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Study on Bone Health Promotion of the Elderly in Community During the 14th Five Year Plan Period

Mu Ranhua

Department of Physical Education, Hankou University, Wuhan, Hubei, 430212, China

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Abstract: In order to strengthen and deepen the research on the health promotion of the elderly in the new era, this study adopts the research methods of experiment, index test and mathematical statistics to explore the internal value of aerobic exercise in improving the physical fitness level and overall quality of life of the elderly on the basis of testing various physical indexes, body composition, bone mineral density and bone metabolism indexes of the elderly, In order to provide a sports health promotion model suitable for the level of self fitness for the community elderly with different health conditions during the 14th Five Year Plan period. The results show that long-term aerobic exercise can effectively improve the physical function of the elderly, reduce the quiet heart rate of the elderly, improve cardiopulmonary function, help to improve and improve the bone metabolism of the elderly, and has positive significance to improve the overall health level of the elderly. However, the mechanism of long-term aerobic exercise to improve the bone health of the elderly needs to be further studied.

1. Introduction

The Fifth Plenary Session of the 19th CPC Central Committee put forward the main goal of economic and social development of significantly improving the physical and mental health quality of the people during the 14th Five Year Plan period and the long-term goal of building a sports power and a healthy China by 2035. In May 2021, the National Bureau of statistics released the data of the seventh national census bulletin. According to the data, the population aged 60 and over is 260 million, accounting for 18.70%. According to the prediction, the national elderly population will exceed 300 million during the 14th Five Year Plan period, and will move from mild aging to moderate aging. Studies have shown that with the progress of science and technology and social development in the new era, people's living environment and lifestyle have also undergone great changes. Many elderly people have bad habits such as reduced exercise, high-energy diet and excessive dependence on mobile phones and computers for cultural consumption (Liu Kun et al., 2021); In particular, the emergence of COVID-19 has made the health status of the elderly who are overweight, obese and metabolic diseases on the rise in recent years face greater challenges (dupeng et al., 2021); Therefore, in the "14th five year plan" period of accelerating the process of aging society and changing population structure in China, strengthening and deepening the research on health promotion of the elderly in the new era has important practical significance for the improvement of the health level of the elderly and the realization of the goal of healthy China.

With regard to health promotion, the World Health Organization defined it at the fifth global health promotion conference as: health promotion is to make people do everything possible to keep their spirit and body in the best state. Its purpose is to make people know how to keep healthy, live in a healthy lifestyle, and have the ability to make healthy choices. With the deterioration of the body function of the elderly, the occurrence of many elderly diseases is also a serious threat to the health of the elderly, especially bone and joint degenerative diseases, senile osteoporosis and other diseases will directly affect the elderly's participation in various fitness activities and affect the elderly's fitness level and quality of life. Therefore, study fitness projects to improve the elderly's fitness level and enhance the elderly's physique and quality of life, Exploring the bone health promotion scheme and mechanism of the elderly and providing scientific fitness methods for the elderly to engage in fitness activities has undoubtedly become an important issue to be solved.

Physical fitness is a comprehensive index to evaluate health from the perspective of physical education. It refers to the ability of the body to effectively and efficiently perform its own functions. It is a comprehensive evaluation of body functions, sports skills and physiological metabolism related parameters related to individual health. It is directly related to the individual's overall quality of life, as well as the individual's ability to work efficiently, enjoy leisure, health, prevent underexercise diseases and deal with emergencies. Many studies have shown that [1-3], various aerobic fitness activities are sports suitable for the elderly for long-term exercise. They have a positive impact on the improvement of the cardiovascular system, respiratory system, nervous system and bone metabolism of the elderly, which is very conducive to the health promotion of the elderly. However, whether these projects have the same exercise value and effect on the improvement of the elderly's fitness level and the improvement of the quality of life, which projects the elderly with different fitness levels should choose for exercise are more beneficial, and which fitness activities are more conducive to improve the overall quality of life of the elderly, are all important issues that need to be solved in time in front of researchers.

