EFFECTS OF POSTURAL BALANCE TRAINING ON STABILITY IN SWIMMERS

EFEITOS DO TREINAMENTO DE EQUILÍBRIO POSTURAL SOBRE A ESTABILIDADE DOS NADADORES

EFECTOS DEL ENTRENAMIENTO DEL EQUILIBRIO POSTURAL EN LA ESTABILIDAD DE LOS NADADORES

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Qing Ma[1]
(Physical Education Professional)
Yinping Song[1]
(Physical Education Professional)
Quanliang Zheng[1]
(Physical Education Professional)
Xiaojun Meng[2]
(Physical Education Professional)

1. Xi'an Fanyi University, School of Physical Education, Xi'an, Shaanxi, China.
2. Jinyuan International School of Shaanxi Normal University, Xi'an, Shaanxi, China.

Correspondence:
Xiaojun Meng
Xi'an, Shaanxi, China. 710016.
mengxiaojun7805@163.com

ABSTRACT

Introduction: Recent research shows that swimmers with greater stability and better balance reflect better water performance and adjustment ability. Objective: Explore the influence of balance training on the fitness of swimmers. Methods: The volunteers selected in this paper were swimmers aged 18 to 22 years old in a sports school. They were randomly divided into experimental and control groups for an experiment lasting 8 weeks. Both groups of athletes performed training during this period. Postural balance training was added to the athletes in the experimental group instead of traditional training methods, while the control athletes followed the routine professional training plan taught by the sports school. Results: The OSI score of the athletes in the experimental group decreased from 1.79±0.41 to 0.89±0.26; the API score decreased from 1.31±0.22 to 0.64±0.17; and the MLI score decreased from 1.42±0.32 to 0.54±0.30. Conclusion: Postural balance training was shown to increase the stability of swimmers, contributing favorably to sports fitness. Postural balance training can be added to the swimming training process. ***Level of evidence II; Therapeutic studies - investigation of treatment outcomes.***

Keywords: Physical Education and Training; Postural Balance; Physical Fitness; Swimming.

RESUMO

Introdução: Recentes pesquisas demonstram que nadadores com maior estabilidade e melhor equilíbrio refletem melhor desempenho hídrico e capacidade de ajuste. Objetivo: Explorar a influência do treinamento de equilíbrio na aptidão física dos nadadores. Métodos: Os voluntários selecionados neste trabalho foram nadadores de 18 a 22 anos de idade em uma escola de esportes. Eles foram divididos aleatoriamente em grupo experimental e grupo de controle, para um experimento com duração de 8 semanas. Durante este período, os dois grupos de atletas realizaram treinamentos, e aos atletas do grupo experimental foi adicionado um treinamento de equilíbrio postural ao invés dos métodos tradicionais de treinamento, enquanto os atletas-controle seguiram o plano rotineiro de treinamento profissional lecionado pela escola esportiva. Resultados: A pontuação OSI dos atletas do grupo experimental diminuiu de 1,79±0,41 para 0,89±0,26; a pontuação API diminuiu de 1,31±0,22 para 0,64±0,17; e a pontuação MLI diminuiu de 1,42±0,32 para 0,54±0,30. Conclusão: O treinamento de equilíbrio postural revelou aumentar a estabilidade dos nadadores, contribuindo favoravelmente para a aptidão física esportiva. O treinamento de equilíbrio postural pode ser adicionado no processo de treinamento de natação. ***Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.***

Descritores: *Educação Física e Treinamento; Equilíbrio Postural; Aptidão Física; Natação.*

RESUMEN

Introducción: Investigaciones recientes demuestran que los nadadores con mayor estabilidad y mejor equilibrio reflejan un mejor rendimiento en el agua y capacidad de ajuste. Objetivo: Explorar la influencia del entrenamiento del equilibrio en la capacidad de ajuste de los nadadores. Métodos: Los voluntarios seleccionados en este trabajo eran nadadores de entre 18 y 22 años de una escuela deportiva. Se dividieron aleatoriamente en grupo experimental y grupo de control para un experimento de 8 semanas de duración. Durante este periodo, ambos grupos de atletas realizaron entrenamiento, y a los atletas del grupo experimental se les añadió entrenamiento de equilibrio postural en lugar de los métodos de entrenamiento tradicionales, mientras que los atletas de control siguieron el plan de entrenamiento profesional rutinario impartido por la escuela deportiva. Resultados: La puntuación OSI de los atletas del grupo experimental disminuyó de 1,79±0,41 a 0,89±0,26; la puntuación API disminuyó de 1,31±0,22 a 0,64±0,17; y la puntuación MLI disminuyó de 1,42±0,32 a 0,54±0,30. Conclusión: Se ha demostrado que el entrenamiento del equilibrio postural aumenta la estabilidad de los nadadores, contribuyendo favorablemente a la aptitud física deportiva. El entrenamiento del equilibrio postural puede añadirse al proceso de entrenamiento de natación. ***Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.***

