EFFECT OF WEIGHT TRAINING ON LOWER LIMB STRENGTH IN SOCCER PLAYERS

EFEITO DA MUSCULAÇÃO SOBRE A FORÇA NOS MEMBROS INFERIORES DOS JOGADORES DE FUTEBOL

EFECTO DE LA MUSCULACIÓN EN LA FUERZA DE LOS MIEMBROS INFERIORES DE LOS JUGADORES DE FÚTBOL

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ABSTRACT

Introduction: There are many methods for lower limb explosive strength training in soccer athletes, and the most common is strength gain training by load increase. There is still no consensus on whether this type of training can influence jumping performance in soccer athletes. Objective: To explore the influence of muscle gain by added weight on jumping performance and lower limb muscle strength in soccer athletes. Methods: 60 participants were equally divided between high, low, and control training groups. The load was implemented with a weight vest for eight weeks. The training frequency was 40 to 60 minutes three times a week, and the training protocols and schedules of the two groups were the same, while the control group was not involved in any sports training. Results: The isokinetic muscle strength test of the left knee extensor before and after eight weeks of training showed no significant interaction between maximum torque and time to reach maximum torque at 60°/s and 180°/s ($P > 0.05$). After the jump test, a significant difference appears in the main effects on time factors between group A and group B. Conclusion: Strength training by load addition is an effective training method to improve the sport's ability in the lower limbs of soccer athletes. ***Evidence Level II; Therapeutic Studies - Investigating the result.***

Keywords: Athletes; Weight Bearing Exercise Program; Muscle Strength.

RESUMO

Introdução: Existem muitos métodos para o treinamento de força explosiva do membro inferior nos atletas de futebol e o mais comum é o treinamento de ganho de força por aumento de carga. Ainda não há um consenso se esse tipo de treino pode influenciar no desempenho do salto nos atletas de futebol. Objetivo: Explorar a influência do ganho muscular por adição de peso no desempenho de salto e a força muscular nos membros inferiores dos atletas de futebol. Métodos: 60 participantes foram igualmente divididos entre grupos de treinamento de alta carga, baixa carga e grupo controle. A carga foi implementada com um colete de peso por 8 semanas. A frequência de treinamento foi de 40 a 60 minutos três vezes por semana e os protocolos de treinamento e horários dos dois grupos eram os mesmos, enquanto o grupo de controle não estava envolvido em nenhum treinamento esportivo. Resultados: Os resultados do teste isocinético de força muscular do extensor do joelho esquerdo antes e depois de 8 semanas de treinamento mostraram que não houve interação significativa entre o torque máximo e o tempo para atingir o torque máximo a 60°/s e 180°/s ($P > 0,05$). Após o teste de salto, verificou-se que houve diferença significativa nos principais efeitos dos fatores de tempo entre o grupo A e o grupo B. Conclusão: O treinamento de reforço por adição de carga é um método eficaz de treinamento para melhorar a capacidade esportiva nos membros inferiores dos atletas de futebol. ***Nível de evidência II; Estudos Terapêuticos - Investigação de Resultados.***

Descritores: *Atletas; Programa de Fortalecimento por Carga de Peso Força Muscular.*

RESUMEN

Introducción: Existen muchos métodos para el entrenamiento de la fuerza explosiva del miembro inferior en los deportistas de fútbol y el más común es el entrenamiento de la fuerza por aumento de carga. Todavía no hay consenso sobre si este tipo de entrenamiento puede influir en el rendimiento de salto en los atletas de fútbol. Objetivo: Explorar la influencia de la ganancia muscular por peso añadido en el rendimiento de salto y la fuerza muscular de las extremidades inferiores en atletas de fútbol. Métodos: 60 participantes se dividieron por igual entre los grupos de entrenamiento de alta carga, baja carga y control. La carga se implementó con un chaleco de peso durante 8 semanas. La frecuencia de entrenamiento fue de 40-60 minutos tres veces por semana y los protocolos y horarios de entrenamiento de los dos grupos fueron los mismos, mientras que el grupo de control no realizó ningún entrenamiento deportivo. Resultados: Los resultados de la prueba de fuerza muscular isocinética del extensor de la rodilla izquierda antes y después de 8 semanas de entrenamiento mostraron que no había una interacción significativa entre el par máximo y el tiempo para alcanzar el par máximo a 60°/s y 180°/s ($P > 0,05$). Tras la prueba de salto, se comprobó que había una diferencia significativa en los efectos principales de los factores temporales entre el grupo A y el grupo B. Conclusión: El entrenamiento de fuerza por adición de carga es un método de entrenamiento eficaz para mejorar la capacidad deportiva en los miembros inferiores de los atletas de fútbol. ***Nivel de evidencia II; Estudios terapéuticos - Investigación de resultados.***

Descriptores: *Atletas; Programa de Fortalecimiento Levantando Peso; Fuerza Muscular.*

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INTRODUCTION

There are many methods for athletes' lower limb explosive strength training, but the most common one is the weight-bearing super equal length training.[1] The coaches of the former Soviet Union used the training method of weight-bearing super equal length to improve the explosive power of athletes' lower limb muscles. This training method to enhance muscle explosiveness evolved from the impact training method (plyometric training) can effectively increase the rapid contraction strength of muscle due to the significant increase in the number of activated motor units of muscle due to stretch reflex and the full use of muscle elastic potential energy.[2] Therefore, this paper will use the theory and method of weight-bearing super equal length training to study the influencing factors of volleyball players' lower limb explosive power, and explore the improvement effect of appropriate training load intensity on young volleyball players' special ability, hoping to provide some reference and help for the scientific training of young volleyball players.

