

STRENGTH TRAINING AND COORDINATION IN SOCCER PLAYERS' LOWER LIMBS



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TREINAMENTO DA FORÇA E COORDENAÇÃO NOS MEMBROS INFERIORES DE FUTEBOLISTAS

ENTRENAMIENTO DE FUERZA Y COORDINACIÓN EN MIEMBROS INFERIORES DE FUTBOLISTAS

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ABSTRACT

Introduction: The long distance running and the short distance running shot are common in soccer world, so that soccer presents a higher demand in relation to the strength of lower limbs and motor coordination by the athlete. **Objective:** Analyze the methods of training lower-limb strength and coordination in soccer. **Methods:** The experiment-by-control method was adopted. During the 12 weeks of training, the control group performed the traditional mode of lower limb strength training based on deep squat, while the experimental group adopted the global mode of lower limb strength training. The exercise training plans of the experimental group and control group were standardized. **Results:** The relative performance of the athletes in the experimental group and the control group was improved, however, the developmental effect of the experimental group was more significant. **Conclusion:** The comprehensive mode of lower limb strength training proposed in this study presents little difference in relation to the traditional mode of strength training in the optimization of maximum strength; however, it is more directed to soccer demand, and it can promote a better motor coordination to the athletes, besides optimizing the soccer sport level and making the athletes have more advantages in the field. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

Keywords: Soccer; Resistance Training; Psychomotor Performance; Lower Limbs.

RESUMO

Introdução: A corrida de longa distância e o tiro em corrida de curta distância são comuns no mundo do futebol, de forma que o futebol apresenta uma maior exigência em relação à força dos membros inferiores e à coordenação motora por parte do atleta. **Objetivo:** Analisar os métodos de treinamento de força e coordenação dos membros inferiores no futebol. **Métodos:** Adotou-se o método de experimento por controle. Durante as 12 semanas de treinamento, o grupo de controle efetuou o modo tradicional de treinamento da força dos membros inferiores com base no agachamento profundo, enquanto o grupo experimental adotou o modo global de treinamento da força dos membros inferiores. Os planos de treinamento de exercício do grupo experimental e do grupo de controle foram padronizados. **Resultados:** A performance relativa dos atletas do grupo experimental e do grupo de controle foi melhorada, contudo, o efeito de desenvolvimento do grupo experimental foi mais significativo. **Conclusão:** O modo abrangente de treinamento de força dos membros inferiores proposto neste trabalho apresenta pouca diferença em relação ao modo tradicional de treinamento de força na otimização da força máxima, no entanto é mais direcionado à demanda do futebol, podendo promover uma melhor coordenação motora aos atletas, além de otimizar o nível esportivo do futebol e fazer com que os atletas tenham mais vantagens em campo. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

Descritores: Futebol; Treinamento de Força; Desempenho Psicomotor; Membros Inferiores.

RESUMEN

Introducción: La carrera de larga distancia y la carrera de corta distancia son habituales en el mundo del fútbol, por lo que el fútbol presenta una mayor exigencia en relación con la fuerza de los miembros inferiores y la coordinación motora por parte del deportista. **Objetivo:** Analizar los métodos de entrenamiento de la fuerza y la coordinación de los miembros inferiores en el fútbol. **Métodos:** Se adoptó el experimento por método de control. Durante las 12 semanas de entrenamiento, el grupo de control realizó el modo tradicional de entrenamiento de la fuerza de los miembros inferiores basado en la sentadilla profunda, mientras que el grupo experimental adoptó el modo global de entrenamiento de la fuerza de los miembros inferiores. Se estandarizaron los planes de entrenamiento físico del grupo experimental y del grupo de control. **Resultados:** El rendimiento relativo de los atletas del grupo experimental y del grupo de control mejoró; sin embargo, el efecto de desarrollo del grupo experimental fue más significativo. **Conclusión:** La modalidad integral de entrenamiento de fuerza de miembros inferiores propuesta en este trabajo presenta poca diferencia en relación a la modalidad tradicional de entrenamiento de fuerza en la optimización de la fuerza máxima, sin embargo, está más dirigida a la demanda futbolística, y puede promover una mejor coordinación motora a los atletas, además de optimizar el nivel deportivo del fútbol y hacer que los atletas tengan más ventajas en el campo. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

Descriptor: Fútbol; Entrenamiento de Fuerza; Desempeño Psicomotor; Miembros Inferiores.