Descriptores: *Educación y Entrenamiento Físico; Equilibrio Postural; Aptitud Física; Natación.*

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INTRODUCTION

In the specific environment of swimming, the core part of the body plays an important role in the unstable state of water.[1] During swimming, the core muscle group is located in the center of the body, responsible for the stability of posture, the exertion of strength and the transmission of strength between each limb. The trunk muscles exert force and transmit it to the joints and limb muscles to complete the technical actions, which are one of the most important links in the entire sports chain.[2] The environment of swimming is different from that of land movement, and the resistance characteristics of water are also different from that of land: the resistance of water movement is greater than that of land movement. When the swimmer swims in the water, the strength comes from the strength of the limbs on the water, and the resistance mainly comes from the rotation of the trunk, in which body balance is an important factor affecting the resistance.[3] The reduction of resistance depends in part on the control of body posture during swimming. Although different strokes are different, correct posture and good balance are always required. Good posture helps to reduce resistance and maximize the role of the limbs in the stroke.[4] Because body balance does not exert force directly like arm and leg movements in swimming, its role and training are often ignored and not paid enough attention to in courses and training.[5] Athletes with good balance and stability will have better underwater body control. After the balance and adjustment ability in the water is improved, the technical movements of the arms and legs can be mastered more quickly, with natural coordination and strong sense of rhythm, which is conducive to the improvement of swimming performance.[6] Therefore, this paper designed relevant experiments based on balance ability training to study its impact on the core stability of swimmers.

METHOD

Experimental object

The subjects selected in this experiment are all swimmers in the 18-22 age group of a sports school, a total of 20, including 12 boys and 8 girls. The study and all the participants were reviewed and approved by Ethics Committee of Shaanxi Normal University (SXNU2020PH063). Before the experiment, 20 athletes were randomly divided into the experimental group and the control group, with 10 in each group and the same number of male and female athletes. After the test of each index before the experiment, the basic situation test results of all the tested athletes are relatively consistent, and the statistical results of the two groups have no significant difference in statistics through independent sample T test ($p>0.05$), which meets the basic requirements of this experiment. In addition, before the start of the experiment, all the athletes in this study were in good health, without basic diseases, and their training and rest habits were basically the same. At the same time, the subjects had a clear understanding of the experiment and volunteered to participate in the experiment before the experiment began. Before the experiment, the age, height, weight, balance ability, core quality and other relevant indicators of the selected athletes were tested, and the basic situation analysis results are shown in Table 1.

Experimental scheme

The experiment in this paper lasted for 8 weeks, during which the athletes in the experimental group and the control group carried out training at the same time. The athletes in the experimental group used balance ability training to replace the traditional training methods. The athletes in the control group used the original swimming professional training plan of the sports school unchanged. Before and after the training, the core stability, balance ability and swimming performance of the swimmers were tested and recorded professionally. The balance ability training adopted by the students in the control group mainly includes balance board training and suspension training. The training content of balance board mainly includes balance of balance board sitting posture and flat support, and the suspension training content mainly includes suspension training, including static exercise and dynamic exercise, which are carried out in combination with the actual situation of athletes. The training times of the experimental group and the control group were not less than 4 times a week, and each time was not less than 1 hour. In addition to the balance training in the experimental group, other basic physical training and living and eating habits of the two groups were consistent, and other external factors were avoided as far as possible.

Table 1. Basic information analysis of two groups of subjects.