Based on the tests of various physical indexes, body composition, bone mineral density and bone metabolism indexes of the elderly, this study analyzes and studies whether there are differences in metabolic fitness indexes between the elderly who participate in different fitness activities and the ordinary elderly who lack exercise, so as to explore the internal value of aerobic exercise in improving the physical fitness level and overall quality of life of the elderly, In order to provide a sports health promotion model suitable for the level of self fitness for the community elderly with different health conditions during the 14th Five Year Plan period, improve the overall quality of life and health level of the community elderly, and improve the beneficial reference for the research on health promotion of the community elderly.

2. Research object and method

2.1 Research object

According to the purpose of the study, the stratified random sampling method was used to select the community elderly in the central and suburban areas of Wuhan, Yichang, Yueyang, Shiyan and Huangshi in Hubei Province (a total of 15 communities, 10-20 people in each community) as samples. Combined with the physical and mental health characteristics of the elderly in the community, the exercise intervention path, health promotion structural equation model and promotion mechanism were deeply and systematically studied.

2.2 Research method

2.2.1 Experimental method

The exercise intervention experiment used the methods of traditional aerobic training, aerobic training combined with resistance training and blood flow restriction training to carry out health promotion intervention for the elderly in different project groups for 6 months and 3 ~ 5 times a week; Sports mainly include fitness walking, Taijiquan, taijifan, softball, square dance, aerobics, shuttlecock, long-term aerobic exercise, Mulan Boxing, Taijijian, etc; Each sample community carries out 1-3 sports, and the time of each exercise is controlled at about 1 hour.

2.2.2 Index test method

The test of physical fitness index shall be carried out with full reference to the instrument and project standards specified in the national physical fitness measurement standard; The bone mineral density of human calcaneus was measured by Sahara clinical bone sonometer made in the United States; The biochemical indexes of bone metabolism, such as blood calcium (CA), phosphorus (P) and alkaline phosphatase (ALP), were measured by Japanese modular automatic biochemical analyzer and original reagent. The levels of fasting serum Ca, P and ALP were observed in the morning; The indexes of osteocalcin (BGP) and tartrate resistant acid phosphatase 5b (Tracp5b) were determined by enzyme-linked immunosorbent assay (ELISA) and S200 enzyme labeling instrument produced by thermo company in the United States.

2.2.3 Mathematical statistics

All statistical data were analyzed by using IBM SPSS statistics 24.0 statistical software. The measurement data were mainly expressed by means, standard deviation, mean standard error, etc., with $P < 0.05$ as the difference, which was statistically significant; The analysis methods mainly use t-test, analysis of variance, analysis of covariance, correlation analysis, regression analysis, factor analysis and cluster analysis. The structural equation model is mainly constructed by amos24.0 statistical software. The relationship between measurement variables and potential variables is mainly analyzed by path analysis, multi group analysis and structural mean analysis. The measurement data are mainly expressed by mean, intercept, variance, regression coefficient and covariance.

3. Results and analysis

3.1 Comparison of bone metabolism between long-term aerobic exercise group and control group

The research results in Table 1 and table 2 show that the indexes affecting bone metabolism show different changes between the two groups: the average value of serum phosphorus (P) in the long-term aerobic exercise group is higher than that in the control group, but it has no statistical significance; The serum calcium (CA) and alkaline phosphatase (ALP) in the long-term aerobic exercise group were slightly higher than those in the control group; The measured value of tartrate resistant acid phosphatase 5b (Tracp5b) was slightly lower than that of the same index in the control group. The statistical test results of the three groups were significantly different ($P < 0.05$); The measured value of osteocalcin (BGP) in the long-term aerobic exercise group was significantly higher than that in the control group, and there was a very significant difference ($P < 0.01$). The results suggest that long-term aerobic exercise can change the relevant physiological indexes

reflecting bone metabolism.

Table 1: Descriptive statistics of bone metabolism indexes in long-term aerobic exercise group and control group

	group	Number	mean	standard deviation	standard error
Serum calcium (mmol/L)	exercise group	61	2.211	0.067	0.01
	control group	53	2.141	0.032	0.00
Serum phosphorus (mmol/L)	exercise group	61	1.183	0.069	0.01
	control group	53	1.175	0.043	0.01
alkaline phosphatase (U/L)	exercise group	61	97.347	5.331	0.68
	control group	53	94.135	8.007	1.10
osteocalcin (μg/L)	exercise group	61	5.457	0.197	0.03
	control group	53	4.851	0.058	0.01
Tartrate resistant acid phosphatase 5b (μg/ml)	exercise group	61	2.668	0.079	0.01
	control group	53	2.8126	0.096	0.01

