.62±2.33
	After the experiment	160.21±2.03	50.07±2.63	19.93±1.28	18.63±3.32	12.91±1.66	39.73±2.41
Training group (n=30)	Before the experiment	162.30±2.66	52.08±3.71	19.70±1.42	15.99±4.38	12.19±1.45	39.88±2.83
	After the experiment	163.52±2.41	51.30±3.69	19.36±1.52	15.53±4.01**	12.03±1.41*	39.43±2.70

Note: "*", $P < 0.05$; "*", $P < 0.01$.

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