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The Influence of Sports APP on College Students' Physical Exercise and Mental Health Mechanism

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Abstract: At present, the social competition is fierce, and students are facing great pressure of study and employment, which will inevitably bring negative impact on students' mental strength and endanger students' physical and mental health. The frequent student suicides in recent years are evidence. These tragic cases remind us to strengthen students' psychological education and relieve students' learning pressure in time. Exercise is a good way to relieve stress and plays an irreplaceable role in students' psychological recovery. This paper aims to study the impact of sports APP on the mental health of college students, hoping to use good physical exercise to calm students' bad emotions. This paper proposes a physical exercise program for college students, relying on the sports APP to adjust the physical condition of the students, so as to realize the adjustment of the psychological state. The experimental results of this paper show that sports APP can adjust the mental health level of college students and reduce the incidence of negative emotions by 20%.

1. Introduction

Health is the cornerstone of life. Historical and cultural background has shaped the diversity of health views. The modern view of health attaches great importance to mental health. Teenagers bear great psychological pressure because of the intensification of social expectations, which affects their mental health. As a high-quality group, the health of college students is very important to their overall and national social progress. Health covers both physical and mental aspects. Physical exercise can comprehensively improve college students' physical and mental quality, adjust emotions and relieve psychological pressure. However, college students' sports level is generally insufficient, and efficient sports practice becomes a challenge. Sports App combines smart devices to accurately record sports data such as calorie consumption, running distance, etc., and stimulate exercise interest through reward mechanism. Innovate "internet plus" fitness to enhance sports participation and sex, and bring freshness and freshness to sports. Although this kind of App can promote physical exercise significantly, the research on its specific influence on mental health mechanism is still shallow. This paper discusses how sports App can promote college students' physical exercise and mental health, clarifies its positive role in mental health, and designs a

targeted sports plan to guide college students to use App to actively exercise, relieve bad emotions and restore good mental state through sports communication.

2. Related Work

Scholars at home and abroad have made remarkable achievements in the research of college students' mental health. Li Y pointed out that tennis can enhance college students' cardiopulmonary function and promote mental health, such as cultivating independent personality and eliminating depression tendency [1]. Kim found that physical identity plays an intermediary role between physical activity and mental health, and affects gender-specific moderate physical activity has a direct promotion effect on mental health [2]. Wang M proved through intervention experiments that exercise intervention significantly improved the anxiety symptoms of college students and improved their mental health level [3]. Mehrad A studied the relationship between stress, physical activity and mental health of athletes, and pointed out that they have double effects on mental health [4]. Panchal found that aerobic exercise and strength training can significantly alleviate depression and anxiety in the elderly and adolescents, but exercise should be avoided [5]. Silva F C compared the effects of different physical activities on patients with type 2 diabetes, emphasizing the positive role of aerobic exercise in improving life and mental health. Resistance exercise is also of great significance to mental health [6].

3. The Principle of Motion Recognition and the Introduction of the Mental Health Mechanism of College Students

3.1. Principle of Motion Recognition

Motion describes the dynamic state of the human body, including direction and displacement. Motion recognition can be divided into two categories: static and dynamic, and can be further refined into the recognition of different body parts such as the head, trunk, upper limbs, and lower limbs. There are two strategies in recognition based on action sequence: template-based and statistical probability-based [7]. As shown in Figure 1.

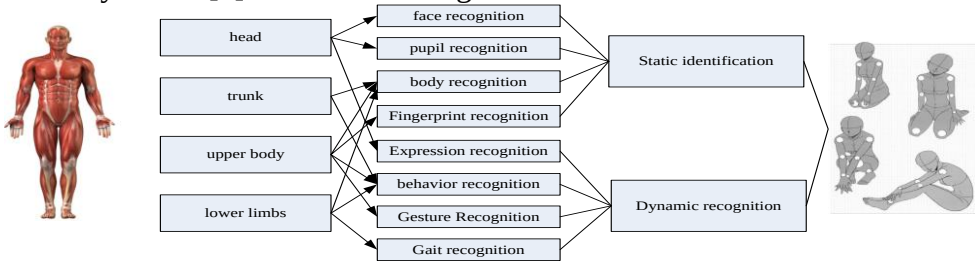

Figure 1: Body movements and recognition classification

Suppose there are two time series P and Q of length a and b, whose values are the eigenvalues of each frame, expressed as:

$$P = p_1, p_2, ..., p_a \tag{1}$$

$$Q = q_1, q_2, ..., q_b \tag{2}$$

Construct the distance matrix E, the length is $a \times b$, the distance between the template elements p_m and q_n is the matrix element E(m,n), and the Euclidean distance $d(a,b) = (p_a - q_b)^2$ [8] is used, that is, the similarity of each frame sequence.

