FUNCTIONAL MOVEMENT SCREENING IN THE PHYSICAL FITNESS TEST IN HIGH SCHOOL ADOLESCENTS

TRIAGEM FUNCIONAL DO MOVIMENTO NO TESTE DE APTIDÃO FÍSICA EM ADOLESCENTES COLEGIAIS

CRIBADO FUNCIONAL DEL MOVIMIENTO EN LA PRUEBA DE APTITUD FÍSICA EN ADOLESCENTES COLEGIALES

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ABSTRACT

Introduction: Functional Movement Screening is a qualitative triage of human movement based on a classification and scoring system which includes seven tests to evaluate basic movement patterns where muscle limitations or asymmetries are identified. Its scale has 21 points, with 14 being the limit of normality. Adolescence is critical to improving athletic ability, and the validity of applying this screening technique to discover potential injuries is questioned. Objective: To verify the validity of functional movement screening on the early detection and correction of dysfunctional movements to implement physical fitness in adolescents. Methods: Functional movement screening was performed on students from a school. According to the screening requirements, functional movement examinations were performed before (October 2017) and after (December 2017) intervention with individual demand functional training. Results: After functional training, students' physical fitness increased from 13.00±0.44 to 14.77±0.28 points ($p<0.05$). Conclusion: The results of functional movement assessment can analyze the physical problems of adolescents in universities and colleges. Targeted functional training can effectively improve the physical fitness of adolescents in schools and colleges. ***Evidence Level II; Therapeutic Studies – Investigating the results.***

Keywords: Exercise; Adolescent; Soccer; Physical exercise; Physical Fitness.

RESUMO

Introdução: Triagem Funcional do Movimento é uma triagem qualitativa do movimento humano baseado em um sistema de classificação e pontuação que inclui 7 testes de avaliação dos padrões de movimento básico onde limitações ou assimetrias musculares são identificadas. Sua escala possui 21 pontos sendo 14 o limite de normalidade. A adolescência é um período crítico para melhorar a capacidade atlética e questiona-se a validade da aplicação dessa técnica de triagem para a descoberta de lesões potenciais. Objetivo: Verificar a validade da triagem funcional do movimento sobre a detecção e correção precoce de movimentos disfuncionais visando implementar a aptidão física dos adolescentes. Métodos: Foi efetuada a triagem funcional do movimento em estudantes de uma escola. Exames de movimento funcional foram realizados antes (outubro de 2017) e depois (dezembro de 2017) da intervenção com treinamento funcional sob demanda individual de acordo com os requisitos da triagem. Resultados: Após o treinamento funcional, a aptidão física dos estudantes elevou-se de 13.00±0.44 para 14.77±0.28 pontos ($p<0,05$). Conclusão: Os resultados da avaliação do movimento funcional podem analisar os problemas físicos dos adolescentes nas universidades e colégios. O treinamento funcional direcionado pode efetivamente melhorar a aptidão física dos adolescentes nas escolas e faculdades. ***Nível de evidência II; Estudos Terapêuticos - Investigação de Resultados.***

Descritores: *Exercício Físico; Adolescente; Futebol; Aptidão Física.*

RESUMEN

Introducción: El cribado funcional del movimiento es un cribado cualitativo del movimiento humano basado en un sistema de clasificación y puntuación que incluye 7 pruebas para evaluar los patrones de movimiento básicos en los que se identifican limitaciones o asimetrías musculares. Su escala tiene 21 puntos, siendo 14 el límite de la normalidad. La adolescencia es un periodo crítico para mejorar la capacidad atlética y se cuestiona la validez de aplicar esta técnica de cribado para descubrir posibles lesiones. Objetivo: Verificar la validez del cribado del movimiento funcional en la detección temprana y la corrección de los movimientos disfuncionales con el fin de implementar la aptitud física de los adolescentes. Métodos: Se realizó un cribado de movimiento funcional en alumnos de una escuela. Se realizaron exámenes de movimiento funcional antes (octubre de 2017) y después (diciembre de 2017) de la intervención con entrenamiento funcional a demanda individual según los requisitos del cribado. Resultados: Tras el entrenamiento funcional, la aptitud física de los estudiantes aumentó de 13,00±0,44 a 14,77±0,28 puntos ($p<0,05$). Conclusión: Los resultados de la evaluación del movimiento funcional pueden analizar los problemas físicos de los adolescentes en las universidades y colegios. El entrenamiento funcional dirigido puede mejorar eficazmente la aptitud física de los adolescentes en las escuelas y colegios. ***Nivel de evidencia II; Estudios terapéuticos - Investigación de resultados.***

Descriptores: *Ejercicio Físico; Adolescente; Fútbol; Aptitud Física.*

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INTRODUCTION

Functional training and FMS functional action screening are relatively less used in campus football in China. In traditional testing methods, the athlete's athletic ability is evaluated by time, length, and height. The quality of movements is rarely used to evaluate the athletic ability of athletes. Middle school football players are in a critical period of improving their athletic ability.[1] Therefore, the prevention of sports injuries in campus football training is particularly important.