Option	Age (Y)	Height (CM)	Weight (KG)
Control group	20.470±1.8918	166.466±1.1984	49.883±1.7214
Experience group	20.074±2.0264	164.486±1.3981	52.131±1.7922
P	0.21372	0.31997	0.18121

Experimental test methods

The core stability test of the tested athletes mainly includes four indicators: TFE (trunk flexion and extension range of motion test), DLH (dominant side single leg long jump test), SU (sit up test) and DLS (dominant side single leg standing test). The four indicators were tested and recorded before and after the experiment. Before the test, let the test athletes know the precautions. Each test index is tested three times, and the results are the average of the three times.

The dynamic balance test of the tested athletes adopts the Biodex balance system, which mainly includes three indicators: the overall stability index (OSI), the stability index in the front and back directions (API) and the stability index in the left and right directions (MLI). The test results use numerical values to express the body stability of the subjects, that is, the average swing amplitude in different directions. The smaller the test result is, the smaller the body swing amplitude is, that is, the better the body balance ability is. The test level is set as level 11, and the test duration is 10 seconds/time. The test is conducted 3 times in total, and the average value is taken. During the test, the subjects need to look at the screen cursor and change the body center of gravity according to the cursor. After each test, the adjustment time is 10 seconds, and then continue the next test.

The athletic performance of the athletes was tested by two indicators: 50m butterfly stroke performance and 50m butterfly leg performance. The butterfly related techniques all use the strength of the upper body to break the waves, and transfer the strength downward in turn, and finally the lower limbs form a whipping action and continue to move forward. The results of butterfly stroke and butterfly leg can reflect the core stability and overall swimming skills to a certain extent. The results of butterfly stroke and butterfly leg were tested and recorded before and after the experiment, and compared before and after.

RESULTS

Effect of balance ability training on core stability of swimmers

After 8 weeks of balance ability training, the core stability of the tested swimmers before and after the experiment was counted and compared. The specific results are shown in Table 2.

According to the data in Table 2, the overall core stability test results of the students in the experimental group showed a significant improvement after the experiment, while the scores of the control group had a relatively small change. The control group only had a significant increase in DLS, from 23.175 ± 9.1675s before the experiment to 34.677 ± 5.6698 after the experiment. In addition, the changes of TFE, DLH and SU in the control

group were not obvious, and even the mean value decreased slightly. The changes in the experimental group were more obvious, and the four indicators were improved to varying degrees. TFE increased from 10.164 ± 3.1510 CM before the experiment to 14.434 ± 2.2919 CM after the experiment, DLH increased from 193.928 ± 7.8268 CM before the experiment to 208.163 ± 4.0691 CM after the experiment, SU increased from 45.837 ± 8.3350 times/MIN before the experiment to 52.450 ± 2.3915 times/MIN after the experiment, and DLS increased from 19.552 ± 9.3515S before the experiment to 42.017 ± 4.0691S after the experiment. The results in Table 2 show that the core stability of swimmers can be greatly improved after a certain period of balance training, while the ability of general physical training to improve core stability is limited.

After the pre-test and post test of the core stability of the tested athletes, the dynamic balance ability of the tested athletes was compared and analyzed. The data results are shown in Table 3.

According to the data in Table 3, after 8 weeks of experiment, the test results of the test athletes in the control group did not change significantly, with only a small increase, while the dynamic balance test results of the test athletes in the experimental group after balance ability training had a significant improvement. The OSI score of the athletes in the experimental group decreased from 1.796 ± 0.4168 before the experiment to 0.891 ± 0.2680 after the experiment, the API score decreased from 1.315 ± 0.2236 before the experiment to 0.640 ± 0.1794 after the experiment, and the MLI score decreased from 1.429 ± 0.3253 before the experiment to 0.547 ± 0.3077 after the experiment. Since the Biodex balance system reflects the stability of the subject's body center of gravity, the lower the score, the more stable the center of gravity. The experimental results in Table 3 prove that the balance ability training of a certain length of time has a significant effect on improving the dynamic balance ability of swimmers, and the basic physical training also has a certain ability to improve, but due to the weak pertinence, the role of improving the dynamic balance ability is limited. Therefore, in the daily training of swimmers, balance ability training should be combined to improve the core stability and dynamic balance ability of swimmers, so as to improve the final swimming performance.

Table 2. The Effect of Balance Training on the Core Stability of Swimmers.