Table 2: T-test results of independent samples of bone metabolism indexes in long-term aerobic exercise group and control group

	F	P	T	f	P	Mean square deviation	Standard error	95%confidence	
								Low	Max
CA	6.492	0.012	6.954	112	0.000	0.070	0.010	0.050	0.090
P	0.720	0.398	0.780	112	0.437	0.008	0.011	-0.013	0.030
ALP	6.007	0.016	2.550	112	0.012	3.211	1.259	0.715	5.707
BGP	70.869	0.000	21.572	112	0.000	0.606	0.028	0.550	0.661
Tracp5b	5.543	0.020	-8.829	112	0.000	-0.144	0.016	-0.177	-0.112

4. Discussion

4.1 Effect of long-term aerobic exercise on bone metabolism in the elderly

4.1.1 Effect of long-term aerobic exercise on biochemical indexes of serum calcium and phosphorus in the elderly

Calcium and phosphorus are the main components of human bone tissue. The relative stability of serum calcium and phosphorus content mainly depends on the balance ability of human body to absorb and excrete calcium and phosphorus. These balance abilities are mainly regulated by vitamin D3, parathyroid hormone, calcitonin and other related hormones. Relevant studies have shown that the content of calcium and phosphorus in human serum can indirectly reflect bone metabolism [4], and only when the product of calcium and phosphorus concentration is maintained at a certain level can the anabolism of bone tissue be ensured, that is, when expressed in mg / dl, the product of calcium and phosphorus concentration in blood is greater than 40 Mg2 / dl2 (calcium: 1mmol / L = 4mg / dl; phosphorus: 1mmol / L = 3.5mg / dl), which is conducive to the deposition of calcium and phosphorus in bone tissue in the form of bone salt, Less than 35 Mg2 / dl2 may hinder bone calcification and affect osteogenesis [5].

Both the long-term aerobic exercise group and the control group are the elderly without bone metabolic diseases. From the measurement results of biochemical components of bone minerals, it can be seen that the measured values of each index are within the normal range. However, from the

product results of serum calcium and phosphorus, the calcium and phosphorus concentration product (36.50 Mg2 / dl2) of the elderly in the long-term aerobic exercise group is slightly higher than that of the elderly in the control group (35.05 Mg2 / dl2). The measured index values show that, This result is mainly due to the fact that the content of serum calcium in the elderly in the long-term aerobic exercise group is slightly higher than that in the control group. It may be that long-term aerobic exercise not only accelerates the process of human metabolism, but also effectively promotes the synthesis of more endogenous vitamin D3 in the skin, which is conducive to the absorption of calcium by the human body, It is beneficial to increase the content of serum calcium in the body.

4.1.2 Effect of long-term aerobic exercise on serum osteocalcin content in the elderly

Studies have shown that most of Serum Osteocalcin (BGP) is produced by osteoblasts in vivo and released into the blood. There is a close positive correlation between serum osteocalcin and osteocalcin content in bone. Osteocalcin value will change differently with age and bone renewal rate. The faster the bone tissue renewal rate is, the higher the serum osteocalcin value will be. The serum osteocalcin concentration in vivo can reflect the activity of osteoblasts to a certain extent, It can also explain the speed of bone formation rate in the process of bone turnover to a certain extent [6], which has unique significance for reflecting the instantaneous bone turnover level of human bone tissue and evaluating the bone metabolism state of human body [7]. Therefore, the detection of Serum Osteocalcin (BGP) in vivo is also considered to be an ideal detection index for studying the state of bone formation and bone renewal.

In this study, the mean value of serum BGP in the long-term aerobic exercise group was higher than that in the control group, and there was a very significant difference between the long-term aerobic exercise group and the control group ($P < 0.01$). It shows that long-term aerobic exercise for the elderly is conducive to improve their own bone formation and bone conversion level, improve the rate of bone formation and bone metabolism, and play a positive role in the prevention of osteoporosis in the elderly. This is also more consistent with the research results of ouyangmei [8]. Her research shows that the elderly can enhance the activity of osteoblasts through long-term aerobic exercise such as cross-country walking, increase the value of serum BGP and enhance bone formation, and keep the bone metabolism of the elderly in a good state.

