IMPACTS OF CORE TRAINING ON ATHLETES' PERFORMANCE IN LONG-DISTANCE RUNNING

IMPACTOS DO TREINO DO CORE NO DESEMPENHO DE ATLETAS NA CORRIDA DE LONGA DISTÂNCIA

EFECTOS DEL ENTRENAMIENTO DEL CORE EN EL RENDIMIENTO DE ATLETAS EN CARRERAS DE LARGA DISTANCIA

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ABSTRACT

Introduction: Long-distance runners cannot achieve training effects by relying only on speed endurance training. Core training exercises significantly improve stability, allowing learning of techniques with superior movement efficiency. Several factors that affect the development of athletes' special skills are considered, highlighting their main strengths and working on intermediate characteristics. Objective: Verify the impacts of core training on athletes' performance in long-distance running. Methods: This paper had 18 middle-distance runners as volunteers for the research. The athletes' physical conditioning and athletic performance before and after training were examined. Statistical analyses on the indicators of the experimental and control groups were analyzed based on the T-test. Results: There were significant differences in endurance, core muscle elasticity, core strength, explosive power, and stability ($P<0.05$); the results showed that the differences in core stability between the left and right legs of the experimental group were significant ($P<0.05$). Conclusion: Core strength exercise is more conducive to exercising a myocardial group in medium and long-distance exercise than conventional strength exercise. Core strength exercises can compensate for a lack of regular strength. ***Level of evidence II; Therapeutic studies - investigation of treatment outcomes.***

Keywords: Athletes; Marathon Running; Sports; Resistance Training.

RESUMO

Introdução: Corredores de longa distância não podem alcançar efeitos de treinamento apenas contando com os treinos de resistência de velocidade. Os exercícios de treino do core melhoram significativamente a estabilidade que permite um aprendizado da técnica com eficiência superior do movimento. Para isso, são considerados vários fatores que afetam o desenvolvimento das habilidades especiais dos atletas, destacando seus principais pontos fortes e trabalhando nas características intermediárias. Objetivo: Verificar os impactos do treino do core no desempenho de atletas na corrida de longa distância. Métodos: Este artigo teve a participação de 18 corredores de média distância como voluntários para a pesquisa. Foi examinado o condicionamento físico dos atletas e o desempenho atlético antes e depois dos treinos. As análises estatísticas nos indicadores dos grupos experimentais e de controle foram analisadas com base no teste-T. Resultados: Houve diferenças significativas na resistência, elasticidade muscular essencial, força do core, potência explosiva e estabilidade ($P<0,05$); os resultados mostraram que as diferenças na estabilidade do núcleo entre as pernas esquerda e direita do grupo experimental foram significativas ($P<0,05$). Conclusão: O exercício de força do core é mais propício ao exercício de um grupo miocárdio em exercícios de média e longa distância do que o exercício de força convencional. Exercícios de força do core podem compensar a falta de força regular. ***Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.***

Descritores: *Atleta; Corrida de Maratona; Esporte; Treinamento de Força.*

RESUMEN

Introducción: Los corredores de larga distancia no pueden conseguir los efectos del entrenamiento basándose únicamente en el entrenamiento de la velocidad y la resistencia. Los ejercicios de entrenamiento del core mejoran significativamente la estabilidad que permite un aprendizaje de la técnica con una eficiencia de movimiento superior. Para ello, se tienen en cuenta varios factores que afectan al desarrollo de las capacidades especiales de los deportistas, destacando sus principales puntos fuertes y trabajando sobre las características intermedias. Objetivo: Verificar los impactos del entrenamiento del core en el rendimiento de los atletas en carreras de larga distancia. Métodos: Este artículo contó con la participación de 18 corredores de media distancia como voluntarios para la investigación. Se examinó la condición física y el rendimiento deportivo de los atletas antes y después del entrenamiento. Los análisis estadísticos en los indicadores de los grupos experimental y de control se analizaron a partir de la prueba T. Resultados: Hubo diferencias significativas en la resistencia, la elasticidad de los músculos centrales, la fuerza central, la potencia explosiva y la estabilidad ($P<0,05$); los resultados mostraron que las diferencias en la estabilidad central entre las piernas izquierda y derecha del grupo experimental eran

significativas (P<0,05). Conclusión: El ejercicio de fuerza del núcleo favorece más el ejercicio del grupo miocárdico en el ejercicio de media y larga distancia que el ejercicio de fuerza convencional. Los ejercicios de fuerza del core pueden compensar la falta de fuerza habitual. ***Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.***

Descriptore: *Atletas; Carrera de Maratón; Deportes; Entrenamiento de Fuerza.*

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INTRODUCTION

Scientific training has become the main form of middle-distance running in China. Athletes have higher and higher requirements for the economy and effectiveness of training.[1] At present, the physical fitness training of middle and long-distance runners is challenging to break through only through the training of speed and speed endurance. As the energy expenditure rate of the body of middle-distance runners increases, the demands on the body also increase accordingly. The data shows that scientific strength training should be paid attention to in middle and long-distance running. Sports play an essential role in promoting the development of athletes' abilities and sports performance.