INTRODUCTION

So far, football has a large scale, and there are countless researches on football. As we all know, football is mainly about running and jumping.¹ And in the process of sports, because of the existence of football, players often have to move in the state of dribbling football. Therefore, football has put forward certain requirements for the strength and coordination of the athletes' lower limbs.^{2,3} And these two related attributes can directly affect the athletes' competitive level and the use of tactics. It plays a decisive role in the outcome of the game.⁴ Therefore, targeted training should be carried out for the strength of lower limbs, and the technical movements should be better played through coordination analysis. It can effectively improve the sports performance and increase the competitiveness of the competition field.^{5,6}

METHOD

In this paper, 30 football major freshmen and sophomores in a university were invited as research objects, and were divided into experimental group and control group in the form of dark box random sampling. The study and all the participants were reviewed and approved by Ethics Committee of Wuchang Institute of Technology (NO.WCIT19-TD12). There are 15 student athletes in the experimental group and 15 in the control group. P values of the athletes' height, age, weight, BMI and other options are greater than 0.05, indicating that the relevant indicators of different populations will not cause too much interference to the experimental results.

The article adopts the method of controlled experiment. During the 12-week training, the control group chooses the traditional lower limb strength training mode based on deep squatting, and the experimental group chooses the comprehensive lower limb strength training mode. The exercise training plans of the experimental group and the control group are consistent, except for the specific lower limb training of one hour every time three times a week, there is no other difference, so as to control the only variable and ensure the rigor of the experiment.

In the course of the experiment, if there is a sudden disease of sports injury or the athletes are absent from more than two training sessions due to the arrangement of lessons, the data will be deleted. After 12 weeks of training, 30 athletes from both groups were able to effectively complete relevant training tasks, thus ensuring the preciseness of the experimental results.

RESULTS

Analysis of lower limb strength changes before and after sports training

In terms of changes in lower limb strength, the maximum strength index was selected as the comparison of test results, in which BS was the back squat project, RFESS was the Bulgarian squat project, RDL was the Romanian hard pull project, and SRDL was the single leg Romanian hard pull project. The specific results are shown in Table 1 and Table 2.

Table 1 shows the changes of the lower limbs of the 15 athletes in the experimental group before and after sports training. After the BS1RM experiment, they rose to (142.445 ± 13.1074) kg, after the RFESS1RM experiment, they rose to (119.281 ± 14.8316) kg, after the RDL1RM

Table 1. Changes of lower limb strength before and after exercise training in the experimental group (n=15).

Option	Before	After	p
BS1 _{RM} (kg)	116.937 ±15.5511	142.445 ±13.1074	P<0.01
RFESS1 _{RM} (kg)	91.561 ±13.8249	119.281 ±14.8316	P<0.01
RDL1 _{RM} (kg)	113.452 ±16.0115	139.329 ±16.1720	P<0.01
SRDL1 _{RM} (kg)	98.769 ±14.2911	120.207 ±13.6605	P<0.01

experiment, they rose to (139.329 ± 16.1720) kg, and after the SRDL1RM experiment, they rose to (120.207 ± 13.6605) kg, P<0.01 indicating that there was a very significant difference. It can be seen that selecting the comprehensive lower limb strength training method in this paper can effectively strengthen the optimization of lower limb strength in the experimental group.

Table 2 shows the changes of the lower limbs of 15 athletes in the control group before and after sports training. It can be seen from the data comparison that the traditional lower limb strength training method mainly based on squatting can enhance the maximum strength of the athletes' lower limbs. From the data comparison between the experimental group and the control group, it can be seen that both groups can significantly increase the maximum strength of the athletes' lower limbs, and there is little difference between them. The experimental group is slightly higher than the control group, indicating that in terms of the optimization of the maximum strength, the advantages of the comprehensive lower limb strength training optimization method selected by the experimental group are not obvious enough. In the follow-up research, it is necessary to strengthen the supplementary training of the maximum strength and carry forward its advantages.

