CORE STRENGTH TRAINING ON PHYSICAL CONDITIONING OF COLLEGE MALE SOCCER PLAYERS

TREINO DE FORTALECIMENTO DO CORE NO CONDICIONAMENTO FÍSICO DE JOGADORES DE FUTEBOL UNIVERSITÁRIOS

ENTRENAMIENTO DE FORTALECIMIENTO DEL CORE EN EL ACONDICIONAMIENTO FÍSICO DE JUGADORES DE FÚTBOL UNIVERSITARIOS

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ABSTRACT

Introduction: The concept of CORE emerged in mechanical-neurological studies of rehabilitation in the 80s, referring to the central muscles of the human trunk, including the lumbar-pelvis-abdominal-perineal-hip complex responsible for the body orthostatic stability and support. Strengthening the CORE has received increasing attention from sports medicine specialists after the 2000s, and strength training is the subject of recent research in competitive sports. However, there is still a lack of conceptual studies of protocols for training focused on soccer athletes. Objective: Verify a CORE strength training protocol based on the analysis of the CORE training concept, its main functions, and introductory practical examples. Methods: Literature data collection, experimental and statistical-mathematical methods, and theoretical analysis about CORE training focused on explosive strength performance in soccer players are used. The developed protocol experiments with 44 athletes, divided into experimental and control groups, by sex. Information is collected on goal shooting, 30-meter pass, balance, stability, and symmetry. Results: The group experienced better results in both sexes(P<0.05). Conclusion: The explosion strength indicators of the players were significantly improved. Whether male or female athletes, the higher the skill level, the stronger the CORE stability in players. Therefore, the CORE stability and strengthening in athletes promote a benefit in the technical level of soccer players. ***Evidence Level II; Therapeutic Studies - Investigating the result.***

Keywords: Endurance Training; Soccer; Athletes; Exercise Test.

RESUMO

Introdução: Em estudos mecânico-neurológicos da reabilitação na década de 80, surgiu o conceito CORE, em referência ao conjunto de musculatura central do tronco humano, abarcando o complexo lombar-pelve-abdominal-períneo-quadril, responsável pelo suporte e estabilidade ortostática corporal. O fortalecimento do CORE tem recebido uma atenção crescente por especialistas em medicina esportiva após os anos 2000 e os treinamentos de força são tema de recentes pesquisas nos esportes competitivos, porém ainda há carência de estudos conceituais de protocolos para o treinamento focado nos atletas do futebol. Objetivo: Verificar um protocolo de treino de fortalecimento do CORE baseado na análise do conceito de treinamento de CORE, suas principais funções e exemplos práticos introdutórios. Métodos: Utiliza-se coleta de dados literários, método experimental, e estatístico-matemático, além de análise teórica sobre o treinamento do CORE focado no desempenho da força explosiva nos jogadores de futebol. O protocolo desenvolvido é experimentado em 44 atletas, divididos em grupos experimental e controle, por sexo. São coletas informações sobre tiro de meta, passe de 30 metros, equilíbrio, estabilidade e simetria de estabilidade. Resultados: O grupo experimentou melhores resultados em ambos os sexos(P<0,05). Conclusão: Os indicadores da força de explosão dos jogadores foram significativamente melhorados. Sejam atletas masculinos ou femininos, quanto maior o nível de habilidade, mais forte será a estabilidade do CORE nos jogadores. O treinamento de estabilidade e fortalecimento do CORE nos atletas promove benefício ao nível técnico dos jogadores de futebol. ***Nível de evidência II; Estudos Terapêuticos - Investigação de Resultados.***

***Descritores*:** *Treinamento de Resistência; Futebol; Atletas; Teste de Esforço.*

RESUMEN

Introducción: En los estudios mecánico-neurológicos de rehabilitación de los años 80, apareció el concepto CORE, en referencia al conjunto de músculos centrales del tronco humano, incluyendo el complejo lumbar-pelvis-abdominal-perineal-cadera, responsables del soporte y la estabilidad ortostática del cuerpo. El fortalecimiento del CORE ha recibido una atención creciente por parte de los especialistas en medicina deportiva a partir de la década de 2000, y el entrenamiento de la fuerza es objeto de investigaciones recientes en los deportes de competición. Sin embargo, todavía faltan estudios conceptuales de protocolos de entrenamiento centrados en los deportistas de fútbol. Objetivo: Verificar un protocolo para el entrenamiento de la fuerza del CORE basado en el análisis del concepto de entrenamiento del CORE, sus principales funciones y ejemplos prácticos introductorios. Métodos: Se utiliza la recopilación de datos literarios, el método experimental y el método estadístico-matemático, así como el análisis teórico sobre el entrenamiento CORE centrado en el rendimiento de la fuerza explosiva en los jugadores de fútbol.

