# THE THERAPEUTIC EFFECT OF SPORTS ON RELIEVING CHRONIC FATIGUE

*O EFEITO TERAPÊUTICO DOS ESPORTES NO ALÍVIO DA FADIGA CRÔNICA*

*EL EFECTO TERAPÉUTICO DE LOS DEPORTES PARA ALIVIAR LA FATIGA CRÓNICA*

**Original Article**
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## ABSTRACT

Introduction: Chronic fatigue syndrome (CFS) is a group of long-term fatigue; the rest is difficult to achieve. At the same time, it is accompanied by corresponding physical dysfunction and psychological and mental symptoms. It is very meaningful to find exercise countermeasures to cope with chronic fatigue syndrome actively. Object: This article analyzes the current students' CFS to realize the cognition of the disease. At the same time, it analyzes the effect of sports on the treatment of chronic fatigue to help students formulate related sports programs. Method: The article conducts a related questionnaire survey and analysis of students and analyzes CFS and exercise status symptoms. Results: Generally, students with CFS did not actively participate in sports and had poor physical fitness, especially muscle endurance and cardiopulmonary function. However, students who actively participate in sports training basically do not have CFS. Conclusion: CFS students should strengthen physical exercise and improve the CFS situation through exercise. ***Level of evidence II; Therapeutic studies - investigation of treatment results.***

**Keywords:** Fatigue Syndrome, Chronic; Physical Fitness; Sports.

## *RESUMO*

*Introdução: a síndrome da fadiga crônica (SFC) é um grupo de fadiga de longa duração; o descanso é difícil de conseguir. Ao mesmo tempo, é acompanhado por disfunção física correspondente e sintomas psicológicos e mentais. É muito significativo encontrar contramedidas de exercícios para lidar ativamente com a síndrome da fadiga crônica. Objetivo: este artigo analisa o CFS de alunos atuais para a compreensão da doença. Ao mesmo tempo, analisa o efeito dos esportes no tratamento da fadiga crônica para ajudar os alunos a formular programas esportivos relacionados. Método: o artigo conduz uma pesquisa de questionário relacionada e análise de alunos e analisa CFS e sintomas de status de exercício. Resultados: Geralmente, os alunos com SFC não participavam ativamente de esportes e apresentavam má aptidão física, principalmente resistência muscular e função cardiopulmonar. Por outro lado, os alunos que participam ativamente do treinamento esportivo basicamente não possuem CFS. Conclusão: os alunos do CFS devem fortalecer o exercício físico e melhorar a situação do CFS por meio do exercício.* ***Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.***

***Descritores:*** *Síndrome de Fadiga Crônica; Aptidão Física; Esportes.*

## *RESUMEN*

*Introducción: El síndrome de fatiga crónica (SFC) es un grupo de fatiga a largo plazo; el descanso es difícil de conseguir. Al mismo tiempo, se acompaña de la correspondiente disfunción física y síntomas psicológicos y mentales. Es muy significativo encontrar contramedidas de ejercicio para hacer frente activamente al síndrome de fatiga crónica. Objeto: Este artículo analiza el SFC de los estudiantes actuales para comprender la enfermedad. Al mismo tiempo, analiza el efecto del deporte en el tratamiento de la fatiga crónica para ayudar a los estudiantes a formular programas deportivos relacionados. Método: El artículo lleva a cabo un cuestionario relacionado y un análisis de los estudiantes y analiza los síntomas del SFC y el estado del ejercicio. Resultados: En general, los estudiantes con SFC no participaron activamente en deportes y tenían una mala condición física, especialmente la resistencia muscular y la función cardiopulmonar. Por otro lado, los estudiantes que participan activamente en el entrenamiento deportivo básicamente no tienen SFC. Conclusión: Los estudiantes de CFS deben fortalecer el ejercicio físico y mejorar la situación de CFS a través del ejercicio.* ***Nivel de evidencia II; Estudios terapéuticos: investigación de los resultados del tratamiento.***

