EFFECT OF FUNCTIONAL TRAINING ON ADOLESCENT HEALTH

EFEITO DO TREINAMENTO FUNCIONAL NA SAÚDE DO ADOLESCENTE

EFECTO DEL ENTRENAMIENTO FUNCIONAL EN LA SALUD DEL ADOLESCENTE

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Yang Yang[1]
(Physical Education Professional)

1. Physical Education College of Zhengzhou University, Zhengzhou, Henan, China.

Correspondence:
Yang Yang
Zhengzhou, Henan, China. 450044.
yang66yang1@163.com

ABSTRACT

Introduction: The high rate of obesity caused by the modern sedentary lifestyle associated with bad eating habits and the high intellectual demand at school generates a physical and psychological deficit in contemporary youth. The damage caused in this growth phase is irrecoverable, and the habits acquired during this period are crucial to individual health. The urgency of this problem has generated research on methods to reverse this situation, among them functional training. Objective: To study the effect of functional training on adolescent health. Methods: 30 boys and 30 girls were recruited as study subjects. The experiment lasted one semester, including two weekly physical education classes focused on functional training. Data on body indexes, fitness, and physical test results were collected before and after the intervention. The results of the experiment were integrated and compared. Results: The selection of functional training can optimize adolescents' biochemical indexes, making adolescents' orthostatic posture more balanced, and significantly improve muscle strength, body flexibility, explosive strength of upper and lower extremities, motor coordination, body flexibility, muscular endurance, cardiopulmonary function, etc. Conclusion: Functional training can effectively improve the physical health of adolescents. Participants have increased their interest in sports, and this intervention can potentially promote the development of adolescents' physical and mental health if replicated nationwide. Studies are needed to popularize functional training in adolescents. ***Level of evidence II; Therapeutic studies - investigation of treatment outcomes.***

Keywords: Obesity Management; Adolescent; Exercise.

RESUMO

Introdução: O elevado índice de obesidade ocasionada pelo sedentarismo moderno associado a maus hábitos alimentares e a alta demanda intelectual escolar geram um déficit físico e psicológico na juventude contemporânea. Os danos ocasionados nessa fase de crescimento são irrecuperáveis e os hábitos adquiridos nesse período são determinantes para a saúde individual. A urgência desse problema tem gerado pesquisas sobre métodos para reverter essa situação, dentre eles desponta o treinamento funcional. Objetivo: Estudar o efeito do treinamento funcional na saúde do adolescente. Métodos: 30 meninos e 30 meninas foram recrutados como sujeitos de estudo. O experimento durou um semestre, incluindo duas aulas semanais de educação física, com foco no treinamento funcional. Os dados dos índices corporais, aptidão física e resultados dos testes físicos foram coletados antes e depois da intervenção. Os resultados do experimento foram integrados e comparados. Resultados: A seleção do treinamento funcional pode otimizar os índices bioquímicos dos adolescentes, tornar a postura ortostática dos adolescentes mais equilibrada, melhorar significativamente a força muscular, a flexibilidade corporal, a força explosiva das extremidades superior e inferior coordenação motora, flexibilidade corporal, resistência muscular, função cardiopulmonar, etc. Conclusão: O treinamento funcional pode melhorar efetivamente a saúde física dos adolescentes. Os participantes aumentaram seu interesse pelo esporte e essa intervenção tem o potencial de promover o desenvolvimento da saúde física e mental dos adolescentes caso replicada a nível nacional. Estudos são necessários para a popularização do treinamento funcional em adolescentes. ***Nível de evidência II; Estudos terapêuticos - investigação dos desfechos do tratamento.***