El protocolo desarrollado se experimenta en 44 atletas, divididos en grupos experimental y de control, por sexo. Se recoge información sobre el tiro a puerta, el pase de 30 metros, el equilibrio, la estabilidad y la simetría de la estabilidad. Resultados: El grupo experimentó mejores resultados en ambos sexos (P<0,05). Conclusión: Los indicadores de fuerza de explosión de los jugadores mejoraron significativamente. Ya sean atletas masculinos o femeninos, cuanto más alto sea el nivel de habilidad, más fuerte será la estabilidad del CORE en los jugadores. El entrenamiento de la estabilidad y el fortalecimiento del CORE en los deportistas promueve el beneficio del nivel técnico de los futbolistas. ***Nivel de evidencia II; Estudios terapéuticos - Investigación de resultados.***

Descriptores: *Entrenamiento Aeróbico; Fútbol; Atletas; Prueba de Esfuerzo.*

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INTRODUCTION

Since the early 1990s, some European and American scholars have paid great attention to the role of the human torso. They studied the human torso from the perspective of disciplines such as mechanics, neurology, and rehabilitation. They put forward the concept of core stability.[1] After 2000, the core stability has been paid more and more attention by sports medicine experts. This article mainly studies the core strength training concept. The main function of core strength and training ideas are briefly explained. And conducted in-depth research on the introduction of core strength training into football strength training.

METHOD

Test method

We selected 44 national second-level football players as experimental subjects. Divided into two groups with obvious differences in technical level through game technical evaluation and football skill test.[2] We tested the core stability of all players in these two groups and checked the results.

Mathematical Statistics

We organize the data during the experiment and the data obtained from the experimental results. Use SPSS17.0 statistical software to analyze the collected data.

Modeling of elbow and knee joint injuries in football player training

Assuming that $\delta(X)$ represents the variance vector of the elbow (knee) joint injury vector set X caused by football player overtraining, the following formula can be obtained

$$\delta(X)(i)=\frac{1}{2}\sum_{n-1}^{N}[X_n(i)-X(i)]^2 \quad (1)$$

According to the above formula, the following formula can be obtained during the optimization modeling process of the elbow (knee) joint injury caused by the overtraining of football players:

$$X=E(X)=\frac{1}{N}\sum_{n=1}^{N}X_n \quad (2)$$

$$V\alpha r(X)=\left\|\delta(X)\right\|^2=\sum_{k=1}^{d}[\delta(X)(k)]^2 \quad (3)$$

U represents the orthogonal transformation matrix of the injury to the elbow (knee) joint caused by the football player's overtraining.[3] Use the following formula to define the transform code gain of U.

$$G_{TC}(U)=\frac{V\alpha r(UX)}{\exp H(UX)} \quad (4)$$

According to the above formula, it can be obtained in the process of optimizing the elbow (knee) joint injury by football players overtraining

$$H(X)^{\xi}=\frac{1}{d}\sum_{i=1}^{d}\log\delta(X)(i) \quad (5)$$

We regard the above formula as a set of optimal vectors selected by the wavelet packet. Calculate all vectors in vector set X using the following formula

$$\delta_{Sf}^2(X)(P)=\frac{1}{N}\sum_{n=1}^{N}(\lambda_{sf}^{(n)}(p))^2 \quad (6)$$

We use the following formula to calculate the cost function $H(V_{sf})$ that affects football players' elbow (knee) joint injury factors:

$$H(V_{sf})=\sum_{p=1}^{d/2s}\delta_{sf}(X)(P) \quad (7)$$

RESULTS

Technical evaluation results and group comparison

As shown in Table 1, the sample size of male and female players in the experimental and control groups is 11. The men's technical evaluation results were 7.94±0.63 points for the experimental group and 6.50±0.61 points for the control group. The average score of the experimental group (male) was 7.49 points, and the average score of the control group (male) was 6.50 points. Its P-value is 0.000 (P<0.001). This shows that the two groups have very significant differences in football technology.[4] Observing the statistical results, it is found that the skill level of the experimental group (female) players is significantly stronger than that of the control group (female). The grouping results according to

Table 1. Analysis of players' technical evaluation results.

Group	Sample size	Mean ± standard deviation	df	P value
Experimental group (male)	11	7.94±0.63	16	0.000
Control group (male)	11	6.50±0.61		
Experimental group (female)	11	8.41±0.66	20	0.000
Control group (female)	11	6.59±0.49		

the biggest gap of technical evaluation scores meet the requirement of very obvious differences in football skills between the two groups. The experimental group is stronger than the control group.

Technical test scores and group comparison

Diffraction shot results and group comparison

The rationality of the technical evaluation results is verified through technical testing, as shown in Table 2. The experiment results showed that the score of the experimental group (male) was 8.90±0.32, and the control group (male) was 9.22±0.43. There are significant differences between male and female players in the experimental and control groups (P<0.05). The results of the experimental group were better than those of the control group.[5] A group of high technical evaluation scores shows the stronger the ability of the shot technique test.