***Descriptores:*** *Síndrome de Fatiga Crónica; Aptitud Física; Deportes.*



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## INTRODUCTION

Chronic fatigue syndrome (CFS) is a group of long-term conscious fatigue. Rest is difficult to alleviate and is accompanied by corresponding physical dysfunction and psychological and mental symptoms. Since 1988, the United States Centers for Disease Control (CDC) officially proposed chronic fatigue syndrome. We explored their physical fitness characteristics after illness and found exercise countermeasures to cope with chronic fatigue syndrome actively have become significant tasks.[1]

## METHOD

### Object selection

From a total of 1617 students in the second and third grades of a university, through fatigue questionnaire surveys and clinical diagnosis, we screened out 21 students who met the International Diagnostic Standards for Chronic Fatigue Syndrome established by the US Centers for Disease Control and Prevention in 1994. We randomly selected 21 students. Students whose gender and age are matched are used as healthy controls.

### Research tools

The diagnosis of chronic fatigue syndrome adopts the 1994 diagnostic criteria for chronic fatigue syndrome developed by the Centers for Disease Control and Prevention of the United States. We selected body mass index (BMI), softness, muscle strength-instantaneous explosive strength, Five indicators of muscular endurance and cardiorespiratory endurance were evaluated.[2] We used the subjective exertion rating (RPE) index for the self-perception of exercise.

### Research methods

(1) Screening for chronic fatigue syndrome. We used the Fatigue Self-Rating Scale (FS-14) to conduct a questionnaire survey of 1617 college students. The students with chronic fatigue found in the questionnaire were asked face-to-face to determine whether they were in line with the 1994 Comprehensive Chronic Fatigue in the United States. Symptom diagnostic criteria. (2) Investigation of physical fitness characteristics. We conducted various physical fitness tests on the students with chronic fatigue syndrome and healthy control group and self-assessed the degree of subjective exertion upon completing each test.

### Data processing

The mean ± standard deviation expresses the test data and related indexes. We use Microsoft Excel software to calculate. The physical fitness parameters of the exhausted and healthy students are compared with the subjective exertion degree. The measurement data uses the t-test, and the count data use X2. Test the correlation between physical fitness and fatigue degree adopts Pearson correlation analysis. P<0.05 means the difference is significant, P<0.01 means the difference is hugely significant.

## AUTOMATIC POSITIONING ALGORITHM FOR JOINT HUMAN POINTS

### Registration Algorithm

This paper uses an image registration algorithm based on gray-scale differences. This algorithm makes full use of the gradient information of the two images. Compared with the general search method, the calculation amount is much less, and the accuracy is higher.[3] Figure 1 shows the automatic positioning algorithm for human joints. Generally, the relationship between two images $F(X)$ and $G(X)$ with translation, rotation and various distortions and distortions relative to the same scene can be expressed as:

$$G(X) = T_F(AX + S) + U \quad (1)$$

Among them

$$A = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}, S = \begin{bmatrix} S_1 \\ S_2 \end{bmatrix}, X = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} \quad (2)$$

The coefficient matrix A represents the linear space transformation caused by rotation and scale changes. The coefficient matrix S represents the displacement. The matrix X represents the plane coordinate, T is the contrast adjustment coefficient, and U is the brightness adjustment coefficient.[4]

