EFFECT OF HIGH-INTENSITY TRAINING ON BONE MINERAL DENSITY IN BASKETBALL PLAYERS

EFEITO DO TREINAMENTO DE ALTA INTENSIDADE NA DENSIDADE MINERAL ÓSSEA EM JOGADORES DE BASQUETE

EFECTO DEL ENTRENAMIENTO DE ALTA INTENSIDAD SOBRE LA DENSIDAD MINERAL ÓSEA EN JUGADORES DE BALONCESTO

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ABSTRACT

Introduction: Increasing the bone mineral density of athletes can provide better basic physical conditions for basketball players, prevent fractures caused by osteopenia and reduce the occurrence of serious sports injuries. Objective: Explore the effect of high-intensity training on bone mineral density in basketball players. Methods: In this experiment, 30 subjects were divided into male and female groups, and high-intensity exercise training was performed for 60 minutes, three times a week, for eight weeks. The relevant indices were measured before and after training, and their data were classified and analyzed. Results: High-intensity training can significantly improve the bone mineral density of basketball players, and the increase of bone mineral density of female basketball players is slightly lower than that of male players. In addition, the increase in bone mineral density can comprehensively improve athletes' muscular strength and physical fitness. Conclusion: High-intensity training can improve basketball players' bone mineral density and sports skills, requiring promoting studies for its popularization in colleges and universities. ***Level of evidence II; Therapeutic studies - investigation of treatment outcomes.***

Keywords: Exercise; Basketball; Bone Density.

RESUMO

Introdução: Aumentar o nível de densidade mineral óssea dos atletas pode proporcionar melhores condições físicas básicas para jogadores de basquetebol, prevenir fraturas causadas pela osteopenia e reduzir a ocorrência de lesões esportivas graves. Objetivo: Explorar o efeito do treinamento de alta intensidade na densidade mineral óssea de jogadores de basquetebol. Métodos: Neste experimento, 30 indivíduos foram divididos em grupo masculino e feminino, o treinamento de exercícios de alta intensidade foi realizado por 60 minutos, três vezes por semana durante um total de 8 semanas. Os índices relevantes foram medidos antes e após o treinamento, seus dados foram classificados e analisados. Resultados: O treinamento de alta intensidade pode melhorar significativamente a densidade mineral óssea dos jogadores de basquetebol, e o aumento da densidade mineral óssea das jogadoras de basquetebol feminino é ligeiramente menor do que o dos jogadores masculinos. Além disso, o aumento da densidade mineral óssea pode melhorar de forma abrangente a força muscular e a aptidão física dos atletas. Conclusão: O treinamento de alta intensidade pode promover a melhoria da densidade mineral óssea e habilidades esportivas dos jogadores de basquetebol, necessitando de estudos promotores para sua popularização em Faculdades e Universidades. ***Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.***

Descritores: *Exercício Físico; Basquetebol; Densidade Óssea.*

RESUMEN

Introducción: Aumentar el nivel de densidad mineral ósea de los deportistas puede proporcionar mejores condiciones físicas básicas a los jugadores de baloncesto, prevenir las fracturas causadas por la osteopenia y reducir la aparición de lesiones deportivas graves. Objetivo: Explorar el efecto del entrenamiento de alta intensidad sobre la densidad mineral ósea en jugadores de baloncesto. Métodos: En este experimento, 30 sujetos se dividieron en el grupo de hombres y mujeres, se realizó un entrenamiento de ejercicios de alta intensidad durante 60 minutos, tres veces por semana durante un total de 8 semanas. Se midieron los índices relevantes antes y después del entrenamiento, se clasificaron sus datos y se analizaron. Resultados: El entrenamiento de alta intensidad puede mejorar significativamente la densidad mineral ósea de los jugadores de baloncesto, y el aumento de la densidad mineral ósea de las jugadoras de baloncesto es ligeramente inferior al de los jugadores. Además, el aumento de la densidad mineral ósea puede mejorar ampliamente la fuerza muscular y la forma física de los deportistas. Conclusión: El entrenamiento de alta intensidad puede promover la mejora de la densidad mineral ósea y de las habilidades deportivas en los jugadores de baloncesto, siendo necesario promover estudios para su popularización en Colegios y Universidades. ***Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.***

