PHYSICAL TRAINING SYSTEM ASSOCIATED WITH STRENGTHENING OF THE CORE IN YOUNG SWIMMERS

SISTEMA DE TREINAMENTO FÍSICO ASSOCIADO AO FORTALECIMENTO DO CORE EM JOVENS NADADORES ESPORTISTAS

SISTEMA DE ENTRENAMIENTO FÍSICO ASOCIADO AL FORTALECIMIENTO DEL CORE EN JÓVENES NADADORES

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ABSTRACT

Introduction: CORE fitness training in athletes is intimately related to their performance in competitive sports. However, few academic studies are dedicated to investigating this relationship in young swimmers. Objective: Verify the association between supplementary physical training focused on the CORE in young swimmers and their athletic performance. Methods: Randomized controlled study with 20 swimmers (12 males) born post-2000 was made in aquatic training three times a week for six months. The experimental group received a specific exercise protocol with emphasis on the CORE. The physiological comparison of the data considered the total time to complete the 400 and 800-meter freestyle swim. Results: After six months, the control group obtained a reduction of 2.6s versus 3.2s of the experimental group in the 400-meter freestyle swim; performance in the 800 meters revealed a reduction of 1s for the control group versus 4.5s of the experimental group, compared to the initial measurement. Conclusion: Supplemental fitness training focused on the CORE in young swimmers is positively associated with improvements in their athletic performance. ***Evidence Level II; Therapeutic Studies – Investigating the results.***

Keywords: Resistance Training; Physical Conditioning, Human; Athletes; Sports.

RESUMO

Introdução: O treinamento da aptidão física do CORE no atleta está intimamente relacionado com o seu desempenho nos esportes competitivos. Porém, ainda são poucos os trabalhos acadêmicos dedicados a investigar essa relação em jovens nadadores. Objetivo: Investigar a associação entre o treinamento físico complementar focado no CORE em jovens nadadores e seu desempenho atlético. Métodos: Estudo randomizado controlado com 20 nadadores (12 homens) nascidos após o ano 2000 sob treino aquático com frequência de 3 vezes na semana e duração de 6 meses. O grupo experimental recebeu um protocolo específico de exercício com ênfase no CORE. A comparação fisiológica dos dados considerou o tempo total para completar o nado em estilo livre de 400 e 800 metros. Resultados: Ao fim de seis meses, o grupo controle obteve uma redução de 2,6s contra 3,2s do grupo experimental no nado livre de 400 metros; a performance nos 800 metros revelou uma redução de 1s para o grupo controle contra 4,5s do grupo experimental, comparados a mensuração inicial. Conclusão: O treinamento complementar de aptidão física focado no CORE em jovens nadadores está positivamente associado com melhorias no seu desempenho atlético. ***Nível de evidência II; Estudos Terapêuticos - Investigação de Resultados.***

Descritores: *Treinamento de Força; Condicionamento Físico Humano; Atletas; Esportes.*

RESUMEN

Introducción: El entrenamiento de la aptitud física del CORE en el atleta está estrechamente relacionado con su rendimiento en el deporte de competición. Sin embargo, todavía hay pocos trabajos académicos dedicados a investigar esta relación en nadadores jóvenes. Objetivo: Investigar la asociación entre el entrenamiento físico complementario centrado en el CORE en jóvenes nadadores y su rendimiento deportivo. Métodos: Estudio controlado aleatorio con 20 nadadores (12 varones) nacidos después del año 2000 sometidos a un entrenamiento acuático con una frecuencia de 3 veces por semana y una duración de 6 meses. El grupo experimental recibió un protocolo de ejercicio específico con énfasis en el CORE. La comparación fisiológica de los datos tuvo en cuenta el tiempo total para completar los 400 y 800 metros de natación en estilo libre. Resultados: Después de seis meses, el grupo de control obtuvo una reducción de 2,6s frente a 3,2s del grupo experimental en los 400 metros de natación en estilo libre; el rendimiento en los 800 metros reveló una reducción de 1s para el grupo de control frente a 4,5s del grupo experimental, en comparación con la medición inicial. Conclusión: El entrenamiento físico complementario centrado en el CORE en jóvenes nadadores se asocia positivamente con mejoras en su rendimiento deportivo. ***Nivel de evidencia II; Estudios terapéuticos - Investigación de resultados.***

Descriptores: *Entrenamiento de Fuerza; Acondicionamiento Físico Humano; Atletas; Deportes.*

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INTRODUCTION

The main content of core strength training includes core stability training and core specialized strength training. "Core stability" means that the human body establishes a fulcrum for the strength of the limbs through the stability of the core during exercise. It creates conditions for the transmission of upper and lower limbs and provides a proper body posture for the stability and displacement of the body's center of gravity. It is restricted by the control, active, and passive subsystem.[1] The "core specialized power" is a powerful capability whose main purpose is to stabilize the core part of the human body, control the movement of the center of gravity, generate power, and transmit power. Competitive sports provide strong support for core stability and can actively exert force in many technical movements and sports skills. It is an important "power source" for the overall movement of the human body. The training of young swimmers is the foundation of the development of competitive swimming in China.[2] Strengthening the training of youth swimming reserves is an important part of the Olympic glory program. Therefore, the pertinence and effectiveness of training become particularly important. Based on this, the author has researched young swimmers specifically for muscle endurance training methods.