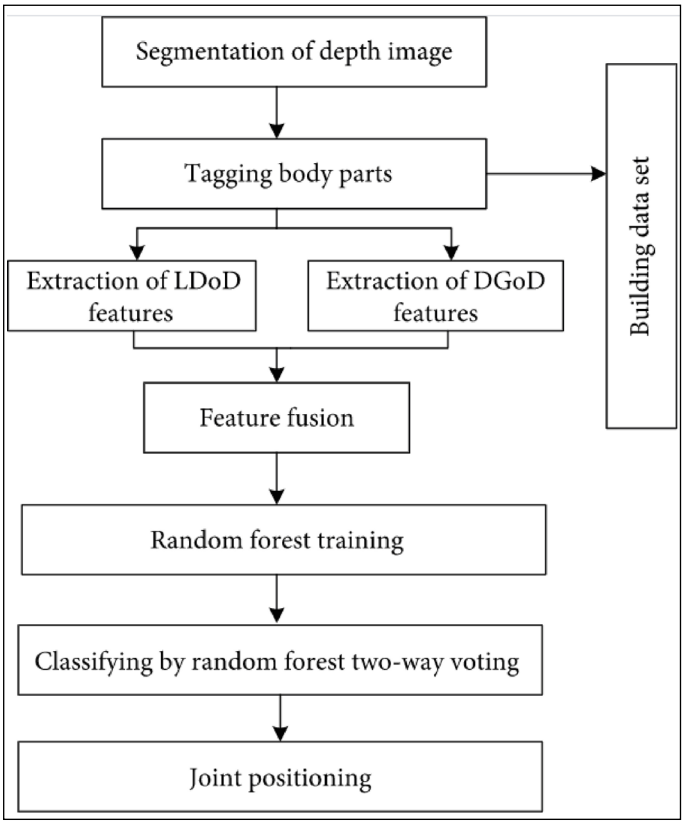


**Figure 1.** Algorithm flow of automatic positioning of joint human points.

$$E = \sum_{x \in R} [T_F(X+S) + U - G(X)]^2 \quad (3)$$

### Moving object detection algorithm

The detection of moving objects is based on the registered image, using a time-domain threshold algorithm, and taking the inter-frame contrast as a parameter. The interframe contrast is defined as:

$$FCON = | I(x, y, t) - I(x, y, t-1) | \quad (4)$$

Among them, $I(x, y, t)$ represents the gray pixel value of the current frame $(x, y)$ and $I(x, y, t-1)$ represents the gray pixel value of the previous frame at the point $(x, y)$. Therefore, the inter-frame contrast describes the continuity of the gray level of different frames at the same position in the time direction.[5] If the contrast between frames is level N, then every pixel in the current frame corresponds to a parameter F. Let $f_i$ be the number of pixels in the image whose interframe contrast is i, and $P_i$ is the probability of occurrence of parameter i.

$$P_i = \frac{f_i}{H^* H} \quad (5)$$

Among them $H^* H$ is the size of the image (that is, the number of pixels), so the distribution probability corresponding to the static background and moving objects can be defined as:

$$P_{B_i}(F) = \frac{f_i}{\sum_{n=0}^{F} f_n} \quad (6)$$

$$P_{M_i}(F) = \frac{f_i}{\sum_{n=F+1}^{N-1} f_n} \quad (7)$$

Therefore, the entropy corresponding to the two regions can be defined as:

$$H_B(F) = -\sum_{i=0}^{F} P_{B_i}(F) \log P_{B_i}(F) \quad (8)$$

$$H_M(F) = -\sum_{i=F+1}^{N-1} P_{M_i}(F) \log P_{M_i}(F) \quad (9)$$

## RESULTS

### Chronic fatigue syndrome screening

Among the 1617 college students, 715 are males, and 901 are females. The average age is 20.17±5.17 years. After a questionnaire survey, 322 students with chronic fatigue were found, accounting for 19.91% of the total.