Descritores: *Manejo da Obesidade; Adolescente; Exercício Físico.*

RESUMEN

Introducción: La alta tasa de obesidad causada por el sedentarismo moderno asociado a malos hábitos alimenticios y la alta exigencia intelectual escolar generan un déficit físico y psicológico en la juventud contemporánea. Los daños causados en esta fase de crecimiento son irrecuperables y los hábitos adquiridos durante este periodo son cruciales para la salud del individuo. La urgencia de este problema ha generado la investigación de métodos para revertir esta situación, entre ellos surge el entrenamiento funcional. Objetivo: Estudiar el efecto del entrenamiento funcional en la salud de los adolescentes. Métodos: Se reclutaron 30 chicos y 30 chicas como sujetos de estudio. El experimento duró un semestre, incluyendo dos clases semanales de educación física, centradas en el entrenamiento funcional. Se recogieron datos sobre los índices corporales, la forma física y los resultados de las pruebas físicas antes y después de la intervención. Los resultados del experimento se integraron y compararon. Resultados: La selección del entrenamiento funcional puede optimizar los índices bioquímicos de los adolescentes, hacer que la postura ortostática de los adolescentes sea más equilibrada, mejorar significativamente la fuerza muscular, la flexibilidad corporal, la fuerza explosiva de las extremidades superiores e inferiores la coordinación motora, la flexibilidad corporal, la resistencia

muscular, la función cardiopulmonar, etc. Conclusión: El entrenamiento funcional puede mejorar eficazmente la salud física de los adolescentes. Los participantes han aumentado su interés por el deporte y esta intervención tiene el potencial de promover el desarrollo de la salud física y mental de los adolescentes si se reproduce a nivel nacional. Se necesitan estudios para la popularización del entrenamiento funcional en adolescentes. ***Nivel de evidencia II; Estudios terapêuticos - investigación de los resultados del tratamiento.***

Descriptores: *Manejo de la Obesidad; Adolescente; Ejercicio Físico.*

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INTRODUCTION

At present, with the continuous development of economy, people's living standards have been greatly improved, but corresponding to it is a series of problems caused by too convenient life. For example, the popularity of elevators and cars makes people have relatively few opportunities to exercise independently. The popularity of takeout and the Internet makes people's living habits deviate to a certain extent. For teenagers who are still in the stage of growth and development, the problems of excessive lack of exercise and heavy burden of schoolwork make teenagers have certain deficiencies in their body and psychology, which are reflected in their physical health, such as uneven heart rate, physical obesity, high blood lipid, lack of exercise ability and so on.[1] These have many disadvantages for the healthy growth of teenagers. The literature suggests that at present, teenagers have a series of problems, such as soft muscles, hard joints, weak ability to adjust and balance, and limited ability to exercise coordination.[2] For example, according to the physical test results carried out by the state every year, it can be seen that the physique of teenagers in many areas is declining. Therefore, it is urgent to improve the physical health of teenagers.[3] Many researchers have discussed the functional training of teenagers. The literature puts forward that physical function training is a multi-directional training, which not only emphasizes the attitude control, movement coordination and optimization of each part, but also pays attention to the overall development.[4] According to the literature, the functional training of teenagers mainly includes the combination of two aspects, that is, the combination of muscle system and nervous system, and the combination of sports quality and physical function, so as to promote the healthy development of teenagers.[5] By summarizing the previous literature research results, it can be seen that the coordination of teenagers' physical function and the comprehensive development of various body parts have a certain significance to improve teenagers' physique, improve teenagers' interest in exercise, and effectively prevent sports injuries in the process of exercise. Therefore, this paper takes a senior high school student as the research object to explore the impact of functional training on Teenagers' physical health.

METHOD

In the form of volunteer recruitment, 30 boys and 30 girls were recruited from senior one students of a high school as the research objects. The study and all the participants were reviewed and approved by Ethics Committee of Zhengzhou University (NO. ZZNU2019PE16). The basic information is shown in Table 1.

Table 1. Basic information of the two groups of research objects.

Option	Boy	Girl
Age	15.4562±0.4050	15.1315±0.2696
Height (cm)	1.6574±8.0389	1.6402±6.1659
Weight (kg)	64.8449±12.7081	61.7598±10.2439
BMI (kg/m^2)	20.2096±2.2865	20.2588±3.1659

Because the high school is a boarding system, it can ensure that the daily work and rest time, diet structure and training structure of 60 students participating in the experiment are consistent, so as to reduce the interference of human factors to the experiment.