30m pass to score and its group comparison

The rationality of the technical evaluation results is verified through technical testing, as shown in Table 3. The 25m pass score of the experimental group (male) was 9.78±1.56 points, and the 25m pass score of the control group (male) was 8.44±1.50 points. The 25m pass score of the experimental group (female) was 7.63±1.57 points, and the 25m pass score of the control group (female) was 5.91±1.30 points.[6] A set of 25m passing technique tests with high technical evaluation scores will show better results.

Test results and analysis of the core stability of each team member

Balance and stability test results and analysis

As shown in Table 4, the P values of independent samples of the male experimental group and the control group in the forward, right, back, left, and left directions are 0.048, 0.045, 0.032, 0.034, 0.044. This shows significant differences between the male experimental group and the male control group in these directions.[7] The P values of the male experimental group and the control group were 0.009, 0.007, and 0.000 in the right front, back, and left front directions, respectively. This shows very significant differences between the male experimental group and the control group in these directions. The P values of independent samples of the female experimental group and the control group in the forward, backward, and left front directions were 0.033, 0.049, and 0.046, respectively. This shows very significant differences between the female experimental group and the control group in these directions.

Table 2. Analysis of the scores of players circling the shot.

Group	Sample size	Mean ± standard deviation	df	P
Experimental group (male)	11	8.90±0.32	16	0.045
Control group (male)	11	9.22±0.43		
Experimental group (female)	11	11.76±0.24	20	0.013
Control group (female)	11	12.13±0.38		

Table 3. Analysis of players' 25m passes performance.

Group	Sample size	Mean ± standard deviation	df	P
Experimental group (male)	11	9.78±1.56	16	0.044
Control group (male)	11	8.44±1.50		
Experimental group (female)	11	7.63±1.57	20	0.011
Control group (female)	11	5.91±1.30		

Table 4. The balance stability P-value of the experimental group and the control group.

	P	
Direction	Men's Team	Women's Team
Forward A	0.048	0.033
Right front AM	0.009	0.000
Right M	0.045	0.022
Right rear PM	0.032	0.056
After P	0.007	0.049
Left rear PL	0.034	0.004
Left L	0.044	0.017
Left front AL	0.000	0.046

Test results and analysis of stability symmetry

As shown in the statistical results of Table 5, the P values of the men's group in different directions are 0.018, 0.045, 0.036, 0.053, 0.003. The P values of the women's group in different directions are 0.047, 0.023, 0.008, 0.034.0.049. The experimental and control groups have obvious differences in stability and symmetry, and the experimental group with good technique is stronger than the control group.[8] Players with better skills in football sports have stronger stability and symmetry, which is not related to the gender of the players.

Table 5. The P-value of stable symmetry between the experimental group and the control group.

	P value	
Direction	Men's Team	Women's Team
A	0.018	0.047
AM/AL	0.045	0.023
M/L	0.036	0.008
PM/PL	0.053	0.034
P	0.003	0.049

DISCUSSION

Football is a sport that integrates flexibility, agility, explosiveness, strength, speed, and other physical qualities. A football player has a high level of overall skill in the game. Its physical fitness and detailed skills support the technical level. The ability of a football player to change direction in a game is determined by his reaction speed and movement speed.[9] The ability to change direction is an important basis for football players to dribble and form a breakthrough.

The long pass of about 25m is a technique commonly used in football matches, and it is also an important technique that must be included in a variety of tactics. In a quick counterattack, a team's long-distance pass accuracy is low, or the ability to grasp the timing of the pass is not strong, which directly affects the team's game performance.[10] Long passes over 25m require strong support from the passer's leg and toes pointing in the ball's direction. The 25m long possibility is an aspect of the overall strength of a team. The experimental group with a high technical evaluation score also showed stronger ability in the technical test than the control group.

Core stability and ball technology

Ball skills mainly include kicking, stopping, dribbling, breakthrough, and shooting skills. The common feature is the technical action performed by the supporting leg and swinging leg.[11] This ability is based on controlling the peripheral nerves of the hip, knee, and ankle joints to adapt to the corresponding muscles. Improving the control of the muscles around these joints helps improve these joints' ability to maintain balance. This can lay a good foundation for improving the technical movements of the players.

Core stability and ball-free technology

Off-ball skills mainly include defensive skills and running skills. Defensive skills include defensive players and non-team players.[12] These abilities are closely related to the balance ability and reaction speed of

the players themselves. Defensive non-team players are mainly based on marking the opponent's main players and preventing the opponent from air cuts. At the same time, they can use offside tactics. This has higher requirements for the defensive team's response, agility, speed, and other physical qualities.

CONCLUSION

Strong symmetry has nothing to do with gender. Whether male or female athletes, the higher the skill level, the stronger the core stability of the players. The overall technical level of football players in the game is positively correlated with their technical level. Strengthening the core stability training of athletes and improving the core stability of football players will promote the improvement of football players' technical level. It is recommended to add core stability training to football training. At the same time, we can extend the core stability training to all levels of football training to promote the improvement of players' football skills.

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