Analysis of changes in coordination before and after sports training

In the aspect of the change of sports training coordination, we chose the single leg standing test with eyes closed, the standing step test with eyes closed and the standing walk test as the judgment indicators. Only when the athlete's body coordination is high, can the athlete be able to control his body well in the state of closed eyes and unstable standing. This can also enable athletes to maintain good coordination and stability on the sports field, especially in the fierce stage of football dribbling and confrontation, reduce falls, and prevent sports injuries or loss of initiative due to falls. See Table 3 and Table 4 for specific table data.

Table 3 shows the coordination changes of 15 athletes in the experimental group before and after sports training. After the experiment, the results of the standing test with eyes closed rose to (37.768 ± 14.3604) s, the results of the standing test with eyes closed rose to (21.459 ± 7.8250) s, and the results of the standing test rose to (4.575 ± 0.5339) s, P<0.01 indicating that there was a very significant difference. It can be seen that the comprehensive lower limb strength training method in this paper can strengthen the coordination of the athlete's body, so that when the athlete is in an unstable state or there is a blind spot in his sight, he can also better ensure the balance of his body and control his own body state.

Table 4 shows the coordination changes of 15 control group athletes before and after sports training. It can be seen from the data comparison

Table 2. Changes of lower limb strength in the control group before and after exercise training (n=15).

Option	Before	After	p
BS1 _{RM} (kg)	117.357 ±14.9545	137.922 ±16.3755	P<0.01
RFESS1 _{RM} (kg)	94.601 ±9.7388	115.059 ±10.9144	P<0.01
RDL1 _{RM} (kg)	121.590 ±13.2307	134.817 ±12.9530	P<0.01
SRDL1 _{RM} (kg)	95.648 ±10.3614	112.623 ±12.9324	P<0.01

Table 3. Changes in coordination of the experimental group before and after exercise training (n=15).

Test	Before	After	P
Single leg standing test with eyes closed (s)	28.356 ±15.6373	37.768 ±14.3604	P<0.01
Step test with eyes closed (s)	15.835 ±10.6402	21.459 ±7.8250	P<0.01
Stand up and walk test (s)	5.443 ±4.6205	4.575 ±0.5339	P<0.01

that the traditional strength training pays more attention to the improvement of lower limb strength, enabling athletes to master faster speed and stronger explosive force, but there are certain problems in coordination. When the vision is blind or the body is in an unbalanced state, the training mode selected by the control group has some omissions in the optimization of the athletes' own coordination, and its numerical results also have some uncertainties. There is no clear explanation to describe the relationship between the two. Therefore, the experimental group selected in this paper is comprehensive, and the optimization method of lower limb strength training can better help athletes master their own coordination in the changing environment, so that athletes can better control their own actions on the football field and obtain more initiative.

Analysis on changes of sports level before and after sports training

For football players, the improvement of sports level and competitive ability is the most concerned problem in all football training. Therefore, in this section, the broken line dribbling around the pole, forward and backward jumping hurdles, and change running indicators are selected as the analysis data of sports level changes. The specific results are shown in Table 5 and Table 6.

As shown in Table 5, the changes of sports level of 15 athletes in the experimental group before and after sports training. The winding time of the broken line dribble was shortened to (10.294 ± 0.4376) s after the experiment, the advancing and retreating jumping hurdles was shortened to (12.860 ± 0.7292) s after the experiment, and the changing running time was shortened to (11.697 ± 0.3673) s after the experiment, $P < 0.01$ indicating that there was a very significant difference. It can be seen from this that the comprehensive lower limb strength training mode of the experimental group can greatly shorten the time of broken line dribbling around the pole, advancing and retreating jumping hurdles, and changing running, so that the athletes can complete more actions in a shorter time and improve their agility.

Table 4. Changes in coordination of the control group before and after exercise training (n=15).