In order to minimize the impact of the experiment on the curriculum rhythm of senior high school students, this paper selects physical education and big recess as the training time for teenagers. The experiment lasted for one semester, including two PE classes every week, 45 minutes each, and two large class breaks, 30 minutes each. Among them, the 45-minute physical education class includes 10 minutes of warm-up activities, 25 minutes of functional training and 10 minutes of stretching and relaxation. The 30-minute break includes 8 minutes of warm-up activities, 15 minutes of functional training and 7 minutes of stretching and relaxation activities, so as to complete relevant experiments on the premise of ensuring sports safety.

In terms of data measurement, this experiment adopts the method of intra group comparison before and after the experiment. Before and after the experiment, the physical quality of teenagers is measured respectively, including heart rate, RPE, waist circumference, hip circumference, waist hip ratio, body fat rate, triglyceride, low-density lipoprotein, high-density lipoprotein and other indicators. In the measurement of teenagers' sports quality, we choose the physical test results as the research data, integrate and compare the physical test of teenagers in two semesters, and explore the impact of functional training on Teenagers' sports quality. In addition, due to the differences in physical and motor abilities between men and women in the process of adolescent development, men and women are divided into groups respectively in the determination of relevant indicators, so as to avoid the error caused by data average.

RESULTS

Effect of functional training on Teenagers' physical quality

The most intuitive display of the results of functional training is the changes of teenagers' body shape and related biochemical indicators. Therefore, in this section, the factors such as heart rate, waist hip ratio, body fat rate and blood lipid are analyzed.

As shown in Table 2, in the physical fitness test of boys, the heart rate increased from (100.8553 ± 4.6541) beats / min to (137.5890 ± 5.2262)

Table 2. Effect of functional training on physical quality of boys.

Option	Before	After	P
Heart rate (times/minute)	100.8553±4.6541	137.5890±5.2262	0.0000
RPE	7.8392±0.7742	12.1148±0.8783	0.0000
Waist circumference (cm)	83.0268±5.6400	80.4873±5.9210	0.0000
Hip circumference (cm)	89.0630±4.1292	88.7553±3.9814	0.0535
Hip -to -hip ratio	0.9141±0.0301	0.9032±0.0397	0.0674
Body fat rate	26.9058±3.5752	26.0227±2.2345	0.0635
Triglyceride (mmol/L)	1.2922±0.5658	1.1227±0.5608	0.0323
Low density lipoprotein (mmol/L)	1.2745±0.2133	1.1315±0.2019	0.0000
High -density lipoprotein (mmol/L)	1.0884±0.3772	1.3407±0.3814	0.0000

beats / min, the RPE increased from (7.8392 ± 0.7742) to (12.1148 ± 0.8783), the waist circumference decreased from (83.0268 ± 5.6400) cm to (80.4873 ± 5.9210) cm, and the low density lipoprotein increased from (1.2745 ± 0.2133) mmol / L to (1.1315 ± 0.2019) mmol / L, HDL increased from (1.0884 ± 0.3772) mmol / L to (1.3407 ± 0.3814) mmol / L, $P < 0.01$, indicating that there was a very significant difference. Triglyceride decreased from (1.2922 ± 0.5658) mmol / L to (1.1227 ± 0.5608) mmol / L, $P < 0.05$, indicating that there was a significant difference. Hip circumference decreased from (89.0630 ± 4.1292) cm to (88.7553 ± 3.9814) cm, waist hip ratio decreased from (0.9141 ± 0.0301) to (0.9032 ± 0.0397), body fat ratio decreased from (26.9058 ± 3.5752)% to (26.0227 ± 2.2345)%, $P > 0.05$, indicating that there was no significant difference.

