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The survey and analysis of sports' influence on teenagers' bone mineral density and bone metabolism

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ABSTRACT

Learning about the influence of sports on the teenagers' bone mineral density and bone metabolism and providing more reliable theories for reducing the possibility of suffering from the Osteoporosis Disease by measuring and comparing indexes relative to the bone mineral density and bone metabolism of two groups of teenagers. One group of teenagers do regular exercise and others do a little. The method: Based on the principal of randomization, choosing forty students from universities in Beijing, twenty of whom are major in PE and do regular exercise but others are not PE majors and just do a little exercise, to measure their bone mineral content, bone mineral density and projection area of the different parts in their waists and hips, and also their biochemical indexes reflecting the bone metabolism, such as T, ALP, U-HOP, U-Ca, U-Cr and so on. The result: The bone mineral content and bone density of the teenagers who do regular exercise are higher than those of students who are not in PE major, and especially the T of the former is distinctly higher than that of the latter; Although other biochemical measurements of the two groups of teenagers are low and without distinct differences, the ALP of the teenagers who do regular exercise is higher than that of ones who do a little. The conclusion: Doing regular exercise makes a positive effect on teenagers' bone health because that is helpful to increase their bone mineral density and bone mineral content by influencing their bone metabolism. So doing regular exercise can make a solid healthy bone foundation for teenagers and reduce the possibility of them suffering from the Osteoporosis Disease as they grow older.

KEYWORDS

Teenagers; Sports; Bone mineral density; Bone metabolism; The osteoporosis disease.



INTRODUCTION

The recent studies have found that the Osteoporosis Disease ranks seventh among common diseases and frequently-occurring diseases. This fact has attracted the attention of biology research experts and relative medical workers home and abroad. The Osteoporosis Disease has a close relationship with the increasing of human life expectancy and the reducing of doing exercise. In our field of sports medical science, there are more and more scientists undertaking to study the positive influence of sports on preventing people from suffering from the Osteoporosis Disease and also its effects on developing the curing of such disease. And now there have been some delightful achievements made by our experts and scientists. Many researches have shown that the Osteoporosis Disease has a close relationship with the metabolic imbalance because bone metabolism is an very important part of human metabolism. Doing adequate and regular exercise is one of the important ways to strengthen our bones, on account of that our bone mineral content increases rapidly in our adolescence, and that the indexes of our bone mineral content and bone metabolism would change distinctly before and after such period. This paper focuses on the detecting and analyzing of sports' effect on the teenagers' bone metabolism and does a research on those indexes about bone metabolism, so that to lay a more solid theoretical basis for further preventing and curing the Osteoporosis Disease^[1].

RESPONDENTS AND THE METHOD

Respondents

Choosing 40 students of 18-22 years old from universities in Beijing, 20 of whom are PE majors and do regular exercise (5-7 times a week and 2 hours per day) but another 20 of whom are not PE majors and just do a little exercise or physical work. All these respondents, ones being of health that is proven by clinic effective and also without the clinic history of endocrine disease, chronic diarrhea and receiving the isotopic examination and radioactive therapy recently, will be divided into two groups, the sports one and the ordinary one, between which there are no distinct differences in sex ratio, height and weight. The information of two groups of students is shown by TABLE 1:

TABLE 1 : The basic information about two groups of students

Group	Number	Male	Female	Age	Height(cm)	Weight(kg)
The Sporting Group	20	17	3	20.45±1.50	171.35±9.20	61.50±7.16
The Ordinary Group	20	17	3	20.25±1.80	170.68±10.00	62.25±8.05

The study method

At 8 o'clock in the morning, drawing blood of 2ml from a calm respondent in fasting state who doesn't eat any food that would have an influence on the testing result before. Spending ten minutes in washing the glass tube containing of blood of 2ml with water of 37 degrees Celsius, and then preserving the blood serum, which is achieved after ten minutes are spent in processing the blood of 2ml with 3000turns/separation, in a refrigerator with a temperature of 2°C-8°C. Every one's second urine in the same morning should be kept. The indexes that should be tested are bellow: the bone mineral content, bone mineral density and projection area of the different parts in every respondent's waist and hip, U-HOP, U-Ca, U-Cr, T, ALP and so on. And U-HOP/U-Cr和U-Ca/U-Cr also needs to be calculated. Data processing should be done to the test results of bone mineral content, bone density, projection area and

also to a set of indexes like what referred above. At last discussing and analyzing the differences in such indexes between two groups^[2].