Descriptores: *Ejercicio Físico; Baloncesto; Densidad Ósea.*

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INTRODUCTION

Basketball is a sport full of confrontation and impact. In the process of sports, the confrontation between athletes not only needs the application of skills and strength, but also is closely related to the level of athletes themselves.[1] At present, we can often see the injury of athletes in basketball. Whether it is ankle sprain and even fracture caused by running and jumping, or hand fracture caused by collision and falling, it has seriously affected the health of athletes and shortened their sports life.[2] Through the previous analysis, it can be seen that enhancing the level of athletes' bone mineral density can not only provide athletes with better physical basic conditions, promote the improvement of their muscle strength and physical level, and make athletes more smooth on the field, but also prevent fractures caused by athletes' osteoporosis, reduce the occurrence of serious sports injuries as much as possible, so as to prolong the athletes' sports life.[3] Through literature research, it can be found that bone mineral density is an important index to study the bone quality of athletes. If the bone mineral density is low, it is easy for athletes to have fractures in the process of sports.[4] The literature suggests that although bone mineral density is greatly affected by genetic factors, bone mineral density can be improved through acquired forms, such as calcium supplementation, eating dairy products, active exercise and so on.[5] The literature suggests that basketball has certain antagonism and impulse load, which is beneficial to the improvement of athletes' bone mineral density.[6] Through literature research, we can see that sports with high exercise intensity and higher confrontational impact are more beneficial to the improvement of athletes' bone mineral density, while some more soothing sports, such as jogging, cycling, swimming and so on, athletes' bone mineral density level is relatively low. Is the bone mineral density level related to high-intensity training? Can high intensity training comprehensively improve athletes' skills, especially bone mineral density? Taking 30 basketball majors in a university as an example, this paper discusses the impact of high-intensity exercise on the bone mineral density level of basketball players, so as to optimize the basketball training scheme from a more scientific point of view.

METHOD

Before training, select the research object among the professional basketball players in Colleges and universities. The study and all the participants were reviewed and approved by Ethics Committee of Xi'an Jiaotong University (NO. 19XNJTU05ZZ). The selection is based on the following criteria: first, athletes know the experimental contents and have good cooperation ability; Secondly, there is no drug taking and no sports injury in the whole process of sports; Third, athletes can complete the high-intensity training for 8 weeks in good order, and the personnel in the group are almost consistent in other training and diet, so as to reduce the interference of irrelevant variables as much as possible. (Table 1)

This experiment adopts the method of comparison before and after the group. Because there are many differences in bone mineral density between men and women, the subjects are divided into men's group and women's group for relevant high-intensity training respectively. Each exercise lasts 60 minutes, including 15 minutes of warm-up stretching, 30 minutes of high-intensity training, and 15 minutes of relaxation activities. Ensure that athletes get good exercise, reduce sports injuries as much as possible, and give athletes a good state. High intensity exercise training is conducted three times a week for a total of 8 weeks.

In addition to the measurement of bone mineral density before and after training, it also analyzes the improvement of basketball skills after high-intensity training. Taking the indexes such as multi-point passing and receiving in the whole field, low hand shooting in one minute, line turning back dribbling in the whole field, playing and grabbing technology, rebounding technology in the front court and rebounding technology in the back court as the judgment criteria, the measurement before and after training is carried out, and the data are sorted and analyzed.

Table 1. Basic situation analysis of experimental subjects.

Option	Male	Female
Height (cm)	189.941±7.1220	176.462±6.2252
Weight (kg)	90.759±30.8045	72.742±9.2265
BMI(kg/m^2)	24.667±6.4399	22.648±2.1983
Years of exercise	5.701±1.5096	5.818±1.4548

RESULTS

Effect of high intensity training on bone mineral density of basketball players

As shown in Table 2, after high-intensity training, the BMD of male basketball players' upper limbs increased from 0.960 ± 0.0789 (g / cm2) to 1.069 ± 0.0874 (g / cm2), lower limbs from 1.598 ± 0.1979 (g / cm2) to 1.778 ± 0.2172 (g / cm2), trunk from 1.184 ± 0.0594 (g / cm2) to 1.306 ± 0.0646 (g / cm2), and whole body BMD from 1.362 ± 0.0495 (g / cm2) to 1.508 ± 0.0543 (g / cm2). It can be seen that high-intensity training is of good help to the improvement of bone mineral density of male athletes, and the improvement range of bone mineral density of lower limbs and trunk is slightly higher than that of upper limbs.

As shown in Table 3, after high-intensity training, the BMD of female basketball players' upper limbs increased from 0.831 ± 0.0493 (g / cm2) to 0.925 ± 0.0546 (g / cm2), lower limbs from 1.401 ± 0.0990 (g / cm2) to 1.542 ± 0.1086 (g / cm2), trunk from 1.064 ± 0.0693 (g / cm2) to 1.162 ± 0.0753 (g / cm2), and whole body BMD from 1.253 ± 0.0693 (g / cm2) to 1.388 ± 0.0760 (g / cm2). Through the comparative analysis of data, it can be seen that high-intensity exercise can effectively improve the bone mineral density of female athletes' limbs, trunk and whole body, but compared with male athletes, the increase range of bone mineral density of female athletes is slightly lower, which may also be related to the characteristics of human body. Generally speaking, high-intensity exercise can effectively improve the bone mineral density of athletes and provide better physical basis and physical conditions for athletes.

Influence of high intensity training on skill improvement of basketball players

When discussing the effect of high-intensity sports training on the improvement of basketball skills, male athletes and female athletes are regarded as one, and the situation before and after training is discussed. As shown in Table 4, after high-intensity training, the duration of multi-point

Table 2. Changes of bone mineral density of male basketball players before and after high-intensity training (g / cm^2).

