

# INFLUENCE OF WEIGHT TRAINING ON LOWER LIMB STRENGTH IN SOCCER PLAYERS



ORIGINAL ARTICLE  
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INFLUÊNCIA DO TREINAMENTO COM PESOS SOBRE A FORÇA DE MEMBROS INFERIORES EM JOGADORES DE FUTEBOL

INFLUENCIA DEL ENTRENAMIENTO CON PESAS EN LA FUERZA DE LAS EXTREMIDADES INFERIORES EN JUGADORES DE FÚTBOL

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## ABSTRACT

**Introduction:** Soccer games are of long duration and more confrontational; in the second half of the game, many players have a decline in their physical level, leading to loss of matches. **Objective:** To explore the effect of weight training on lower limb fitness in soccer players. **Methods:** 60 athletes were included as subjects and randomly divided into control group, weight training group, and traditional physical fitness training group. All athletes trained for 45 minutes 3 times a week for 6 weeks. Before and after training, lower limb strength and proprioception were evaluated, and the strength of the knee flexor and extensor group was assessed by isokinetic muscle tester. **Results:** Both weight training and traditional physical training were able to improve the vertical jump performance of young soccer players, the training effects of both groups were equivalent. **Conclusion:** Weight training has the same enhancing effect as traditional physical training in terms of strength and explosive power, promoting athletic performance in youth soccer players. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

**Keywords:** Resistance Training; Exercise; Soccer.

## RESUMO

**Introdução:** Os jogos de futebol são de longa duração e de maior confrontação; na segunda metade do jogo, muitos jogadores têm um declínio em seu nível físico, levando à perda das partidas. **Objetivo:** Explorar o efeito do treinamento com peso na condição física nos membros inferiores dos jogadores de futebol. **Métodos:** 60 atletas foram incluídos como sujeitos e divididos aleatoriamente em grupo de controle, grupo de musculação e grupo de musculação física tradicional. Todos os atletas treinaram por 45 minutos 3 vezes por semana durante 6 semanas. Antes e depois do treinamento, a força dos membros inferiores e a propriocepção foram avaliadas, e a força do grupo flexor e extensor do joelho foi avaliada pelo testador muscular isocinético. **Resultados:** Tanto o treinamento físico com peso quanto o treinamento físico tradicional conseguiram melhorar o desempenho do salto vertical dos jovens jogadores de futebol, os efeitos do treinamento dos dois grupos foram equivalentes. **Conclusão:** O treinamento com peso tem o mesmo efeito de aprimoramento que o treinamento físico tradicional em termos de força e poder explosivo, promovendo o desempenho atlético em jogadores de futebol juvenil. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

**Descritores:** Treinamento de Força; Exercício Físico; Futebol.

## RESUMEN

**Introducción:** Los partidos de fútbol son de larga duración y de mayor confrontación; en la segunda mitad del partido, muchos jugadores tienen un descenso en su nivel físico, lo que lleva a la pérdida de partidos. **Objetivo:** Explorar el efecto del entrenamiento con pesas sobre la aptitud de las extremidades inferiores en jugadores de fútbol. **Métodos:** Se incluyeron 60 atletas como sujetos y se dividieron aleatoriamente en el grupo de control, el grupo de entrenamiento con pesas y el grupo de acondicionamiento físico tradicional. Todos los atletas entrenaron 45 minutos 3 veces por semana durante 6 semanas. Antes y después del entrenamiento, se evaluó la fuerza de las extremidades inferiores y la propiocepción, y la fuerza del grupo de flexores y extensores de la rodilla se evaluó mediante un probador muscular isocinético. **Resultados:** Tanto el entrenamiento con pesas como el entrenamiento físico tradicional fueron capaces de mejorar el rendimiento del salto vertical de los jóvenes futbolistas, los efectos del entrenamiento de ambos grupos fueron equivalentes. **Conclusión:** El entrenamiento con pesas tiene el mismo efecto potenciador que el entrenamiento físico tradicional en términos de fuerza y potencia explosiva, promoviendo el rendimiento atlético en los jugadores de fútbol juvenil. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