$$E=\begin{bmatrix} d(p_1,q_1) & d(p_1,q_2) & \cdots & d(p_1,q_b) \\ d(p_2,q_1) & d(p_2,q_2) & \cdots & d(p_2,q_b) \\ \vdots & \vdots & \ddots & \vdots \\ d(p_a,q_1) & d(p_a,q_2) & \cdots & d(p_a,q_b) \end{bmatrix} \tag{3}$$

The process of dynamic regularization is to find a path of multiple points in the distance matrix, so that the Euclidean distance of the sequence points passing through the path is the smallest and the similarity is the highest [9]. Define a regular alignment as L, where x elements $L_x=(m,n)$ represent the mapping between sequences P and Q:

$$L=\{l_1,l_2,...,l_x\}, \max(a,b)\le x\le a+b-1 \tag{4}$$

Under the constraints, the path with the least cost is selected from among many dynamic regularization routes:

$$DTL=\min\left\{\frac{\sqrt{\sum_{x=1}^{X} l_x}}{X}\right\} \tag{5}$$

The method based on statistical probability splits the dynamic sequence information into individual static states and transforms them into state nodes. Express it in the form of a certain probability, calculate the corresponding joint probability, and the maximum value is the expected classification result. Commonly used statistical probability methods include Hidden Markov Model (HMM), Dynamic Bayesian Network (DBN), Support Vector Machine (SVM), etc. [10].

(1) Human behavior recognition process

Generally speaking, the human behavior classification and recognition process mainly has five stages. They are: data collection, data analysis and preprocessing, action segment cutting, feature attribute extraction, and identification and classification [11], as shown in Figure 2:

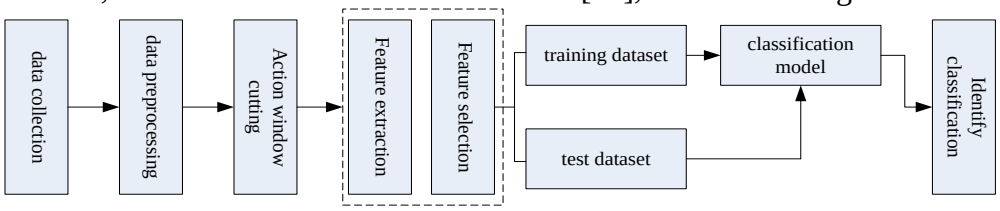

Figure 2: Flow chart of human behavior recognition

(2) Data preprocessing

The collected human motion data often contain interference and zero drift. Preprocessing aims to eliminate noise. Restoration involves digital filtering and normalization [12]. Normalization aims at unifying sample distribution.

(3) Feature extraction classification

In pattern recognition, the sample data cannot be directly input into the classifier for action classification, because the length of the sample data is too long and the data dimension is too high. Therefore, it is necessary to construct the feature space through the related algorithm of feature generation, and input the features of limited dimension into the classifier for action classification and recognition [13].

(1) Feature Generation

Feature space generates diversity in time domain and frequency domain. Time domain features such as mean skewness and frequency domain features such as cepstrum parameters [14]. Sensor coordinates change with posture in human motion. In order to simplify the calculation, the acceleration amplitude S (T) is defined to reflect the non-simple linear relationship of motion intensity, which can be extracted as an eigenvalue.

$$S(\mathrm{t}) = \sqrt{z_{x,t}^2 + z_{y,t}^2 + z_{z,t}^2} \tag{6}$$

(2) Feature extraction

Feature extraction is divided into quadratic features in time domain and frequency domain by mapping the dimension of feature space. FFT transform transforms time domain to frequency domain for feature recognition.The Fourier transform Formula is as follows:

$$F(\theta) = \int w(t)\exp(-k\theta t)dt \tag{7}$$

The corresponding obtained Fourier function matrix is:

$$V_{kk} = f(\theta_k) * f(\theta_k) \tag{8}$$

$\max\{V_{kk}\}$ is used as a feature, as shown in the figure for the V matrix diagonal data plot. The energy spectrum obtained by the Fourier transform is symmetrically distributed. After obtaining the energy spectrum data, the maximum value in the energy spectrum value is used as a feature. Figure 3 is a graph of the maximum energy spectrum with 100 as a processing unit.