As shown in Table 3, in the physical fitness test of girls, the heart rate increased from (99.0578 ± 1.9384) times / min to (134.0766 ± 5.3355) times / min, and the RPE increased from (7.7498 ± 0.8308) to (12.3167 ± 0.3907), $P < 0.01$, indicating that there was a very significant difference. Waist circumference decreased from (81.2298 ± 3.4121) cm to (78.9091 ± 3.4523) cm, hip circumference decreased from (85.6784 ± 1.3662) cm to (85.4468 ± 1.3407) cm, waist hip ratio decreased from (0.9240 ± 0.0401) to (0.9132 ± 0.0397), body fat ratio decreased from (25.5545 ± 0.7922)% to (24.9642 ± 1.0868)%, triglyceride decreased from (1.4235 ± 0.2878) mmol / L to (1.1724 ± 0.2345) mmol / L, Low density lipoprotein decreased from (1.1340 ± 0.0914) mmol / L to (0.9926 ± 0.1514) mmol / L, and high density lipoprotein increased from (1.0086 ± 0.1529) mmol / L to (1.0969 ± 0.1305) mmol / L, $P > 0.05$, indicating that there was no significant difference.

By comprehensively analyzing the results in Table 2 and 3, it can be seen that functional training optimizes the physical quality of boys and girls to a certain extent. For example, increase heart rate and RPE index, reduce waist circumference, hip circumference and waist hip ratio, reduce body mass rate, and make the body shape more symmetrical. In addition to the morphological changes on the surface, functional training can also optimize the blood lipid of teenagers, reduce the content of triglycerides and low-density lipoprotein, and increase the content of high-density lipoprotein, so as to reduce the problems of hypertension, high thrombosis and high blood lipid caused by physical deficiency, and make teenagers healthier.

Influence of functional training on Teenagers' sports quality

In the research of teenagers' sports quality, in order to reduce the interference of additional cooperation to teenagers' learning and life rhythm as much as possible. Therefore, in the discussion of sports quality, the results of two physical tests before and after the experiment were selected as the research object. Teenagers participated in the physical fitness test together with other students in the class, and the results were summarized and analyzed at the researchers.

As shown in Table 4, in the physical test results of boys, the forward flexion of sitting body increased from (6.0703 ± 4.6513) cm to (11.0095 ± 5.4550) cm, the 50 meter running time decreased from (8.3753 ± 1.0887) s to (7.7258 ± 0.9351) s, the 1000 meter running time decreased from (4.5053 ± 0.8478) min to (3.7627 ± 0.6736) min, and the vital capacity increased from (3236.8978 ± 508.3740) ml to (3850.4014 ± 476.4688) ml, The distance of standing long jump increased from (199.6146 ± 33.2598) cm to (226.3296 ± 30.1975) cm, and the number of pull ups increased from (4.9772 ± 4.5429) to (10.4483 ± 8.7698) ($P < 0.01$).

As shown in Table 5, in the physical test results of girls, the forward flexion of sitting body increased from (10.7708 ± 6.4250) cm to (16.2177 ± 5.7437) cm, the 50 meter running time decreased from (9.4008 ± 0.6613) s to (8.3762 ± 0.5530) s, the 800 meter running time decreased from (4.3940 ± 0.5005) min to (3.4442 ± 0.2313) min, and the vital capacity increased from (1763.8005 ± 520.7864) ml to (2550.3026 ± 394.4476) ml, The distance of standing long jump increased from (169.8909 ± 17.6052) cm to (190.6713 ± 13.6845) cm, and the number of sit ups increased from (46.1185 ± 3.3012) to (56.6964 ± 3.9419), $P < 0.01$, indicating that there was a very significant difference.

By comprehensively analyzing the results in Table 4 and table 5, it can be seen that whether it is the physical test items commonly used by boys and girls or the physical test items carried out by boys and girls alone, participating in functional training can significantly optimize their physical test results, and the physical test results reflect significant improvements in muscle strength, physical coordination, lower limb explosive power, physical flexibility, endurance and other factors. Therefore, participating in functional training. It has a strong role in improving the sports quality of teenagers.

Table 3. Effect of functional training on physical quality of girls.

Option	Before	After	P
Heart rate (times/minute)	99.0578±1.9384	134.0766±5.3355	0.0000
RPE	7.7498±0.8308	12.3167±0.3907	0.0000
Waist circumference (cm)	81.2298±3.4121	78.9091±3.4523	0.5567
Hip circumference (cm)	85.6784±1.3662	85.4468±1.3407	0.6457
Hip -to -hip ratio	0.9240±0.0401	0.9132±0.0397	0.6467
Body fat rate	25.5545±0.7922	24.9642±1.0868	0.0563
Triglyceride (mmol/L)	1.4235±0.2878	1.1724±0.2345	0.4232
Low density lipoprotein (mmol/L)	1.1340±0.0914	0.9926±0.1514	0.1352
High -density lipoprotein (mmol/L)	1.0086±0.1529	1.0969±0.1305	0.2313

Table 4. Effect of functional training on physical test scores of boys.