METHOD

Research object

We study the effect of muscular endurance training on the performance of young swimmers. The subjects of this experiment are 20 swimmers born after 2000. The ratio of boys to girls is 12:8. In this experiment, 20 swimmers were randomly divided into groups.[3] The test subjects were divided into a control group and an experimental group.

Research methods

The entire experiment process lasted about 6 months. The experimental and control groups were conducted simultaneously, including water training courses and water and land combined training courses. All athletes in a training group receive the same venue equipment conditions, the same class hours, the same warm-up, and water preparation activities plan.[4] Since the experimental group used targeted muscular endurance training 3 times a week, the two groups' intensity and density stimulation load would be significantly different. The experimental group emphasized the intensity and density requirements of strengthening muscle endurance training methods in physical fitness and water training classes. The control group used a conventional comprehensive training program and did not perform muscular endurance training. The medley and freestyle in training are determined separately before and after the training, and the results are recorded. Statistically process the data through Excel software.

Co-evolutionary algorithm of the physiological two-way regulation mechanism

We assume $f_{\max}(i), f_{av}(i)$ $(i = 1, \mathrm{L}, N)$. Where N is the real search algebra. They are the maximum fitness and average fitness of each generation of individuals. According to the maximum fitness and average fitness of each generation of individuals and the relationship with the evolutionary algebra, the following search index $\alpha(i)$ is designed:

$$\alpha(i) = 1 - \left(0.3\frac{k}{N} + 0.7\frac{f_{av}(i)}{f_{\max}(i)}\right) \quad (1)$$

k is the current evolutionary algebra. Obviously $0.0 \le \alpha(i) \le 1.0$. In the initial search, the diversity of individuals in each generation is better, and the $\alpha(i)$ value is larger.[5] When entering the middle and late stages of the search, the individuals tend to be unified, and the value of $\alpha(i)$ is small or even close to zero. Therefore, the law of enhancing and inhibiting the synergy can be determined according to the value of $\alpha(i)$. We choose the search index $\alpha(i)$ as the motivating factor, and design the following enhanced synergy law:

$$R(\alpha(i)) = \begin{cases} \dfrac{0.5}{\alpha(i)^{0.5} + 0.5}, 0.7 \le \alpha(i) < 1.0, \\ \dfrac{0.5}{\alpha(i) + 0.5}, 0.5 \le \alpha(i) < 0.7, \\ \dfrac{0.5}{\alpha(i)^2 + 0.5}, 0.0 \le \alpha(i) < 0.5. \end{cases} \quad (2)$$

In the formula, $R(\alpha(i))$ is the enhancement factor. In the same way, the following restraining synergy laws are designed as follows:

$$S(\alpha(i)) = \begin{cases} \dfrac{\alpha(i)^{0.5}}{\alpha(i)^{0.5} + 0.5}, 0.7 \le \alpha(i) < 1.0, \\ \dfrac{\alpha(i)}{\alpha(i) + 0.5}, 0.5 \le \alpha(i) < 0.7, \\ \dfrac{\alpha(i)^2}{\alpha(i)^2 + 0.5}, 0.0 \le \alpha(i) < 0.5. \end{cases} \quad (3)$$

In the formula, $S(\alpha(i))$ is an inhibitor.

RESULTS

Swimmers will have more exercise styles in the process of land training. These exercise styles also have great differences in difficulty. For swimmers, the specific performance is the most objective reflection of the training effect. This article mainly judges and counts the freestyle performance.[6] We conduct an in-depth analysis of the effect of muscular endurance training methods on athletes' specific levels.

It can be seen from Table 1 and Table 2 that in the speed comparison of 400m freestyle athletes, it can be found that the 400m freestyle performance of the experimental group before and after the experiment is reduced by 3.2s. The 400m freestyle performance of the control group before and after the experiment decreased by 2.6s. In the speed comparison of 800m freestyle athletes, it can be found that the 800m freestyle performance of the experimental group before and after the experiment

Table 1. 400m freestyle performance statistics of the two groups of athletes before and after the experiment.