With the continuous development of training theories and methods, more and more people use them for training movements' stability, effectiveness, and coordination. Middle and long-distance running is a cyclical exercise based on physical strength. It requires you to minimize physical exertion while running.[2] It requires more physical reserves. Stability training works deep and minor muscles. Academia applies it to the training of middle and long-distance running. It can increase the athlete's physical fitness and reduce the physical exertion of the athlete. Core strength training can also prevent sports injuries, improve sports performance, and extend sports life. From the analysis and synthesis of middle and long-distance running characteristics, this paper discusses the stability training methods of middle and long-distance runners and their role in unique ability. The conclusions of this paper can provide a reference for future middle-distance running training.

METHOD

Research objects

The research object of this study was young middle-distance runners. Eighteen young middle-distance runners were selected for this study. His average age is fifteen. This paper divides them into two groups.[3] The core ability training group was used as the experimental group, and the conventional ability training group was used as the control group. The various experimental data of the two subjects before and after the test are shown in Table 1.

Research methods

The training for the core strength training group is divided into two parts. One is the core strength to maintain body balance. Exercise time is 12 weeks. The second stage is balance-based core strength exercises. Exercise time is 12 weeks.

Table 1. Subjects' numerical literacy tests before the experiment.

Test indicators	Test group	Control group
Maximum strength	70.68±5.67	70.82±5.96
Strength endurance	22.42±1.76	22.69±2.49
Speed force	48.68±6.68	48.82±5.29
The ability of muscles to store elastic energy	8.53±2.81	8.67±1.61
12-minute run	3285.57±79.32	3297.25±78.17
Core power	15.82±4.59	16.5±4.16
Core strength endurance	24.75±4.03	25.03±4.15
Core explosiveness	7.43±2.42	6.94±2.26
Core stability	33.97±5.27	31.77±6.42

The control group mainly used the circulation strength exercise method in the conventional strength exercise.[4] Time lasts 24 weeks. The experimental group and the control group underwent strength training at the same time and under the same conditions. The target heart rate is 120-140 beats/min.

Endurance prediction model for long-distance runners

It is assumed that u represents the frequency of the player and the acceleration of the knee and ankle joints. In this paper, formula (1) is used to obtain the statistical value of the relationship between the athlete's kinematic dimension T and endurance:

$$T = \frac{ux}{pqY} \tag{1}$$

p represents the order of the first factor is 1 in the equation. q represents the actual exercise volume of the athlete. Y represents the athlete's endurance prediction within the exercise intensity range. Extraction of sports load characteristics of athletes using equation (2)

$$\delta = \frac{\beta_{\min} + \beta_{\max}}{\alpha_{\min} + \alpha_{\max}} \tag{2}$$

δ represents the discriminant factor for endurance prediction. $\beta_{\max}$ refers to the change of the movement load of the three joints of the hip, knee and ankle in the sagittal axis, coronal axis and vertical axis during the athlete's movement. $\alpha_{\min}$ is the difference between the historical prediction of the athlete's exercise endurance and the actual exercise outcome. Using Equation (3) to Construct the Endurance Prediction Model of Athletes

$$\phi = \frac{\rho\beta_{\max}}{\delta \times \alpha} Y \tag{3}$$

This paper establishes an athlete's endurance prediction model according to formula (3). It is used to predict the endurance of athletes.

Statistics

The collected experimental data were sorted and analyzed by SPSS 11.5. There is no need for a code of ethics for this type of study.

RESULTS

Comparison of various indicators between the experimental group and the control group after 12 weeks of the experiment

There are significant differences in the four indices of strength tolerance, muscle elasticity, core strength tolerance, core explosiveness, and core stability.[5] There was a significant difference in the core stability of the left and right legs in the control group. Table 2

Table 2. Comparison of different digital literacy test results in 12 weeks before and after the experiment.

Test indicators	Test group	Control group
Maximum strength	75.08±5.21	77.69±3.89
Strength endurance	27.09±3.05	30.525±2.74
Speed force	50.47±7.7	53.63±6.11
The ability of muscles to store elastic energy	9.63±1.93	11.28±1.41
12-minute run	3485.63±82.82	3526.88±85.39
Core power	25.44±5.04	24.07±2.85
Core strength endurance	35.07±2.45	29.98±3.37
Core explosiveness	11.97±1.8	10.45±2.04
Core stability	64.77±11.96	44.83±4.98

Table 3. Comparison of two groups of physical fitness tests after 24 weeks.