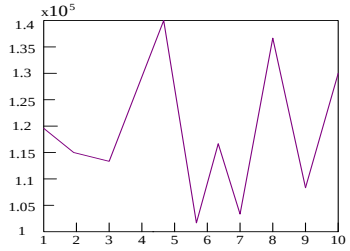

Figure 3: Schematic diagram of energy spectrum

Support vector machine (SVM) is a classical statistical learning method for two-class classification. It pursues the maximum classification interval by segmenting data with a hyperplane to improve classification accuracy. SVM solves the optimal convex quadratic programming problem for linearly separable data directly, while for nonlinear problems, it introduces a soft boundary and kernel function. SVM is widely used in the fields of text recognition, classification, and finance due to its strong statistical learning background and high efficiency [15].

(3) The introduction of the kernel function

When the dataset is linearly inseparable, it cannot be classified according to the previous method. The classification of nonlinearly separable datasets requires the introduction of the concept of kernel function, that is, the nonlinear classification problem is transformed into a linear classification problem, and then the classification is performed by the linearly separable method. The idea of the kernel function is to match the input space to a feature space through nonlinear changes. The hypersurface of the input space corresponds to the hyperplane of the feature space, so that once converted to a hyperplane, the hyperplane can be classified as previously described for linearly separable datasets [16].

There is a mapping relationship $\varphi(x): \omega \to G$

If the function satisfies $H(x,y)=\varphi(x)\cdot\varphi(y)$, then $H(x,y)$ is called a kernel function.

When different kernel functions are selected, the mapped feature spaces are different. Therefore, the obtained classification results may also be different, and the validity of the selected kernel function can be verified through experiments.

Commonly used kernel functions are:

1) Polynomial kernel function;

$$H(x,y)=(x\cdot y+1)^q \tag{9}$$

2) Radial basis kernel function (RBF);

$$H(x,y)=\exp\left(-\frac{x-y^2}{2\beta^2}\right) \tag{10}$$

3.2. Sports Apps and Physical Exercise

The exercise app is an auxiliary tool for physical exercise, which is suitable for smartphones and tablet computers. Its functions are divided into three categories [17]: First, fitness teaching covers data recording, movement line marking, body index measurement, video teaching, and personalized exercise plans; Second, information provision includes science guidance, health knowledge, weight loss suggestions, and event news pushes; Third, social interaction supports sports sharing, evaluation, and messaging, promotes communication and learning among users, and helps cultivate and improve sports habits. Physical exercise aims to improve physical fitness and posture, which can be carried out individually or collectively [18]. It is both challenging and relaxing to enjoy sports, as shown in Figure 4.

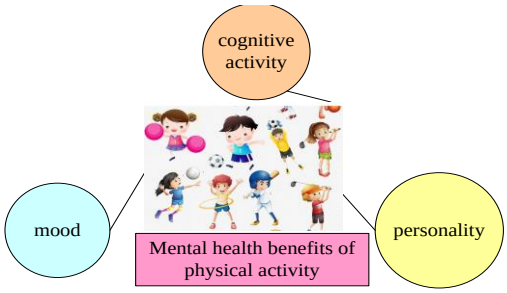

Figure 4: Mental health benefits of physical exercise

3.3. Mental Health of College Students

Psychology is a discipline that studies psychological changes and aims to achieve mental health. This field combines medical sociology and psychology. [19] Mental health in China covers mental health status and harmonious coexistence with society. Good mental health is conducive to preventing psychological harm from problem behaviors and promotes personal positivity.

4. Experiment and Analysis on the Influence of Sports APP on College Students' Physical Exercise and Mental Health

4.1. Experimental Subjects

Randomly selected 200 first-year students of non-physical education majors from normal schools to participate in the experiment. The average age of the experimental subjects was 18 years old, 100

males and 100 females participated in the experiment.