THE STUDY RESULTS

The bone mineral density of members from two different groups

The test results have shown us that the datum of members from the sporting group are higher at different levels than those of students from the ordinary group. There is a distinct difference in the bone density of Ward triangle and lumbar vertebra (L2-4) between two groups of students, but no obvious difference in the bone density of femoral neck and the greater trochanter. The bone mineral density of lumbar vertebra (L2-4) and left femoral neck of members from two groups is shown by the TABLE 2 below:

TABLE 2 : The bone mineral density of lumbar vertebra (L2-4) and left femoral neck of members from two groups.(unit:g/ cm²)

Group	Number	The Femoral Neck	The Ward Triangle	The Greater Trochanter	L2	L3	L4
The Sporting Group	20	0.85±0.07	0.78±0.10	0.78±0.07	1.01±0.12	1.08±0.13	1.11±0.12
The Ordinary Group	20	0.79±0.09	0.68±0.08	0.72±0.09	0.88±0.06	0.94±0.08	0.96±0.10

The bone mineral content of lumbar vertebra (L2-4) and left femoral neck of members from two groups

All test datum have shown us that all datum of the sporting group are higher than those of the ordinary one. Especially there are distinct differences in the bone mineral content of the greater trochanter, the femoral neck, lumbar vertebra L2 and L4 between two groups. Ward Triangle and lumbar vertebra L3 of the two groups are still different from each other, but not distinct. The details of the test result are shown in Chart 3 below:

TABLE 3 : The bone mineral content of lumbar vertebra (L2-4) and left femoral neck of members from two groups(unit:g)

Group	Number	The Femoral Neck	The Ward Triangle	The Greater Trochanter	L2	L3	L4
The Sporting Group	20	3.36±0.32	1.10±0.15	9.65±1.40	12.22±2.00	14.73±2.11	16.54±2.47
The Ordinary Group	20	2.85±0.35	0.94±0.13	7.54±1.41	10.56±1.33	12.77±1.63	13.86±2.15

The projection area in lumbar vertebra (L2-4) and left femoral neck of members from two groups

Based on the datum we have gotten, the projection area in different parts of teenagers from the sporting group is larger than that of the ordinary one. Although the difference in the projection area of the greater trochanter between two groups is distinct, there are little obvious ones in femoral neck, Ward Triangle and lumbar vertebra (L2-4) between two groups. The details of the test result are shown in the TABLE 4 below:

TABLE 4 : The projection area reflecting in lumbar vertebra (L2-4) and left femoral neck of members from two groups (unit: cm²)

Group	Number	The Femoral Neck	The Ward Triangle	The Greater Trochanter	L2	L3	L4
The Sporting Group	20	4.01±0.35	1.36±0.08	12.06±1.33	11.98±1.50	13.37±1.68	15.23±2.00
The Ordinary Group	20	3.69±0.27	1.34±0.08	10.69±1.15	11.17±1.00	13.18±1.17	14.28±0.88

The biochemical indexes of both the sporting group and the ordinary group

The test result has shown us that the T of the sporting group is distinctly higher than that of the ordinary one. ALP of the sporting group is also higher than that of the ordinary group, but not distinct. U-HOP, U-Ca, U-HOP/U-Cr and U-Ca/U-Cr of the sporting group is lower than those of the ordinary one, but not distinct. The biochemical indexes of both groups are shown below in the TABLE 5:

TABLE 5 : The biochemical indexes of two groups

Group	Number	T($\mu\text{g/ml}$)	ALP (U/L)	U-HOP ($\mu\text{g/mg}$)	U-Ca (mmol/L)	U-HOP/U-Cr	U-Ca/U-Cr
The Sporting Group	20	11.09 \pm 2.05	77.95 \pm 13.45	0.85 \pm 0.31	2.89 \pm 1.41	0.12 \pm 0.07	0.36 \pm 0.18
The Ordinary Group	20	8.01 \pm 2.76	72.88 \pm 10.65	1.30 \pm 0.83	3.18 \pm 1.65	0.19 \pm 0.10	0.45 \pm 0.24

THE ANALYSIS AND DISCUSSION OF THE TEST RESULTS

Those datum referred above are clear enough to show us that doing sports indeed has an influence on human bone metabolism. There are differences, at different levels, in bone mineral content, bone mineral density and biochemical indexes about bone metabolism between teenagers who do regular exercise and those who do little or not^[3].