	Category	Test group	Control group	P
Before the experiment	400m/(min:s)	04:56.2	04:59.6	<0.05
	Front and back speed difference/s	12.6	13.2	
After the experiment	400m/(min:s)	4:53	4:57	
	Back and forth speed difference/s	8.7	12.64	
	Speed difference before and after experiment/s	1.86	0.65	

Table 2. The average statistics of the 800m freestyle performance of the two groups of athletes before and after the experiment.

	category	Test group	Control group	P
Before the experiment	800m/(min:s)	8:49	8:57	<0.05
	Back and forth speed difference/s	15.4	18.2	
After the experiment	800m/(min:s)	08:44.5	8:56	
	Back and forth speed difference/s	16:48.0	18:00	
	Speed difference before and after experiment/s	0:00	12:00	

decreased by 4.5s. Before and after the experiment, the 800m freestyle performance of the control group decreased by 1s. The overall reduction of the control group was smaller than that of the experimental group.[7] The overall improvement level of the experimental group was higher than that of the control group. This shows that endurance training methods help improve the endurance quality and specific abilities of young swimmers.

DISCUSSION

Changes in heart rate recovered after exercise

We observe the changes in the heart function of the two groups of athletes after different exercises.[8] There is no significant difference in athletes' heart rate recovery ability before and after the 400m freestyle performance experiment or the 800m freestyle performance experiment.

The significance of muscular endurance and aerobic endurance

Generally speaking, swimming is a cyclical competitive event that uses techniques to overcome resistance. Swimming is a phased sport dominated by physical fitness. Athletes need to maintain physical fitness standards to adapt to the high-intensity training of swimming. Physical fitness is an important quality to maintain technical stability. Technical stability is the key to maintaining the stability of swimming speed. Swimmers need to strengthen the training of the muscular system, cardiopulmonary function, and respiratory system.[9] The 400m and 800m swimming competitions are the key events in the youth swimming competition. In the competition, teenagers will have different swimming speeds throughout the stage. The main reason for this is that the athlete's aerobic capacity and speed endurance are not standard. The muscular system's acid resistance and acid excretion capacity are directly related to aerobic capacity. This plays a decisive role in the quality and sustainability of the stroke.

The impact of physiological characteristics on performance

The heart rate of adolescents in adolescence has a great relationship with their age characteristics. The younger the athlete, the faster the heart rate and the faster their development time. Athletes have a stronger metabolism process, and the blood nutrients in the body will be higher. Teenagers have weaker myocardial contractility, and they can only maintain a high heart rate in swimming to meet growth and development requirements.[10] This is why the heart rate of teenagers is much higher than that of adults. Aerobic endurance training in swimming events is the basis of the entire aerobic process and is a key factor determining youth swimming.

In addition, strengthening muscle endurance training can also help athletes effectively recover from their injuries during the competition. In general, coaches will strengthen the muscle endurance training of swimmers when they are adolescents. The main effect of this is to use this age to give full play to the physical value of adolescents. In swimming training, athletes before puberty mainly rely on neurological factors to achieve the purpose of training. In the process of athletes receiving muscular endurance training, their entire body will undergo greater lactic acid resistance training. This is also the main reason why young people can effectively improve their water sports ability through muscle endurance training.[11] At the same time, this is also the main factor that the young swimmers in the experimental group have significantly improved the speed of the 400m medley after receiving muscle endurance training. This shows that young swimmers can effectively improve their swimming ability after receiving endurance and water aerobic exercise training. This ability will increase the weight and fat content of the thinner athletes, thereby reducing their resistance to the water. This makes the speed of the entire swimming process greatly improved compared to before.

The role of amphibious training

Studies have shown that young swimmers receive muscle endurance training on land. This has a very important effect on improving one's muscle mass and reducing body fat. The explosive water power of young swimmers will also be significantly improved. Athletes only receive training on land and cannot improve their sports ability in the water.[12] This requires the coach to pay attention to the performance of the athletes in the water and properly arrange the athletes to strengthen the water muscle endurance training. But it still needs to be executed according to the previous training intensity and competition intensity in terms of intensity. This enables athletes to ensure the same intensity even when training on the water.

It is feasible to focus on muscle endurance training for young swimmers. Coaches should know that the most effective training to improve specific performance is to simulate the intensity and requirements of the competition.[13] Athletes often use or strengthen muscle power and high-intensity training. Young swimmers' early adult training can lead to local muscle damage. Light equipment and medium-intensity comprehensive muscular endurance training are used on land, and high-density training with short intervals and multiple repetitions on the water can effectively control the intensity and effectively improve the special performance. This lays a good foundation for pushing up the intensity in the future. It can also avoid overtraining young swimmers.

CONCLUSION

Young swimmers need to arrange athletic endurance training reasonably at each stage of participating in the physical fitness program. Combine the athlete's special characteristics and physical fitness level to formulate a targeted training plan. This makes young swimmers' special physical training methods more reasonable and scientific, thereby effectively improving their competitive ability. In addition, endurance training is the core content of the entire training process. Coaches should pay attention to the diversification of muscle endurance training methods and the value of endurance training. The coach better integrates endurance training into swimming training, combining physical training on land and water. This lays a solid foundation for the further high-level training of young swimmers.

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