4.2. Physical Activity and Mental Health Research Methods

Based on the Internet database, this paper searches the data of college students' physical exercise habits, mental health, and sports application, and refers to the monographs of sports psychology. Collect first-hand information through field observation and interviews with psychologists, professors, teachers, and students. Design, and distribute, mental health questionnaires to college students to collect their psychological feelings. SPSS11 software was used to process the experimental data, and t-test and single factor variance were used to explore the influence of different sports on mental health.

4.3. Experimental Method

Questionnaire 1 investigates the habits of grade three, including gender, age, exercise and length. Questionnaire 2 used SCL-90 scale [20] to evaluate mental health. The experiment was divided into two groups: male and female. One group participated in exercise through sports App, and the other group was the control group. The research focuses on the changes of college students' psychological state before and after the experiment.

4.4. Data Analysis

The exercise population is an important indicator for assessing physical activity, including the number of weekly workouts, the duration of exercise, and the intensity of each exercise. The criteria for the sports population are that the frequency of physical exercise is ≥3 times/week, the time is ≥30 minutes/time, and the exercise load meets the conditions of self-adaptation and adaptation to sports events and is higher than or equal to the average level. The survey results of 200 undergraduates in Normal University are shown in Table 1.

Table 1: Statistics of sports population

exercise situation		number	rate
Exercise frequency	≥3 times a week	78	39%
exercise time	Each time ≥30min	102	49%
exercise intensity	I feel very tired, I think the exercise intensity is high	146	73%
sports population		52	26%

It can be seen from Table 1 that the physical exercise situation of college students is not optimistic. The sports population accounts for 26%, about a quarter of the total population. The frequency and time of physical exercise are not high, most of which are about 50%, indicating that college students' physical exercise is difficult to sustain. But when asked about the intensity of physical exercise, 73% of college students believe that their exercise intensity is high. It shows that many students do not have a clear understanding of their sports status. This also suggests that college students do not pay much attention to physical exercise and lack of awareness of health.

Table 2 shows that the mental health status of normal students is not optimistic compared with the national standard. The average scores of the four factors of somatization, interpersonal sensitivity, depression and paranoia were all lower than the national standard. Obsessive-compulsive symptoms, anxiety, hostility, phobia, and psychosis indicators were obvious, and the average value was higher than the national standard. The mean values of individual factors

vary widely, such as anxiety, hostility, and fear, etc., with a mean difference of 0.05. Except for anxiety, fear, paranoia, mental illness and other factors, which were statistically significant at $p<0.05$, other factors had no statistical significance at $p>0.05$. But overall, the mental health level of normal students needs to be improved.

Table 2: Comparison between the mental health level of normal students and the national norm (before intervention)

factor	National norm	normal student	$\|U\|$	P
somatization	1.34 ± 0.45	1.30 ± 0.43	3.812	0.051
Obsessive-compulsive symptoms	1.69 ± 0.61	1.70 ± 0.46	0.588	0.283
interpersonal sensitivity	1.76 ± 0.67	1.72 ± 0.51	3.213	0.065
depression	1.57 ± 0.61	1.52 ± 0.12	2.411	0.082
anxiety	1.42 ± 0.43	1.47 ± 0.56	4.947	0.035
hostility	1.50 ± 0.57	1.55 ± 0.41	3.736	0.060
fear	1.33 ± 0.47	1.38 ± 0.27	4.732	0.044
paranoid	1.52 ± 0.60	1.43 ± 0.11	4.821	0.043
psychotic	1.36 ± 0.47	1.42 ± 0.33	4.609	0.041

Table 3: Comparison of SCL-90 symptom self-assessment scores of male and female college students

factor	male college student	female college student	$\|t\|$	P
somatization	1.30 ± 0.26	1.28 ± 0.43	0.127	0.933
Obsessive-compulsive symptoms	1.67 ± 0.33	1.72 ± 0.28	0.565	0.591
interpersonal sensitivity	1.63 ± 0.21	1.76 ± 0.16	2.145	0.018
depression	1.52 ± 0.37	1.57 ± 0.15	0.653	0.621
anxiety	1.47 ± 0.24	1.53 ± 0.13	0.648	0.453
hostility	1.53 ± 0.41	1.58 ± 0.26	1.123	0.107
fear	1.58 ± 0.19	1.45 ± 0.34	2.011	0.033
paranoid	1.46 ± 0.31	1.36 ± 0.18	0.175	0.356
psychotic	1.34 ± 0.16	1.52 ± 0.30	3.178	0.035
other	1.45 ± 0.41	1.46 ± 0.26	0.113	0.627