Option	Before	After	P
Siter forward flexion (cm)	6.0703±4.6513	11.0095±5.4550	0.0000
50 meters running (s)	8.3753±1.0887	7.7258±0.9351	0.0000
1000 meters run (min)	4.5053±0.8478	3.7627±0.6736	0.0000
Lung activity	3236.8978±508.3740	3850.4014±476.4688	0.0000
Standing long jump (cm)	199.6146±33.2598	226.3296±30.1975	0.0000
Timing upward (unit)	4.9772±4.5429	10.4483±8.7698	0.0000

Table 5. Effect of functional training on physical test scores of girls.

Option	Before	After	P
Siter forward flexion (cm)	10.7708±6.4250	16.2177±5.7437	0.0000
50 meters running (s)	9.4008±0.6613	8.3762±0.5530	0.0000
1000 meters run (min)	4.3940±0.5005	3.4442±0.2313	0.0000
Lung activity	1763.8005±520.7864	2550.3026±394.4476	0.0000
Standing long jump (cm)	169.8909±17.6052	190.6713±13.6845	0.0000
Timing upward (unit)	46.1185±3.3012	56.6964±3.9419	0.0000

DISCUSSION

Through the measurement results, it can be seen that functional training can effectively improve the physical health level of teenagers. From the perspective of speed quality, functional training can improve teenagers' lower limb explosive power and physical coordination, so as to make teenagers obtain stronger sports quality. In terms of strength quality, functional training can fully exercise the muscle strength of teenagers in all aspects, increase the connection between muscle system and nervous system, so as to make muscle strength more flexible and improve muscle endurance and explosive power. In terms of flexibility, functional training can improve the flexibility of joints and fully stretch all muscles and ligaments of the body, which can be clearly verified in the comparison of forward flexion results of sitting body. In terms of endurance quality, functional training can effectively improve teenagers' muscle strength and cardiopulmonary oxygen supply capacity, so that teenagers can have stronger endurance in 800-meter race and 1000-meter race, so as to greatly shorten the running time.

A comprehensive analysis of the above points shows that functional training plays an excellent role in promoting the physical health of teenagers, and physical health makes teenagers have more energy in their daily life, improves their mental health, and promotes their physical and mental health growth. In the process of its application, we should pay attention to the following points: first, functional training should be combined with teenagers' actual needs and personal sports ability Secondly, in the process of sports training, PE teachers should pay attention to step by step, patient guidance and repeatedly emphasize the essentials of action Third, in the process of sports function training, we need to always pay attention to the principle of safety. For example, we must check the students' personal clothes before training, and actively and seriously carry out warm-up activities.

CONCLUSION

Through the analysis of the research results of this paper, it can be seen that in view of the current decline of teenagers' physique, the traditional physical education teaching has no certain pertinence, and cannot carry out various training in combination with the actual needs of teenagers. Therefore, the choice of functional training can be combined with the actual situation of teenagers in daily exercise, targeted exercise, so as to optimize the biochemical indicators of teenagers, make teenagers' posture more symmetrical, and significantly improve teenagers' muscle strength, physical flexibility, coordination, explosive power of upper and lower limbs, physical flexibility, muscle endurance, cardiopulmonary function and so on. The results show that functional training can effectively enhance teenagers' physical health and improve their interest in sports, so as to promote the development of teenagers' physical and mental health. Therefore, relevant functional training is worth popularizing.

The author declare no potential conflict of interest related to this article

AUTHORS' CONTRIBUTIONS: The author has completed the writing of the article or the critical review of its knowledge content. This paper can be used as the final draft of the manuscript. The author has made an important contribution to this manuscript. YY: writing and execution.

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