THE KEY RESEARCH OF SPORTS IN MAINTAINING HUMAN HEALTH

A PESQUISA CHAVE DO ESPORTE NA MANUTENÇÃO DA SAÚDE HUMANA

LA INVESTIGACIÓN CLAVE DEL DEPORTE PARA MANTENER LA SALUD HUMANA

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ABSTRACT

Introduction: One of the evaluation factors of human health is bone health, and an evaluation index of bone health is osteoporosis. Sports are an effective way to improve the human body. Objective: The paper discusses the effects of different exercise intensities on human bone health. Methods: The thesis selected 51 female college students, designed different exercise intensities of fitness running intervention programs, and conducted a 12-month exercise intervention. We divide female college students into three groups. The subjects' bone mineral density (BMD), serum alkaline phosphatase (ALP), and serum osteocalcin (BGP) were tested before and after the experiment. Results: The differences in femoral BMD, serum ALP, serum BGP, and lumbar spine BMD of the three groups of volunteers were significant (P<0.05), while the differences in ulna and radius BMD were not significant. Conclusions: Sports can promote human bone health. At the same time, the effect of fitness running on human BMD is site-specific. ***Level of evidence II; Therapeutic studies - investigation of treatment results.***

Keywords: Fitness Running; High-Intensity Interval Training; Bone Density; Bone and Bones.

RESUMO

Introdução: Um dos fatores de avaliação da saúde humana é a saúde óssea, e um índice de avaliação da saúde óssea é a osteoporose. Os esportes são uma forma eficaz de melhorar o corpo humano. Objetivo: o artigo discute os efeitos de diferentes intensidades de exercício na saúde óssea humana. Métodos: A tese selecionou 51 universitárias, elaborou diferentes intensidades de exercícios em programas de intervenção de corrida de aptidão e conduziu uma intervenção de exercícios de 12 meses. Dividimos as universitárias em três grupos. A densidade mineral óssea (BMD), fosfatase alcalina sérica (ALP) e osteocalcina sérica (BGP) dos indivíduos foram testadas antes e depois do experimento. Resultados: As diferenças na DMO femoral, ALP sérica, BGP sérica e DMO da coluna lombar dos três grupos de voluntários foram significativas (P <0,05), enquanto as diferenças na DMO da ulna e rádio não foram significativas. Conclusão: O esporte pode promover a saúde óssea humana. Ao mesmo tempo, o efeito da corrida adaptativa na DMO humana é específico do local. ***Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.***

Descritores: *Treinamento Intervalado de Alta Intensidade; Densidade Óssea; Osso e Ossos.*

RESUMEN

Introducción: Uno de los factores de evaluación de la salud humana es la salud ósea y un índice de evaluación de la salud ósea es la osteoporosis. Los deportes son una forma eficaz de mejorar el cuerpo humano. Objetivo: El artículo analiza los efectos de diferentes intensidades de ejercicio en la salud ósea humana. Métodos: La tesis seleccionó a 51 estudiantes universitarias, diseñó diferentes intensidades de ejercicio de programas de intervención para correr y realizó una intervención de ejercicio de 12 meses. Dividimos a las estudiantes universitarias en tres grupos. La densidad mineral ósea (DMO), la fosfatasa alcalina sérica (ALP) y la osteocalcina sérica (BGP) de los sujetos se analizaron antes y después del experimento. Resultados: Las diferencias en la DMO femoral, la ALP sérica, la BGP sérica y la DMO de la columna lumbar de los tres grupos de voluntarios fueron significativas (P <0,05), mientras que las diferencias en la DMO del cúbito y del radio no fueron significativas. Conclusión: Los deportes pueden promover la salud ósea humana. Al mismo tiempo, el efecto de la actividad física en la DMO humana es específico del sitio. ***Nivel de evidencia II; Estudios terapéuticos: investigación de los resultados del tratamiento.***

Descriptores: *Entrenamiento de Intervalos de Alta Intensidad; Densidad Ósea; Huesos.*

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INTRODUCTION

At present, the research results on exercise intensity mainly focus on the effect of exercise under the same intensity on the human bones.[1] However, few reports on the exercise intervention research of the same exercise item with different exercise intensities exist. This article explores the influence of different exercise intensities on the bones of young women by designing different exercise intensities of fitness running intervention programs.

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METHOD

Research object

This article's research object comes from non-physical college female students majoring in physical education at M University. They signed up voluntarily and learned about their physical fitness, medical history and recent medications through interviews and other methods. Finally, 60 female college students were selected as the research objects.[2] In this study, 60 subjects were randomly divided into experimental group 1, experimental group 2 and control group. However, during the experiment's implementation, because this experiment has certain requirements for the student's physical fitness, and the experiment period is extended, some students are separated from the research object group.