### Physical fitness test results

We took 21 students with chronic fatigue syndrome as the observation group and 21 healthy students who were randomly matched by gender and age as the health group. All students completed the five items of the physical fitness test within one week. (Table 1)

It can be seen from the above table that there is no significant difference between the chronic fatigue syndrome students and healthy students in the softness (sitting forward bending) and muscle strength-instant power (one-hand grip) of the male and female students. In contrast, the muscle endurance (sit-ups)), cardiorespiratory endurance (1000m for boys and 800m for girls), and body mass index (BMI) are significantly different.[6]

### The relationship between physical fitness and fatigue degree of college students with chronic fatigue syndrome

We analyze the correlation between the results of various physical fitness tests and the fatigue self-rating scale (FS-14) scores of college students with chronic fatigue syndrome, and we can find that physical fitness is negatively correlated with physical fatigue.[7] The more physical fitness is the higher the degree of poor fatigue. The correlation with mental fatigue is not significant. Only the BMI index is related to physical fatigue and mental fatigue.[8] The higher the index, the heavier the fatigue. (Table 2)

**Table 1.** Physical fitness test results.

| | Boys (n=9) | | |
|---|---|---|---|
| | **Observation group** | **Healthy group** | **P** |
| Sitting forward bending/cm | 11.91±5.2 | 12.13±7.2 | P≥0.05 |
| Grip strength/N | 62.67±5.6 | 63±4.1 | P≥0.05 |
| Sit-ups/T·M$^{-1}$ | 30.11±2.1 | 32.24±5.4 | P<0.05 |
| Middle distance running/s | 237.2 ± 21.9 | 226.8 ± 22.4 | P<0.05 |
| BMI | 23.54±6.7 | 21.78±3.13 | P<0.05 |
| | **Girls (n = 11)** | | |
| | **Observation group** | **Healthy group** | **P** |
| Sitting forward bending/cm | 13.55±1.7 | 13.62±3.2 | P≥0.05 |
| Grip strength/N | 45±4.7 | 46±5.0 | P≥0.05 |
| Sit-ups/T·M$^{-1}$ | 27.12±4.3 | 30.72±4.7 | P<0.05 |
| Middle distance running/s | 235.7±17.8 | 216±15.44 | P<0.05 |
| BMI | 21.65±9.11 | 19.17 ± 2.18 | P<0.05 |

### Test results of subjective exertion

After informing the students of the subjective estimation method of subjective exertion (RPE) in detail, 10 minutes after the end of each exercise, they are asked to self-evaluate and record their subjective exertion at this time. There is no significant difference between single-handed grip strength and endurance, cardiopulmonary ability-related items for both boys and girls, as shown in Table 3.

**Table 2.** The relationship between physical fitness and fatigue level of college students with chronic fatigue syndrome.

| | Physical fatigue | | Mental fatigue | |
|---|---|---|---|---|
| | **r** | **p** | **r** | **p** |
| Sitting forward bending | -0.495 | <0.05 | -0.215 | >0.05 |
| One-handed grip | -0.512 | <0.05 | -0.14 | >0.05 |
| Sit-ups | -0.69 | <0.05 | 0.211 | >0.05 |
| Middle distance running | -0.849 | <0.05 | -0.461 | >0.05 |
| BMI | 0.677 | <0.05 | 0.578 | <0.05 |

**Table 3.** Evaluation results of subjective exertion (RPE).

| | Boys (n=9) | | |
|---|---|---|---|
| | **Observation group** | **Healthy group** | **P** |
| Sitting forward bending/cm | 10.41±3.4 | 10.11±5.6 | P≥0.05 |
| Grip strength/N | 10.17±8.1 | 9.71±2.2 | P≥0.05 |
| Sit-ups/T·M$^{-1}$ | 17.81±6.4 | 16.21±1.4 | P<0.05 |
| Middle distance running/s | 18.97±1.4 | 18.31±7.4 | P<0.05 |
| | **Girls (n = 11)** | | |
| | **Observation group** | **Healthy group** | **P** |
| Sitting forward bending/cm | 10.81±6.7 | 10.55±2.5 | P≥0.05 |
| Grip strength/N | 10.11±4.8 | 10.14±3.7 | P≥0.05 |
| Sit-ups/T·M$^{-1}$ | 17.97±7.1 | 17.11±2.4 | P<0.05 |
| Middle distance running/s | 18.66±4.3 | 18.20±1.7 | P<0.05 |