METHOD

Research object

This study takes 60 players participating in football matches as the research object. They were randomly divided into high load enhanced training group (a, n = 20), low load enhanced training group (B, n = 20) and control group (C, n = 20). All the subjects were not unable to train due to injury. The basic data of the subjects are shown in Table 1, and there was no significant difference in the basic data of subjects in each group.[3]

Research methods

Experimental design

The subjects participated in the experiment voluntarily. After explaining the relevant contents, processes, risks and training benefits of the study, the subjects were asked to fill in the consent form and health status questionnaire. One week before the pre-test, explain the research content and demonstration to the subjects, so that they can better understand the research content and training actions.

Training program

The load intensity of the high load enhanced training group is 20% of the body mass of the research object, and the load of the low load enhanced training group is 10% of the body mass of the research object. The enhanced training course is shown in Table 2.

Test items and methods

In order to evaluate the training effect of different weight-bearing enhanced training intensity for 8 weeks, all subjects were evaluated with the following physiological indexes before and after the training of this study:

• Leg muscle mass

Table 1. Basic data of research object.

Group	Number / person	Age / cm	Height / cm	Body mass / kg	Load / kg
A group	20	21.4±1.4	176.41±5.14	66.27±8.12	15
B group	20	20.7±1.8	177.21±2.39	64.18±7.45	10
C group	20	19.4±1.7	174.78±5.64	66.14±6.98	0

Table 2. Enhanced training.

Project	1 ~ 2 weeks	3 ~ 4 weeks	5 ~ 6 weeks	7 ~ 8 weeks	Rest time
Vertical jump	11×8	12×8	13×8	14×8	3min
Rebound	2×8	3×8	4×8	5×10	3min
Double-leg hop	4×6	5×8	6×8	7×10	3min
Landing vertical jump	2×5	3×7	4×8	5×10	3min

In this study, the leg muscle mass was measured by body composition analyzer (Inbody 720, Korea) before and after 8 weeks of training, and the results of left leg muscle mass were compared.

• Jumping ability

The jumping ability test in this study is based on the jumping pad of the grating system (fusion sport, smart jump, Australia).

Counter movement jump (CMJ), before the test, the subject stands on the jump pad with both feet shoulder width. When the instrument lights up, the green light indicates the start of the test. The subject bends his knees and swings his arms upward. While jumping upward, try to keep his body in a straight line. When landing, his knees bend slightly to cushion the pressure caused by landing. After two tests, Take the better one and record its jumping height (cm).

Strips jump (SJ), the subject stands outside the test pad for preparation. When the green light signal of the grating system is on, one foot steps forward and both feet fall into the test pad at the same time, then bend the knee joint and cooperate with both arms to drive the body to jump up. When in the air, both legs must be straight and the body must be in a straight line. When landing, both feet bend slightly to reduce the pressure caused by the ground. After two tests , take the better one and record its jumping height (cm).

Drop jump (DJ), before the test, the subject stood on a 40cm high jump box to prepare. When the grating green light was on, the subject stepped out with one foot. After both feet landed at the same time, he jumped up with force while swinging his arms upward. When taking off, try to keep his body in a straight line. When landing, his knees were slightly bent to cushion the pressure caused by landing. After two tests After that, take the better one and record the jump height (cm) and contact time (ms).[4]

Data statistics and analysis

The experimental data were analyzed by SPSS for windows 20.0 statistical software package. The differences of variables between the three groups were compared by mixed design two-way ANOVA. When the interaction reached statistical significance, the single main effect test of independent samples and the single main effect test of dependent samples were carried out respectively. The differences between groups and the pre-test and post-test differences within each group after cutting files were compared. The post-mortem comparison was carried out by LSD method.