The Bone mineral density means the bone mineral content in a standard bone area, and it is also closely relative to the bone mass. Bone metabolism has a direct influence on the bone mineral content and the bone mass of the organism. Foreign studies have shown that the bone mineral content increases rapidly in one's childhood and adolescence and then peaks at one's 30 years old around. The bone metabolism is different in different human life period. However, whichever period you are in, the adequate exercise can bring positive effects to your bone metabolism and improve your bone quality. So there is a great significance in researching this topic for the teenagers because one's adolescence is an important life period when his bone mineral content increases rapidly^[4].

Sports' influence on the bone mineral density, bone mineral content and the projection area

The studying of the teenagers has shown us that doing sports not only has an influence on the bone metabolism but also is helpful to promote the growth of the bone and to increase the bone mineral density and the bone mineral content. This paper focuses on the influence of sports on the teenagers' bone mineral density and their bone metabolism. The test results show that in the same part of the human body, the bone mineral density of L2, L3, L4 and the Ward Triangle of members from the sporting group is distinctly different from that of the ordinary group; and so is the bone mineral content of L2, L4, femoral neck and the greater trochanter. But the projection area is different obviously between two groups. Some studies have proven that the bone mineral density is relative to inheritance, nutrition, sports and hormonal readiness, of which inheritance is the determinant and sports is more important than others. This paper also shows us that doing regular exercise has a positive influence on the bone mineral density, the bone mineral content and the projection area, reducing the possibility of people suffering from the Osteoporosis Disease^[5].

The influence of sports on the testosterone

The test results referred in this paper have shown that the concentration of the testosterone of the sporting group is higher than that of the ordinary one. According to this discovery we can learn that doing regular exercise also is helpful to accelerate the changing of the testosterone concentration^[6].

In the field of the body's biology and chemistry, the sex hormone is crucial because it can have a direct or indirect influence on the process of the body's metabolism. Only when the sex hormone concentration is in an appropriate range, the body's metabolism could operate well. Too high or too low the concentration is, either would damage the body. In the process of the body's metabolism, the sex hormone has also an indirect influence on the bone metabolism. The appropriate concentration of the sex hormone is necessary to promote the bone metabolism, to increase the bone mineral content and to strengthen our bone. When the concentration is in the ordinary range, the higher the sex hormone is, the more distinct its influence on the bone metabolism is^[7].

In this survey, the testosterone concentration of two groups are all in the common range, but the sporting group's is distinctly higher than that of the other one. So the influence of the testosterone on the sporting group is more obvious than that on the ordinary group.

The influence of sports on the biochemical indexes of the bone metabolism such as ALP, U-HOP, U-Ca

The current studies have shown that the stress stimulation directly affects the changing of the bone shaping and the bone mineral content. By observing the test results shown in this paper, we can learn clearly that the ALP of the sporting group is higher than that of the ordinary one and that the U-HOP, U-Ca, U-HOP/U-Cr, U-Ca/U-Cr of the latter are higher than those of the former. The differences in the biochemical indexes referred above between two groups are not distinct, but still cannot be denied nor neglected^[8-10].

Among the three factors of ALP, U-HOP, U-Ca, ALP is an important index, reflecting the shaping of the bone because of its ability to promote the mineralization of the bone; U-HOP, determined by the synthesis and degradation of the collagen, is an important factor reflecting the bone resorption. Our studies have proven that doing exercise is helpful to promote the shaping of the bone and to reduce the bone adsorption. Although all biochemical indexes of two groups, shown in this paper, fluctuate within a normal range, the ALP of members who do much more exercise, to some extent, is higher than that of the ordinary ones. In addition to the relatively lower U-HOP of members from the sporting group, the bone mineral content and the bone density of the sport team are higher than those in the same body part of students from the ordinary group, further proving the positive effect of the adequate exercise on increasing the bone mineral content and the bone mineral density.

THE CONCLUSION AND SUGGESTION

With the increasing of our living standard and the accelerating of the global aging, more and more people are suffering from the Osteoporosis Disease, making it more urgent for us to preventing and curing this disease ever than before. The study about this topic shown in this paper proves that teenagers should do appropriate exercise, which is helpful to promote the healthy growth of their bone and effectively to avoid their suffering from the Osteoporosis Disease.

Because much attention have been devoted to work and study, teenagers, especially those who are in universities, often neglect the importance of doing adequate exercise, reducing and losing their boon mineral content and therefore damaging their bone. So we should make more efforts to spread the importance of doing appropriate exercise among teenagers and to encourage them to participate the exercise by increasing their passion for sports.

By contrary, doing excessive exercise would not only be harmful to the bone healthy growth but also increase the possibility of teenagers suffering from the sport injury. So doing reasonable and appropriate exercise is the priority among priorities.

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