Index	TFE(CM)	DLH(CM)	SU(次/MIN)	DLS(S)
Before the experiment in the control group	9.825±3.7461	197.499±9.4664	46.745±8.0997	23.175±9.1675
After the experiment in the control group	9.315±5.6571	197.298±3.5436	44.953±3.1759	34.677±5.6698
Before the experiment in the experimental group	10.164±3.1510	193.928±7.8268	45.837±8.3350	19.552±9.3515
After the experiment in the experimental group	14.434±2.2919	208.163±4.0691	52.450±2.3915	42.017±4.0691

Table 3. Effect of Balance Ability Training on Dynamic Balance of Swimmers.

Index	OSI (minutes)	API (minutes)	MLI (minutes)
Before the experiment in the control group	1.850±0.3388	1.320±0.1215	1.443±0.2192
After the experiment in the control group	1.744±0.8302	1.174±0.7047	1.216±0.8201
Before the experiment in the experimental group	1.796±0.4168	1.315±0.2236	1.429±0.3253
After the experiment in the experimental group	0.891±0.2680	0.640±0.1794	0.547±0.3077

The influence of balance ability training on the performance level of swimmers

Finally, the test and statistical analysis were carried out on the scores of 50m butterfly stroke and 50m butterfly leg of the tested swimmers to further study the relevant impact of balance ability training on swimmers. The specific data results are shown in Table 4.

It can be seen from Table 4 that the experimental group and the control group have different characteristics in the 50m butterfly stroke and 50m butterfly leg. The results of the two indicators of the control group were improved to a certain extent, including the score of 50m butterfly stroke from 38.138 ± 2.9296S before the experiment to 36.999 ± 2.7944S after the experiment, and the score of 50m butterfly stroke leg from 48.770 ± 2.8653S before the experiment to 47.778 ± 2.1735S after the experiment. However, the 50m butterfly stroke performance of the experimental group did not change significantly before and after the experiment, and only showed a certain improvement in the 50m butterfly stroke leg performance, from 48.667 ± 4.2590S before the experiment to 46.615 ± 3.1289S after the experiment. The experimental results in Table 4 prove that the traditional training mode of system specialty has a certain overall improvement effect on swimmers' 50m butterfly stroke scores and 50m butterfly leg scores.

DISCUSSION

Balance ability training is a kind of training to strengthen the vestibule and proprioception of athletes, and promote the coordination and control of neuromuscular system. Balance ability training is an important part of functional training, and also an essential quality training in all sports. Combined with the particularity of swimming, swimming is a sport to maintain body balance under unstable conditions without fixed support in a special underwater environment, especially for the coordination and relative stability of the athletes' body control, as well as the athletes' sports functional ability, core strength and core stability. The special environment determines the special type of sports technology. When swimming forward or turning around in the water, with the change of swimming posture, the balance of the body changes alternately from static balance to dynamic balance, and the stability of the balance is also in the process of mutual transformation between destruction and balance. The coordination of water balance control technology requires the athletes to be relatively quiet and maintain a more stable posture. The posture during swimming emphasizes the flexible arm technique. The leg technique is based on the strength of the core area, and the trunk is the power source of the arm and leg techniques. Good control of body balance and posture in the water plays an important role in mastering arm and leg techniques, improving stroke and impact, reducing body resistance, and ultimately affecting performance.

CONCLUSION

According to the actual core stability needs of swimmers, this paper conducts an experimental design around the effect of balance ability

Table 4. The Effect of Balance Ability Training on the Performance Level of Swimmers.

Index	50m butterfly stroke result (S)	50m butterfly leg score (S)
Before the experiment in the control group	38.138±2.9296	48.770±2.8653
After the experiment in the control group	36.999±2.7944	47.778±2.1735
Before the experiment in the experimental group	37.406±2.5107	48.667±4.2590
After the experiment in the experimental group	37.411±2.3124	46.615±3.1289

training, and conducts an intervention experiment to further study how to improve the performance of swimmers. The experimental results show that the balance ability training of a certain length of time has a significant effect on improving the core stability and dynamic balance ability of swimmers, and also has a certain role in improving the performance of 50m butterfly leg. The improvement of athletes' core stability is more conducive to the improvement and practice of swimming movements in the training process. During the training of balance ability, the core muscle group and nervous system have been developed to a certain extent, so the individual's ability to control muscle activity and body has been enhanced, which is an important reason for the enhancement of core stability.

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