RESULTS

Effect of reinforcement training on left leg muscle mass

Figure 1 shows that before 8 weeks of training, all subjects measured the amount of left leg muscle with body composition analyzer. The results showed that the interaction of left leg muscle mass was not statistically significant (P > 0.05). There was significant difference in the main effect of time factor in group A after 8 weeks. The left leg muscle

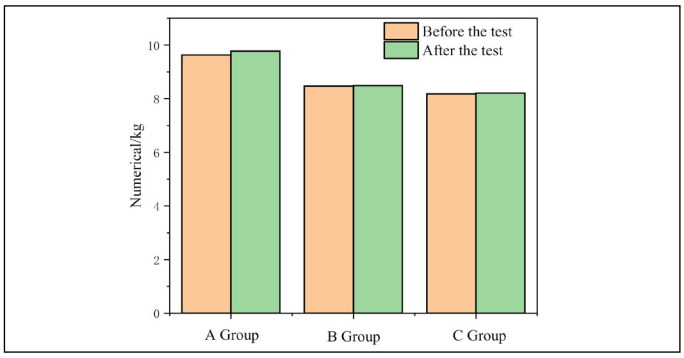

Figure 1. Effect of different weight-bearing enhanced training on left leg muscle mass.

mass in group A after training was significantly higher than that before training (P = 0.019), but there was no significant difference between group B and group C.

Effect of enhanced training on blood CK

As shown in Figure 2, there was no significant difference in the reaction interaction of CK in each group before and after 8-week training (P > 0.05), and there was no significant difference in the main effects of time factors and group factors (P > 0.05).

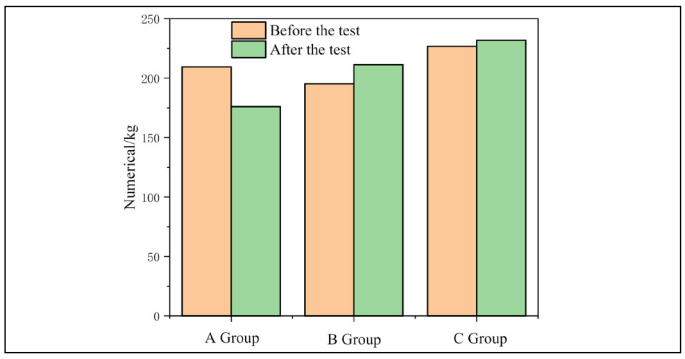

Figure 1. Effect of different weight-bearing enhanced training on left leg muscle mass.

Effect of enhanced training on isokinetic muscle strength of lower limbs

The results of isokinetic muscle strength test of left leg knee extensor before and after 8 weeks of training showed that there was no significant interaction between the peak torque and the time to reach the peak torque at 60 ° / s and 180 ° / S (P > 0.05). After cutting the file, it was found that there was significant difference in the main effect of time factor between group A and group B. When the angular velocity was 60 ° / s, group a made significant progress in the peak torque and the time to reach the peak torque (peak torque: P = 0.019; peak torque time: P = 0.009). In addition, there was significant difference between group A and group B in the performance of angular velocity of 180 ° / S (A: P = 0.005; B: P = 0.026). In addition, there was significant difference in the main effect test of group factors. After post comparison, it was found that the torque peaks of 60 ° / S (A: P = 0.002; B: P = 0.049) and 180 ° / S (A: P = 0.001; B: P = 0.039) in group A and group B were significantly better than those in group C.

DISCUSSION

In terms of sprint performance, this study has significantly improved the sprint performance after training. Ozaki H and others found that the combination of electrical stimulation and enhanced training can significantly improve the 20m sprint time, but there is no statistical significance in simple electrical stimulation or enhanced training.[5] In addition, the results of Moreira O C and others showed that the sprint training group can effectively improve the sprint performance. However, the enhanced training group did not improve the 20m sprint performance.[6] In the research of Gambassi B and Moreira O C and others, only the enhanced training may not significantly improve the sprint performance because it is not combined with other stimuli.[7] However, in the research of Hasegawa J, the enhanced training twice a week for 6 weeks can effectively improve the 20m sprint performance of basketball players;[8] In the study of CD Gómez-Carmona, the enhanced training program can also effectively improve the performance of 20m sprint without other stimuli. In terms of jump performance, after 8 weeks of training, the jump performance of in-situ swing arm vertical jump, step swing arm vertical jump and landing vertical jump in group A and group B increased significantly. Previous studies also pointed out that. Simple reinforcement training can effectively improve jumping performance;[9] Nam HJ and others compared sprint training with enhanced training, and found that the heights of landing vertical jump, squat jump and squat jump in the two groups were significantly improved. Although there was progress after training, the difference was less obvious for the control group.[10] The progress was significantly better than that of the control group; From the above research, it can be found that enhanced training can effectively improve jumping performance, and when combined with different training stimuli, jumping performance can obtain better training effect. In this study, group A and group B have similar progress after weight-bearing enhanced training, which is significantly better than group C.

CONCLUSION

The vertical jump performance of the experimental group was not only significantly improved, but also significantly better than that of the control group. From the above research, it can be found that enhanced training can effectively improve jumping performance, and when combined with different training stimuli, jumping performance can obtain better training effect. In this study, group A and group B have similar progress after weight-bearing enhanced training, which is significantly better than that of group C. The 20m sprint speed of group A with 20% body weight load has significantly improved. At the same time, the muscle strength and jumping performance of lower limbs also increased significantly.

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