The middle school football player is the best period of growth, and development is also a critical period for improving athletic ability. We apply FMS functional action screening to campus football training to discover the potential injuries and risk factors of middle school football players in football and games. Through continuous improvement of functional training to improve the athletic ability of young football players and relatively extend sports life.

METHOD

Research object

After screening and investigation, we identified 11 football team members of a certain university as experimental subjects.[2] To study the effect of functional training on improving the FMS level of middle school football players. This article is a physical function screening for a college football team player. Through the screening results, physical functional training combined with football training characteristics can improve athletes' FMS scores. This method improves athletes' physical fitness and reduces sports injuries. This provides an effective training plan for the physical football training of the football team.

Research methods

This experiment mainly uses seven functional screening actions and three exclusion tests: overhead squat, hurdle up step, straight lunge squat, shoulder flexibility, active straight knee lift, trunk stability push-up, and rotation stability. According to the purpose of the research, we adopted a single-group in-subject design.[3] There are fewer subjects in a single group of subjects that are designed to conduct experimental interventions. The intervention period is from October 2017 to December 2017. We use functional training as the independent variable and functional action screening as the dependent variable. Perform FMS screening before the experiment. Then after 8 weeks of practical training intervention, FMS screening was performed again. Finally, a comparative analysis of the data before and after the training is carried out.

We recorded all subjects during the test. We can test the credibility of on-site scoring and find potential injuries in the subject's body. This provides material and a basis for subsequent targeted training.

Description of fitness test problem

Suppose there is an m physical fitness test item. The test order of each item can be arbitrary. There are $n_i(i = 1, 2, \cdots, m)$ sets of electronic equipment for the physical fitness test in item $i(i = 1, 2, \cdots, m)$. At most $k_i(i = 1, 2, \cdots, m)$ people can test at the same time on an instrument. Existing individual N will perform the physical fitness test.[4] The time $d_{ij}(i = 1, 2, \cdots, m; j = 1, 2, \cdots, N)$ required for each person to complete the $i(i = 1, 2, \cdots, m)$ test item. How to arrange for all individuals to complete all test items in the shortest time?

The physical fitness test problem can be described by a diagram: the vertex set $V = \{i = 1, 2, \cdots, m\}$ represents the physical fitness test item. Each vertex i has $n_i(i = 1, 2, \cdots, m)$ sub-vertices. Each sub-vertex can be included in $k_i(i = 1, 2, \cdots, m)$ paths at the same time. There are $m(m - 1)$ N arcs in the arc set A. The weight on each arc represents the time $d_{ij}(i = 1, 2, \cdots, m; j = 1, 2, \cdots, N)$ required for the j person to do the end item. The problem requires N loops including m sub-vertices.[5] This minimizes the sum of weights of each loop. The probability of ant k moving from vertex i to j at time t is

$$p_{ij}^{k}(t) = \begin{cases} \dfrac{[\tau_{ij}(t)]^{a}[\eta_{ij}]^{\beta}}{\sum\left[[\tau_{ij}(t)]^{a}[\eta_{ij}]^{\beta}\right]} & j \in allowed_k \\ 0, & j \notin allowed_k \end{cases} \quad (1)$$

When $\eta_{ij} > 0$ is the probability that the ant in the neighborhood i moves to the neighborhood j according to the probability p_{ij}. When $\eta_{ij} \leq 0$, the ants in the neighborhood i do a neighborhood search. Its search radius is r; α, β, which respectively represent the information and heuristic factors accumulated by the ants during the movement.[6] Assuming that the retention coefficient of pheromone is $\rho(0 < \rho < 1)$, it reflects the durability of pheromone strength. And $1 - \rho$ represents the degree of disappearance of pheromone. After Δt period, the ant completes a cycle, and the pheromone quantity refresh formula on each arc (i, j) is $\tau_{ij}(t + \Delta t = \rho\tau_{ij}(t) + \Delta t_{ij}(\Delta t)$. Among them, $\Delta\tau_{ij}(\Delta t) = \Sigma\,\Delta\tau^{k}_{ij}$. $\Delta\tau_{ij}(\Delta t)$ and $\Delta\tau^{k}_{ij}$ respectively represent the amount of pheromone left by all m ants and the k ant on arc (i, j) in this cycle Δt time. The calculation formula of $\Delta\tau^{k}_{ij}$ is

$$\Delta\tau_{ij}^{k} = \begin{cases} R / L_k, \\ 0, \end{cases} \quad (2)$$

In the formula, R is a constant. L_k represents the length of the road traveled by the k ant in this cycle. $L_k = \sum_{(i,j)\in tabu_k} d_{ij}$.

Mathematical Statistics

The data obtained in the experiment were analyzed using GraphPadPrism6.01 statistical software.[7] Comparison within the group was completed by paired-sample T-test. P<0.05 indicates that the difference is statistically significant.