Option	Before	After
Upper limb part	0.960±0.0789	1.069±0.0874
Lower limb part	1.598±0.1979	1.778±0.2172
Trunk part	1.184±0.0594	1.306±0.0646
Whole body	1.362±0.0495	1.508±0.0543

Table 3. Changes of bone mineral density of female basketball players before and after high-intensity training (g / cm^2).

Option	Before	After
Upper limb part	0.831±0.0493	0.925±0.0546
Lower limb part	1.401±0.0990	1.542±0.1086
Trunk part	1.064±0.0693	1.162±0.0753
Whole body	1.253±0.0693	1.388±0.0760

Table 4. Effect of high intensity training on the improvement of basketball skills.

Option	Before	After
Multi -point pass from the audience (s)	15.722±2.6562	15.094±2.7147
1min and low -handed shooting between 1min (one)	6.900±0.8019	8.590±0.4929
See the game back to the dribble (s)	30.970±3.1234	29.652±2.8608
Playing the ball technology (score)	78.975±8.4039	87.996±8.9811
Grab the frontcourt rebound technology (score)	77.117±8.1473	84.100±8.4615
Grab the backcourt rebounding technology (score)	80.951±8.1481	88.653±8.8053

passing and receiving in the whole court was reduced from 15.722 ± 2.6562 (s) to 15.094 ± 2.7147 (s), the number of low hand shots during 1-minute travel was increased from 6.900 ± 0.8019 (s) to 8.590 ± 0.4929 (s), the length of turning back and dribbling in the whole court was reduced from 30.970 ± 3.1234 (s) to 29.652 ± 2.8608 (s), and the score of playing and grabbing skills was increased from 78.975 ± 8.4039 (points) to 87.996 ± 8.9811 (points), The technical score of rebounding in the front court was increased from 77.117 ± 8.1473 (points) to 84.100 ± 8.4615 (points), and the technical score of rebounding in the back court was increased from 80.951 ± 8.1481 (points) to 88.653 ± 8.8053 (points). From the data analysis, it can be seen that high-intensity training can effectively improve the sports skills of basketball players, improve the sports speed, enhance the speed and accuracy of shooting, improve the technical score, and finally improve the competition performance of basketball players.

DISCUSSION

Literature studies have found that there is a positive backward relationship between exercise intensity and the improvement of bone mineral density. That is, within a certain range, with the gradual enhancement of exercise intensity, the level of bone mineral density will gradually increase. In this range, in addition to the impact of exercise intensity on bone mineral density, exercise time will also show a positive correlation with the improvement of bone mineral density. However, if the exercise intensity exceeds the load that the athlete's own body can bear, that is, in the stage of overload exercise, it will have an adverse impact on the body. Beyond the critical value, the higher the exercise intensity and the longer the exercise time, the bone mineral density of the body will show a negative correlation, resulting in the reduction of human bone mass, and it is easy to produce stress fractures due to overload exercise. Therefore, when choosing the exercise intensity, we must choose the appropriate exercise range according to the scientific exercise collocation, combined with the actual situation of the athletes and the exercise load they can bear, and improve the bone mineral density, so as to prevent the poor effect of bone mineral density improvement due to low exercise intensity or overload exercise due to high exercise intensity, resulting in sports injury.

Through the research results of this paper, it can be found that improving the level of bone mineral density plays a very important role in improving athletes' comprehensive sports ability and basketball competitive performance. Therefore, coaches should change their ideas. The training of sports basketball skills not only depends on hard work day after day, but also needs to master scientific methods. Coaches should actively learn the knowledge of biomechanics and physiology, fully learn the relevant contents of the improvement of bone mineral density level, combine physiology with sports teaching in combination with the knowledge of physical training, and make scientific and reasonable planning for training content, training intensity, training duration, training frequency and other aspects. Athletes should also straighten out their mentality and treat physical training and teaching from a scientific perspective. They should not only strengthen sports training, but also strengthen the learning of relevant knowledge, and actively analyze and discuss with coaches on various situations generated in the process of sports in time, so as to get a more suitable training development plan, and use scientific knowledge to help physical training, so as to promote the improvement of their own ability level.

CONCLUSION

Through the analysis of this paper, it can be seen that high-intensity training can significantly improve the bone mineral density level of basketball players, but due to certain differences between individuals of different genders, the increase of bone mineral density of female basketball players by high-intensity training is slightly less than that of male basketball players. In addition, the increase of bone mineral density level can comprehensively improve the muscle strength and physical fitness level of athletes, so that athletes can have a better physical foundation on the premise of mastering the same sports skills, so as to significantly improve their basketball scores and promote the comprehensive development of basketball mobilization. Through this research, we can get the following conclusions: high-intensity training can promote the improvement of basketball players' bone mineral density and sports skills, so it is worth popularizing in Colleges and universities. However, there are some problems in this paper. For example, the number of samples is too small, and only 30 students participate in the experiment, so it may be accidental. In addition, in the selection of research objects, the recruitment of volunteers concentrated in the same school may also bring some errors to the experiment due to factors such as the whole diet, climate or daily life. Therefore, in the follow-up experimental research, we should expand the number of samples and research area, so as to make the results more universal.

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