RESEARCH METHODS

Experimental method

Different exercise intensity fitness running intervention plan for female college students: We divided the experimental subjects into three groups: experimental group 1 (higher intensity group), experimental group 2 (medium-small intensity group), and control group. The three groups were treated before and after the experiment. Other research subjects are tested. The experimental group practiced three times a week, each practice four groups, each group 15 minutes, a total of 60 minutes of aerobic running exercise, using the training computer to control the exercise intensity, the higher intensity group's heart rate was controlled at 70%-80 of the maximum heart rate %, about 140-160 times/min. The small and medium-intensity group's heart rate was controlled at 50%-60% of the maximum heart rate, about 100-120 beats/min. The control group had no other exercise arrangements except for standard physical education.[3]

TEST METHOD

Test index

(1) Bone mineral density (BMD, g/cm^2): bone mineral density (BMD) of the radius and ulna (Forearm), lumbar spine L1-4 (spine), and femur. The BMD status of these three parts can more comprehensively reflect the BMD status of the human body. (2) Bone metabolism indicators: serum osteocalcin (BGP); serum alkaline phosphatase (ALP).

The instrument for the index test

Measuring instruments for bone metabolism-related indicators: DNP-9052 electric heating constant temperature incubator; sunrise-basic can microplate reader; Hitachi 7600-020 automatic biochemical analyzer.

Test method

1. Bone density test: Female college students taking part in the test of bone density take out the metal and other objects they carry with them, take off their shoes, and lie on their back on a multi-segment dual-energy BMD tester.[4] Through professional doctors' operation, the BMD of female college students' ulna and radius, lumbar spine and femur were tested in turn.
2. Bone metabolism-related index test: In the early morning, the tester is fasting, and the female college student draws 5 mL of venous blood in a quiet state. Choose a clean test tube containing heat sources and endotoxins to save the sample, and avoid anything during the operation. Cell stimulation, blood collection, centrifugation at a speed of 3,000 revolutions/min for 10 minutes, the specimens were separated, and the serum was stored, pending the detection of serum ALP and serum BGP indicators.

Data Statistics Method

The paper uses SPSS for Windows 11.5 software for data statistics. The test results are all expressed as "mean ± standard deviation." The significance of differences between groups is selected by single-factor analysis of variance. P<0.05 indicates that the differences between groups are significant. P<0.01 indicates that the difference between groups is highly significant.[5] The fitting data algorithm is as follows:

$$D(h) = \sum_{i=1}^{n} L_i; \qquad \overline{D(h)} = D(h)/N(h) \tag{1}$$

In the formula: L_i is the distance between the sample point pairs; $D(h)$ is the cumulative classification distance value; $N(h)$ is the cumulative classification sample point logarithm; $\overline{D(h)}$ is the average group distance, that is, the x coordinate corresponding to the experimental semivariogram obtained.[6] For the sake of unification, Still record it as h.. Repeat the above steps to perform classification inspection on all samples in this direction.

The paper assumes any sample point $A_i(x_i, y_i, z_i)$ in the space, and after the above category inspection (or search), there are m_i other sample points $B_{ij}(x_{ij}, y_{ij}, z_{ij})(j = 1, 2, \cdots, m_i)$ that meet the conditions are found. So, the formula (1) is transformed into:

$$V^*(h) = \frac{1}{2\sum_{i=1}^{n_2} m_i} \sum_{i=n_1+1}^{n-n_3} \sum_{j=1}^{m_i} [Z(A_i) - Z(B_{ij})]^2 + CS\frac{n_3 - n_1}{n_2} \tag{2}$$

RESULTS

BMD comparison results of fitness running female college students with different exercise intensities

The femoral BMD test results (Table 1) showed that in the comparison before and after the experiment, the difference between the experiment 1 group was highly significant, P<0.01, and the difference between the experiment 2 group was significant, P<0.05.

The lumbar spine BMD test (Table 2) showed that in the comparison before and after the experiment, the difference in the experiment 1 group was significant, P<0.05. After the experiment, the difference between the experiment 1 group and the control group was also significant, P <0.05.

The results of the BMD test of the radius and ulna showed (Table 3). After the experiment, experimental group 1 and experimental group 2 were compared with the control group, and the difference was not significant. The BMD of the radius and ulna of the two experimental groups was different before and after the experiment, nor is it significant.

Comparison results of related indexes of bone metabolism among female college students of fitness running at different exercise intensities

Table 1. Comparison of each group before and after the femoral BMD test.

Group	n	Before the experiment	After the experiment
Experiment 1	15	0.752±0.100	0.864±0.071
Experiment 2	16	0.749±0.061	0.801±0.051
Control group	20	0.751±0.093	0.761±0.061

Table 2. List of comparison results of each group before and after the lumbar spine L1-4BMD experiment.

Group	n	Before the experiment	After the experiment
Experiment 1	15	1.031±0.103	1.104±0.081
Experiment 2	16	1.042±0.088	1.069±0.102
Control group	20	1.031±0.112	1.048±0.094

Table 3. Comparison of the results of each group before and after the ulna and radius BMD test.