RESULTS

Analysis of the results of functional action screening before training

It can be seen from Table 2 that the flexibility of the shoulder joint and the straight leg raising of the knee can show that the joint flexibility of the players is better. However, through overhead squats, push-ups, and rotation stability, it can be seen that the players' leg strength and core muscle strength are insufficient. Training in this area should be strengthened later.[8] It can be seen from the overall average score that the player's overall FMS value is less than 14 points. This shows that the players have a certain risk of sports injuries.

Analysis of the results of functional action screening after training

After training, the athlete's overall FMS level has improved (Table 3). This shows that two months of functional training can help improve the FMS level of middle school students.[9] Coaches can add some functional training in the later physical training.

Table 1. Basic information of football players participating in the FMS test.

Name	Age	Gender	Height	Whether there is damage
A	23	male	160	no
B	23	male	163	no
C	24	male	163	no
D	23	male	170	no
E	24	male	175	no
F	24	male	173	no
G	22	male	158	no
H	22	male	158	no
I	23	male	160	no
J	25	male	178	no
K	25	male	175	no

Comparative analysis of FMS test indicators before and after the test

From Table 4, we can see that the average score of the seven items of functional action screening before and after the experiment increased from 13 points to 14.77 points. The P value is less than 0.01. If the P value is less than 0.05 after the T-test on the index, it means that the index has a significant difference. If the index is greater than 0.05, there is no significant difference in the index. There is a significant difference between the FMS scores of the players before and after the experiment.[10] This shows that functional training can effectively improve the FMS level of middle school football team players.

DISCUSSION

The highest overall FMS score is 21 points, and 14 is a passing score. Subjects with a score below 14 are at risk of sports injury. The failing rate increased to 14.77 points and exceeded the passing line, and the P value was less than 0.05, which shows that the test results before and after had significant differences. It shows that through the practical training intervention for 8 weeks, two days a week, the students' FMS level has been significantly improved. This is mainly reflected in the improvement of the overall FMS score. Compared with traditional training methods, functional training can reduce sports injuries of players during sports and pay attention to the improvement of athletes' functional capabilities.

According to the above description, the application of functional training to the football training of middle school students has a significant effect, and the school can add some functional training to the later physical training.

Table 2. The scores of each FMS action mode of the subjects before training (N=11).

	Name	A	B	C	D	E	F	G	H	I	J	K	Mean
Squat		2	1	3	1	2	1	1	2	1	1	2	1.6
Hurdle step	L	2	2	2	2	2	1	2	2	2	2	2	1.9
	R	2	2	2	2	2	1	2	2	2	2	2	1.9
Lunge squat	L	2	1	1	2	2	2	2	3	2	1	2	1.8
	R	2	1	1	2	2	2	2	3	2	3	2	2
Shoulder flexibility	L	3	3	3	3	3	3	3	1	1	3	3	2.6
	R	3	3	2	3	3	2	3	1	1	3	3	2.5
Straight knee lift	L	1	3	1	1	2	3	2	2	2	1	1	1.7
	R	2	3	1	1	2	3	2	2	2	1	1	1.8
Push ups		2	2	1	1	2	1	2	2	2	1	2	1.6
Stable rotation	L	2	1	2	2	2	2	2	2	2	1	2	1.8
	R	2	1	2	2	2	2	2	2	2	1	2	1.8

Table 3. The scores of each FMS action mode of the subjects after training (N=11).

	Name	A	B	C	D	E	F	G	H	I	J	K	Mean
Squat		2	2	3	2	2	2	2	2	2	2	3	2.2
Hurdle step	L	2	2	2	2	2	2	2	2	2	2	2	2
	R	2	2	2	2	2	2	2	2	2	2	2	2
Lunge squat	L	2	1	2	2	2	2	2	3	2	2	2	2
	R	2	1	2	3	2	2	2	3	2	3	2	2
Shoulder flexibility	L	3	3	3	3	3	3	3	2	2	3	3	2.8
	R	3	3	2	3	3	2	3	2	2	3	3	2.6
Straight knee lift	L	2	3	2	1	3	3	2	2	2	1	2	2.1
	R	3	3	2	1	3	3	2	2	2	1	2	2.2
Push ups		2	2	1	1	2	2	2	2	2	2	2	1.8
Stable rotation	L	2	1	2	2	2	2	2	2	2	1	2	1.8
	R	2	1	2	2	2	2	2	2	2	1	2	1.8

Table 4. Analysis of FMS scores before and after the experiment.

	Before the experiment	After the experiment
FMS score	13.00±0.44	14.77±0.28

CONCLUSION

The results of functional action screening can analyze the physical problems of football players. Through targeted functional training, the FMS level of football players can be effectively improved. Through screening results and data analysis, it is found that functional training has significantly improved the sensitivity, coordination, flexibility, strength, and physical stability of middle school football players.

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

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