**Descriptor:** Entrenamiento de Fuerza; Ejercicio Físico; Fútbol.



## INTRODUCTION

Football players often need to repeatedly perform sprint running, rapid reentry and rotation for a long time to perform traditional resistance training or plyometric exercises, which are not generally used in physical fitness training of football players. Many studies have pointed out that plyometric training should have different training designs for different benefits.<sup>1</sup> When plyometric training is combined with different stimuli, it has a better effect on the improvement of sports performance than plyometric training alone.<sup>2</sup> Kang S R et al. pointed out that the benefits of integrated and resistance exercises in enhancing muscle mass are similar, but in terms of isokinetic muscle performance, resistance exercise has a better effect, therefore, we believe that plyometric training combined with resistance may be effective in improving muscle performance.<sup>3</sup> After plyometric training, there was no difference in muscle damage among the groups, compared with this study, the study by Segaran J et al, the CK activity of the land plyometric training group increased significantly after training, while the CK of the water plyometric training group and the control group did not change.<sup>4</sup> The study by Lv X et al. pointed out that, after the muscle damage caused in the early stage of exercise, when a similar eccentric exercise is re-introduced, the muscle damage caused by the exercise can be greatly reduced, the so-called repetition training effect.<sup>5</sup>

## METHOD

### General information

From May 2020 to September 2020, young football players were recruited in the training room of the training center of Xiamen Sports School and a total of 60 athletes were included. Inclusion criteria for this study: All subjects are young football players, aged 16-20 years old, with more than 28 hours of training time per week and more than 120 minutes of special sports participation; Exclusion criteria for this study: Participating in other training programs at the same time.

### Training method

The blank control group did not use systematic physical training methods, but used daily routine training. The weight-bearing training group adopted a training plan based on the results of weight-bearing exercise screening, first, perform weight-bearing exercise screening on patients to identify weak links, the screening contents include squat test, hurdle test, straight lunge test, shoulder mobility test, active straight leg raise test, controlled push-up test, and rotation stability test. Based on the evaluation results, a targeted physical training plan for athletes is arranged. The training content includes lower limb coordination training, stability training, flexibility training, and lower limb alignment training in the first two weeks. 3-4 weeks for lower body strength training, speed training, explosive power training and lower body proprioception training. 5-6 weeks for special training.<sup>6</sup> Training was performed for 6 weeks, 3 times a week, 90 minutes on each side. Traditional physical training includes push-ups, stand-ups, sit-ups, bench presses, pull-ups, weight-bearing half squats, 30-meter acceleration runs, 100-meter runs, planks, supine crunches, 3000 meters Timed jogging, 60 meters, back running, leapfrog. The training is mainly based on strength training in the early stage, endurance training in the middle stage, and sensitivity training in the final stage, the training is carried out for a total of 6 weeks, 3 times a week, 90 minutes each time.

### Indicator test

All volunteers in the three groups, before and after training, use the SJ vertical jump tester to test the height of the lower limbs vertical jump, the isokinetic muscle tester to test the strength of the hamstrings and quadriceps of the lower limbs, and the isokinetic muscle tester to test the hip joint, knee and ankle proprioceptive angle is poor.<sup>7</sup>

## Statistical analysis

All raw data were sorted by EXCEL table, and SPSS 24.0 was used for statistical analysis on the sorted raw data. The measurement data in the author's study were compared between groups using analysis of variance, and the intra-group comparison was performed using paired-samples T-test.<sup>8</sup>

## RESULTS

### Comparison of vertical jump test

In this study, after the intervention of the traditional physical fitness group and the weight-bearing training group, the vertical jump distance and the airborne time were significantly improved ( $P < 0.05$ ), the vertical jump distance and airborne time of the blank control group decreased but not significantly ( $P > 0.05$ ). After the intervention, there was little difference in the vertical jump distance and airborne time between the traditional training group and the weight-bearing training group, and the difference was not statistically significant ( $P > 0.05$ ). This shows that both weight-bearing physical training and traditional physical training can improve the vertical jump performance of young football players, and the training effects of the two are equivalent, the results are shown in Tables 1 and 2.

### Comparison of lower body strength

In this study, after the intervention of the traditional physical fitness group and the weight-bearing training group, the strength of the lower limb extension and flexion muscle groups were significantly improved ( $P < 0.05$ ), there was no significant change in the strength of lower limb extension and flexion muscle groups in the blank control group ( $P > 0.05$ ). After the intervention, there was little difference in lower limb extension and flexion strength between the traditional training group and the weight-bearing training group, and the difference was not statistically significant ( $P > 0.05$ ). This shows that both weight-bearing physical training and traditional physical training can improve the lower body strength of young football players, and the training effects of the two are equivalent, the results are shown in Tables 3 and 4, Figure 1.