4.1.3 Effect of long-term aerobic exercise on serum alkaline phosphatase in the elderly

Alkaline phosphatase (ALP) is an important protein involved in bone metabolism. About half of the alkaline phosphatase in blood comes from bone tissue and most of the rest comes from liver. Therefore, in clinical practice, the determination of alkaline phosphatase (ALP) is mostly used to diagnose the diseases of bone system and hepatobiliary system. For example, the content of bone alkaline phosphatase or serum alkaline phosphatase is often used to evaluate the role of bone formation and bone turnover rate. Most of the alkaline phosphatases in the body are distributed in osteoblasts of bone tissue. When osteoblasts are active, some of the alkaline phosphatases secreted by osteoblasts participate in bone mineralization in the bone mineralization area (alkaline phosphatase can hydrolyze phospholipids in the bone mineralization area and deposit the generated phosphate and calcium ions on the bone collagen frame to produce bone mineralization), and the other part can enter the blood to enhance the activity of alkaline phosphatase in the blood. Therefore, it is generally believed that if there are no other hepatobiliary diseases, the increase of alkaline phosphatase activity in serum indicates that the activity of human osteoblasts is increased and in a more active state.

The results of this study show that the serum alkaline phosphatase of the long-term aerobic

exercise group is higher than that of the control group, indicating that the long-term aerobic exercise is conducive to enhance the activity of osteoblasts and promote bone synthesis. For the elderly who are gradually in a weak position in bone synthesis, long-term aerobic exercise may play a certain role in preventing and alleviating senile osteoporosis. This is more consistent with the research results of Miao Fusheng, Wang Meng and other [9]. By studying the changes of bone mineral density and bone metabolism indexes of 60 postmenopausal women after four kinds of fitness qigong exercises, they found that the blood ALP level of fitness Qigong group was significantly higher than that of the control group. They believe that fitness Qigong exercise can not only promote the bone building state of osteoblasts, but also effectively inhibit the bone resorption activity of osteoclasts.

4.1.4 Effect of long-term aerobic exercise on tartrate resistant acid phosphatase in the elderly

There are a wide range of sources of acid phosphatase in blood, including bone, prostate and other tissues, as well as red blood cells and platelets. Bone derived acid phosphatase, tartaric acid resistant phosphatase (tracp-5b), is named because it can resist the inhibition of tartaric acid. Tartrate resistant acid phosphatase is one of the most important indicators of bone metabolism that can timely reflect bone resorption. It is mainly released by osteoclasts during bone resorption. Research shows that the change of tracp-5b content in blood is significantly earlier than that of bone mineral density [10]. The increase of tartrate resistant acid phosphatase content in blood indicates the enhancement of osteoclast activity and bone resorption [11], Studies have shown that the content of tracp-5b in patients with metabolic bone diseases with high bone conversion rate, such as patients with osteoporotic fractures, may increase.

It can be seen from the research results in Table 1 that the tartrate resistant acid phosphatase of the elderly group participating in long-term aerobic exercise is significantly higher than that of the control group, indicating that long-term aerobic exercise is helpful to enhance the activity of osteoclasts. Combined with the above research results that the activity of alkaline phosphatase is also enhanced, it is considered that the bone metabolism index of long-term aerobic exercise practitioners is more active and shows a higher conversion state than that of the control group, It shows that long-term aerobic exercise can not only enhance the activity of osteoblasts and promote bone synthesis, but also help to improve the activity of osteoclasts and facilitate bone absorption. It is a bone strengthening exercise more suitable for the elderly. The research results of Wu doulei [4] and others also showed that the activity of serum tartrate resistant hydrochloric acid phosphatase increased significantly after half a year or one-year shuttlecock exercise, and the effect of one-year exercise group was the most obvious. They believed that bone strengthening exercise had the trend of inhibiting aging and high conversion bone resorption after menopause.

In conclusion, it can be seen that long-term aerobic exercise can effectively improve the physical function of the elderly, reduce the quiet heart rate of the elderly, improve cardiopulmonary function, help to improve and improve the bone metabolism of the elderly, and has positive significance for improving the overall health level of the elderly. However, the mechanism of long-term aerobic exercise to improve the bone health of the elderly needs to be further studied.

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