Test indicators	Test group	Control group
Maximum strength	77.55±5.19	82.09±4.31
Strength endurance	30.25±2.94	35.62±2.55
Speed force	53.49±7.62	56.38±5.51
The ability of muscles to store elastic energy	11.55±1.95	13.62±1.27
12-minute run	3588.75±86.97	3643.75±81.84
Core power	35.75±2.85	30.25±2.94
Core strength endurance	44.14±2.85	35.62±2.82
Core explosiveness	15.68±1.41	13.31±0.45
Core stability	82.09±8.88	57.75±5.89

Comparison of various indicators between the experimental group and the control group after 24 weeks

In the four indicators of core strength, endurance, core explosiveness, and core stability, the experimental group's scores weres significantly more significant than that of the control group, and there were statistically significant differences.[6] The increase in speed and strength in the test items was significantly more significant in the control group than in the experimental group, but there was no statistically significant difference. Three indicators of maximum strength, endurance, and muscle storage elasticity were significantly improved. The difference in core stability of the left and right legs of the experimental group did not change significantly within 24 weeks. There was still a significant difference in core stability between the left and right legs in the control group after 24 weeks of regular strength training. (Table 3)

DISCUSSION

At present, 90% of the first-level athletes in China will suffer different degrees of sports injuries during training and competition. Changes in body position, heave, rotation, acceleration, and spatial changes require an athlete to have powerful deep muscle groups.[7] This ensures the body's stability and a good sense of the body. Through research on the physiological mechanism and anatomy of the core muscle group, the academic community can see that the ability of training to strengthen the core muscle group can effectively reduce sports injuries. Studies have found that the lack of core muscles causes the lack of lumbar spine and back muscle pain. During running, the unstable center of gravity of long-distance runners can easily lead to muscle strains and joint injuries in the waist, knee joints, ankles, and other parts.[8] This injury can permanently damage an athlete's physical health and athletic ability.

The stability of long-distance running technical movements has a great relationship with the performance of athletes. The main factors determining long-distance running techniques' stability are the transversus abdominis, diaphragm, multifidus, pelvic floor muscles, and deep muscle groups.[9] The strength of the contraction of these deep muscle groups will be weakened, and eventually, the muscle will lack stability. This will seriously affect the expected performance of the players. The technical feature of long-distance running is that the runner must maintain a high degree of coordination and relative stability to ensure good performance. The deep muscle groups on the core allow the entire human body to exert its maximum muscle strength in different technical postures. Deep muscle group training allows the muscles to adjust the rotation of the athlete's body without immobilization. Athletes in different sports need to have deep core muscle groups. In this way, the stability and accuracy of the movement technique can be improved.

The athlete's center of gravity should be lowered at the middle and long-distance running beginning and then gradually raised. The athlete leans forward slightly at the fastest time.[10] At the start, athletes need to control their center of gravity precisely, and the core muscles are responsible for maintaining balance and stability of the body. Athletes need to work with the large muscle groups in the core to adjust their center of gravity. Athletes' pace is a crucial factor in determining middle-distance running performance. When running, the athlete will push the hip forward. This process requires the athlete's legs to push the ground and the coordination, transmission, and integration of the core muscle groups. Finally, the athlete completes the strength of the legs and hips.[11] The stability of the central region during this process is the key to transferring energy. The coordination of the core muscles can effectively promote the transmission of energy and promote the release of strength.

Stability training is done as the body moves from the torso to the pelvis. In addition, the athlete's balance adjustment can be improved when performing core stability training. At the same time, this exercise can also reduce the muscle load during exercise. In the middle and long-distance running, the athlete should ensure the stability of the center of gravity when swinging the legs or swinging the arms.[12] Athletes must effectively transmit the strength of the upper and lower limbs through the excellent contraction of the leading muscle group. This allows the athlete to achieve a more stable speed. Strengthening stability exercises can effectively prevent the occurrence of sports injuries. If the athlete's center of gravity is not stable enough, it will decrease body sensation. This leads to instability of the spine resulting in sports injuries. At the same time, core stabilization exercises can also reduce the load on the lumbar spine and improve the balance and coordination of the trunk. This stabilizes the spine and prevents sports injuries. Core stability training is critical for strength training in middle and long-distance running. Core stability training is a method that organically integrates coordination, stability, and strength. At the same time, it can also promote the conversion of power to extraordinary power. Core stability training is an essential part of strength training.

CONCLUSION

By comparing the core strength and conventional strength training of young middle-distance runners, it is found that both can promote the development of young athletes' athletic performance and strength quality. There are significant differences between core strength and conventional strength exercises in strengthening the strength quality of young people in middle and long-distance running. Core strength exercises are more beneficial to the core muscles than regular strength exercises. Regular strength exercises work better on the body's surface muscles than core strength exercises. The development of core strength and conventional strength complement each other. Athletes can do less by combining core strength with regular strength training.

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