## DISCUSSION AND ANALYSIS

The ball control ability and strength of the lower limbs have always been the basic qualities of young football players, traditionally, high-intensity physical training can effectively improve the strength and speed of young football players, however, adolescents are in a critical period of growth and development, and are not suitable for high-intensity strength training. On the one hand, a large training load can easily lead to fatigue in young people, and on the other

**Table 1.** Variation table of vertical jump distance before and after the three groups.

grouping	Blank control group	weight training group	traditional fitness group	p
Number of cases	20	20	20	
Before intervention	56.82±4.25	56.83±3.98	57.93±3.83	0.353
after intervention	55.25±2.27	64.54±5.07	62.89±4.75	0.815
P	0.845	0.018	0.025	

**Table 2.** Variation of vertical jump stagnation time before and after intervention in the three groups.

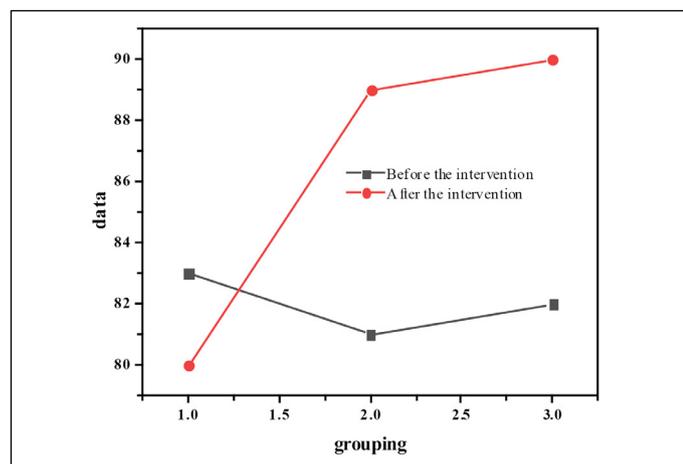
grouping	Blank control group	weight training group	traditional fitness group	p
Number of cases	20	20	20	
Before intervention	0.608±0.005	0.633±0.010	0.613±0.004	0.252
after intervention	0.614±0.011	0.684±0.009	0.684±0.005	0.328
P	0.187	0.025	0.038	

**Table 3.** Changes of lower extremity flexor strength before and after intervention in the three groups.

grouping	Blank control group	weight training group	traditional fitness group	P
Number of cases	20	20	20	
Before intervention	60.35±10.46	63.21±11.30	61.23±16.84	0.853
after intervention	61.16±11.32	71.24±14.85	68.24±14.57	0.348
P	0.629	0.033	0.047	

**Table 4.** Changes of lower limb extensor strength before and after intervention in the three groups.

grouping	Blank control group	weight training group	traditional fitness group	P
Number of cases	20	20	20	
Before intervention	82.36±14.08	80.73±15.08	82.08±11.39	0.572
after intervention	80.71±12.73	89.05±12.76	89.83±12.75	0.246
P	0.421	0.042	0.016	



**Figure 1.** Changes of lower limb extensor strength before and after intervention in the three groups.

hand, it makes all organs of the young athletes' bodies in a state of tension, and the metabolic level of body functions is low, and the training goals cannot be achieved. As an emerging form of training, weight-bearing training, from the perspective of human body structure chain function, achieves the goal of improving overall quality by

making up for the lack of functional movement. Football has high requirements on athletes' physical fitness, cardiorespiratory endurance and ball control ability, traditional physical training only trains athletes in terms of strength and endurance, but at the same time, athletes' lower limb flexibility and control ability are not significantly improved. At present, weight-bearing training has been widely used in physical training such as air volleyball, basketball, badminton, etc.<sup>9</sup> The author believes that it can better reduce the risk of injury to athletes and improve the level of physical training. However, the application in youth football players has not been reported. By comparing traditional physical training, the author explores its effect on lower body strength and proprioception of athletes, the results show that weight training has the same improvement effect as traditional physical training in terms of strength and explosiveness, and can better improve the proprioceptive ability of the lower limbs of athletes, promote athletic performance in youth soccer players.<sup>10</sup>

## CONCLUSION

By comparing traditional physical training, the author explores its effects on lower body strength and proprioception in athletes. The results show, weight training has the same improvement effect as traditional physical training in terms of strength and explosiveness, and can better improve the proprioceptive ability of athletes' lower limbs, promote athletic performance in youth soccer players. The results show: The strength of the lower limb extensor muscles before and after the intervention in the three groups was approximately: 83, 81, 82. After the intervention is approximately: 80, 89, 90. Weight-bearing training can significantly improve the lower body strength of young football players, which has the same effect as traditional physical training, and has a better effect on proprioception. It is worthy of further promotion and application. In the future, it can provide a reference for general improvement of leg muscle mass, sprint time, lower limb muscle strength and jumping performance, so as to improve the performance of ordinary sports participation, but for those with poor lower limb muscle strength, early in training, a progressive training load is recommended.

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

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**AUTHORS' CONTRIBUTIONS:** Each author made significant individual contributions to this paper. JY: study conception and design; write the paper; performed the analysis; DZ: data collection; article review.

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