Group	n	Before the experiment	After the experiment
Experiment 1	15	0.692±0.061	0.714±0.057
Experiment 2	16	0.671±0.036	0.685±0.041
Control group	20	0.690±0.042	0.696±0.029

Serum ALP is a standard indicator reflecting bone formation. Through the 12-month fitness running test, the ALP activity of the experimental group has been improved to a certain extent, and the BGP level of the experimental group has increased. The difference is highly significant, P<0.01, the difference between the experimental group 2 is significant, P<0.05; after the experiment, the difference between the experimental group and the control group is highly significant, P<0.01. The results are shown in Table 4.

Serum BGP is another commonly used index reflecting bone formation. Through the fitness running experiment in this article, the BGP level of the experimental group has increased.[7] In the comparison before and after the experiment, the BGP difference of the experiment 1 group was highly significant, P<0.01, and the difference of the experiment 2 group was significant, P<0.05; after the experiment, the BGP difference of the experiment 1 group and the control The comparison difference is highly significant, P<0.01, while the BGP of the experimental group 2 is significantly different from the control group, P<0.05. The results are shown in Table 5.

Table 4. Comparison of each group before and after the serum ALP test.

Group	n	Before the experiment	After the experiment
Experiment 1	15	72.309±8.091	85.100±10.651
Experiment 2	16	71.042±7.091	79.093±9.022
Control group	20	71.031±9.089	71.471 ± 8.908

Table 5. Comparison of each group before and after the serum BGP test.

Group	n	Before the experiment	After the experiment
Experiment 1	15	3.529±0.097	4.239±0.147
Experiment 2	16	3.462 ± 0.107	3.982±0.125
Control group	20	3.570±0.171	3.551±0.106

DISCUSSION

BMD is an important indicator to measure the quality of human bones. It is very sensitive to reflect the changes in bone structure. Through the detection of human BMD, it can directly assess the level of human bones. Serum ALP and serum BGP are sensitive indicators that reflect the process of bone metabolism. Bone metabolism is mainly the continuous absorption of old bone under the action of osteoclasts and the synthesis of new bone under osteoblasts' action. ALP is secreted by osteoblasts and is an essential protein involved in bone metabolism. It is very sensitive in reflecting the activity of osteoblasts.[8] BGP, also known as bone γ-glutamate protein, is another sensitive marker of bone formation in bone turnover.

The analysis of serum BGP concentration changes are of great significance for exploring the activity of bone metabolism. The discussion of human bones has only been rapidly developed in recent decades.

Sport is an essential factor affecting the quality of human bones. It has been generally recognized that the research results on the relationship between sports and human bones can be found in various academic publications. However, when designing sports programs, what kind of exercise intensity has not been well obtained. Human research has found that after adolescent rhythmic gymnastics athletes undergo long-term high-intensity professional training, their bone mineral content, bone area, and BMD are respectively 23%, 14%, and 11% lower than those of students of the same age. This article compares the effects of fitness running with different exercise intensities on the bones of female college students. It explores whether there are differences in the effects of different exercise intensities on experimental subjects under the same research object, the same intervention time, and the same intervention method.

From the results of this article, we can see that the experimental group 1 college students with greater exercise intensity have significantly improved serum ALP, serum BGP, and femoral BMD after the experiment. The comparison before and after the experiment and the comparison with the control group are highly significant. The lumbar spine's BMD value was also significantly different from the control group before and after the experiment.

Besides, this paper selects the BMD of the three parts of the research object for testing. The improvement of BMD of ulna and radius of young women was not noticeable. The effect on the subjects' lumbar spine BMD and femur BMD is different from that of the radius and ulna. In particular, the BMD of the femur was significantly improved in both experimental group 1 and experimental group 2, and the improvement in experimental group 1 was even more significant. The aerobic fitness run is related to the exercise mode. According to Wolff's law, there is a corresponding relationship between bone structure and mechanical stress. Mechanical stress determines bone structure. Different exercise intervention items have different effects on human bones due to different exercise methods, so choose different exercises.

This article chooses young female college students as the research object because it can be known from the literature review that the current related research mainly focuses on middle-aged and older people. There is relatively little attention to the bone quality of young people. This article explores ways to improve the bone quality of young women and increase their BMD peak when women are young, which can better prevent the occurrence of osteoporosis after women enter the middle-aged stage.

CONCLUSION

Fitness running with greater exercise intensity has a significant effect in promoting the bone health of young women, and the bone-building effect is better than that of small and medium-intensity fitness running. The effect of fitness running on young women's BMD is site-specific, effectively improving the BMD of young women's femur and lumbar spine. Still, it has no noticeable effect on strengthening the bones of the ulna and radius.

All authors declare no potential conflict of interest related to this article

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