Test	Before	After	P
Single leg standing test with eyes closed (s)	28.746 ±15.4132	28.372 ±15.4504	P>0.05
Step test with eyes closed (s)	13.967 ±10.7310	16.642 ±10.5433	P>0.05
Stand up and walk test (s)	5.255 ±0.7644	5.590 ±0.4718	P>0.05

Table 5. Changes of exercise level in the experimental group before and after exercise training (n=15).

Test	Before	After	P
Broken line dribble winding rod (s)	11.313 ±0.3161	10.294 ±0.4376	P<0.01
Forward and backward jump fence (s)	14.533 ±0.9363	12.860 ±0.7292	P<0.01
Change Run (s)	12.757 ±0.4386	11.697 ±0.3673	P<0.01

Table 6. Changes of exercise level in the control group before and after exercise training (n=15).

Test	Before	After	P
Broken line dribble winding rod (s)	11.326 ±0.4173	11.273 ±0.5136	P>0.05
Forward and backward jump fence (s)	14.174 ±0.5773	13.852 ±0.4783	P>0.05
Change Run (s)	13.064 ±0.4666	12.697 ±0.4585	P>0.05

As shown in Table 6, the changes of sports level of 15 control group athletes before and after sports training. It can be seen from the data that although the control group can also improve the athletes' sports level of indicators such as broken line dribbling around the bar, forward and backward jumping hurdles, change running, shorten the time used to complete the action, and improve the athletes' agility in the field, the optimization range is significantly lower than that of the experimental group. $P > 0.05$, the data do not have significant differences, which cannot explain the inevitable relationship. Therefore, there is a certain deviation between the traditional lower limb strength training mode and the specific needs of football, which needs further adjustment.

DISCUSSION

During the football match, the average running distance of the first starters of both sides is about 10000 meters. Long distance running and short distance sprinting are common in the movement of athletes. Moreover, when the players are shooting with the ball, their calves have excellent explosive power, and they can also give the football a certain ball speed, which can make the football have a certain percentage of hits. Therefore, football has put forward higher requirements for the strength of athletes' lower limbs. And good enough lower limb strength to have a strong control over football. It can effectively reduce the mistakes in the competitive links. Therefore, in the daily training link, the targeted training of football players' lower limb strength is essential. At the beginning of the training session, necessary warm-up exercises should be carried out. Warm up exercise can effectively open up the physical activity and improve the flexibility of the body. It can effectively reduce the risk of injury during the training process to make the body reach the best state of exercise. Warm up activities can be carried out with the help of equipment or simple technical movements. The next training link is targeted training for thigh muscles. For the training of thigh muscles, you can use barbell and other equipment for squatting exercises. The weight can be increased when the ability reaches a certain level. This kind of increase is a training method, which can effectively break through the bottleneck period of your own ability. Professional Smith machines can also be used for training, which can ensure that training can be carried out in a safe environment. It can protect the body. The second is to strengthen the hip muscle group. For the hip muscle, the method of hip bridge training can also be used to increase the weight to improve the training intensity. Because of the difficulty of hip muscle training, it should be trained under professional guidance. Avoid the consequences of blind training and wrong exertion, resulting in inefficient training. Next is the training method of calf muscle group. For calf muscle training, you can keep your body standing on the level ground and slowly and evenly lift your heels to the highest point. When reaching the highest point, fall back to the ground at a constant speed. The focus of training should be in the form of uniform speed. Avoid sudden stress, which may damage Achilles tendon and other soft tissues. This method can improve the training difficulty by increasing the weight bearing.

CONCLUSION

On the football match field, whoever can control his body as much as possible during running, make the action stable and have good explosive force, can complete the leg action more effectively, shorten the time of the broken line change run, and enable the athlete to reach the desired position more quickly, who can get more initiative, so as to get better results in the football match field. In view of these needs, this paper designed a comprehensive lower limb strength training model,

trying to improve the athletes' lower limb strength at the same time, optimize the coordination of athletes, so as to comprehensively promote the development of athletes' lower limbs. The research results show that the comprehensive lower limb strength training mode proposed in this paper has little difference from the traditional strength training mode in the optimization of maximum strength, but it is more targeted in

the demand of football, which can better promote the coordination of athletes' bodies, optimize the sports level of sports football, and make athletes have more advantages in the field.

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