## DISCUSSION

Fatigue is a subjective feeling of physical or mental discomfort that makes people feel a lack of energy to continue working or living. Any fatigue that lasts or recurs for more than six months is called chronic fatigue. The remaining chronic fatigue that is difficult to explain belongs to the category of idiopathic chronic fatigue. Because there are many diseases and neurosis, patients may have fatigue as the main complaint, so they must be carefully identified and ruled out at the time of diagnosis.[9]

The incidence of chronic fatigue syndrome found in this survey is 1.3%. There is no significant difference between male and female students; this result is consistent with the literature of 1324 middle school students in Harbin. The survey results have a particular difference in the incidence rate among girls than among boys, which may be related to the survey subjects' different age groups.

Although chronic fatigue syndrome may have multiple causes such as viral infection, physiological changes, psychological effects, genetic factors, etc., it generally exhibits a tolerance threshold for fatigue due to various organs' low ability to coordinate operations. It can be inferred that college students with chronic fatigue syndrome may consume too much neurotransmitter due to various reasons, such as excessive mental activity, which makes the signal transmission between various body organs impaired, resulting in the inability to coordinate the functional activities of the various organs.

Healthy physical fitness refers to the body's ability to maintain its health, keep happily completing daily tasks, and reduce chronic diseases. Indicators to measure healthy physical fitness include aerobic capacity, muscle strength, flexibility, body fat composition and neuromuscular relaxation degree.

In the study of chronic fatigue syndrome, the investigations on patients' etiology and cognitive and psychological changes are concentrated, and there are few studies on physical strength and physical fitness. This study suggests the characteristics of physical fitness changes in patients with chronic fatigue syndrome., Found that the degree of fatigue of college students with chronic fatigue syndrome is closely related to their physical fitness, which provides a basis and possible ways to improve chronic fatigue through exercise.

As chronic fatigue syndrome students have low fatigue tolerance and poor muscle endurance, they will aggravate fatigue symptoms after heavy exercise. Therefore, the exercise intensity should be mainly at medium and low levels and dynamically adjusted according to the individual's specific situation. We can use the British "ladder exercise therapy" for therapeutic exercise. Patients with chronic fatigue syndrome have circadian rhythm disorders, so pay attention to adjusting the circadian rhythm when exercising and exercise regularly and quantitatively every day to avoid chaos. The exercise time should not be too long each time, as it does not cause evident fatigue. The choice of exercise method should be determined according to personal preference. As patients with chronic fatigue syndrome have more mental fatigue, exercise should choose more to increase endurance and cardiorespiratory capacity. The content, avoid some sports that are too tense, too antagonistic, and complicated in movements that may aggravate mental fatigue.

For most patients with chronic fatigue syndrome, the first choice is to rest when they feel tired. This makes the body's operation slower and slower, and the coordination between the body's various organs is getting worse and worse. Feeling more and more powerless during physical exertion and falling into a "wacky circle" of more rest and fatigue. Therefore, these patients must improve their fatigue state by applying treatments that improve the body's various organs' ability to work together. Although the current treatment of chronic fatigue syndrome is There are many methods, the curative effect is generally not good. Exercise has the effect of enhancing physical strength and improving psychology and has good functions in stimulating the expression of nerve factors, regulating the body's immune function, and adjusting the circadian rhythm. It is simple and easy to implement, safe and reliable, and has become the first choice for treating chronic fatigue syndrome.

## CONCLUSION

Chronic fatigue is widespread among college students (19.91%), of which 1.3% of the college students can be diagnosed with chronic fatigue syndrome, indicating that there are not a few chronic fatigue syndrome patients among college students because the disease is easily overlooked. Therefore, sufficient attention must be paid. The physical fitness changes of college students with chronic fatigue syndrome manifest in relatively low muscle endurance and cardiopulmonary ability, high subjective exertion during exercise, and low fatigue tolerance.

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

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