Table 3 shows that the mental health status of male college students is better than that of female college students. Overall, male college students have better interpersonal relationships than female college students. Obsessive-compulsive symptoms, hostility, anxiety, depression and psychosis indicators were better than female college students. Male college students have higher symptoms of fear and paranoia. The possible reason is that some male and female college students have psychological problems due to stimulation caused by an event, and more depression, hostility and psychotic symptoms. Most of them do not cooperate with the treatment and psychological counseling of psychiatrists. If it goes on like this, it will become neurotic and become a person who harms himself, kills himself and endangers the society. All other factors were not statistically significant except for interpersonal sensitivity, phobias, and psychosis $p < 0.05$.

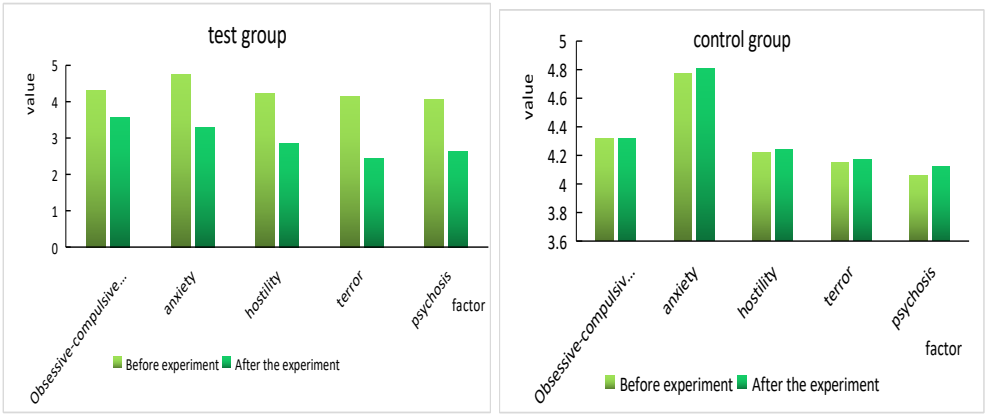

Figure 5: Comparison of the psychological state of students before and after the experiment

It can be seen from Figure 5 that before and after the experiment, the adverse psychological state index of the experimental group decreased significantly, and the students' psychology reached a normal state. The overall situation of mental health shows that exercise can effectively relieve negative emotions. Especially for fear and hostility, exercise can dispel fear, amplify joy, unite teammates, and reduce hostility. The control group did not control, and the psychological state indicators of the students deteriorated, suggesting that early intervention should be given to the students' negative emotions, otherwise it will threaten the students' physical and mental health.

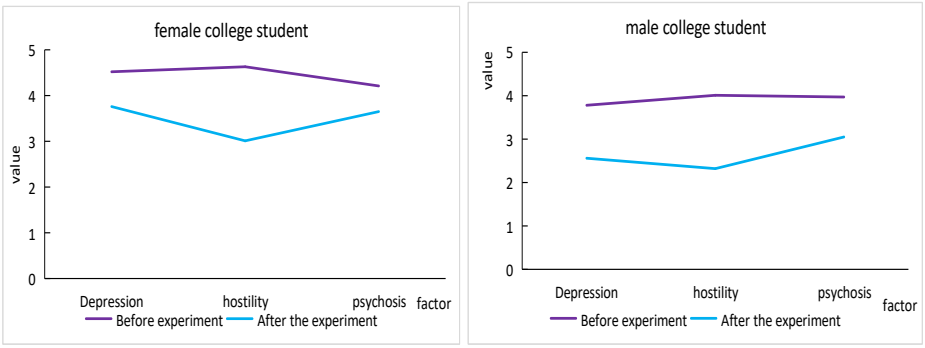

Figure 6: Comparison of psychological states of male and female college students before and after the experiment

It can be seen from Figure 6 that the psychological state of men and women is compared horizontally, and the psychological state of boys is better than that of girls. And with the increase of exercise, boys can relieve their negative emotions faster than girls, and it is easier to achieve a good mental state recovery. The possible reason is that boys are bold and unrestrained, and don't take everything to heart, so their bad emotions are released faster. Girls, on the other hand, are delicate and thoughtful, and they naturally increase their negative emotions.

As can be seen from Figure 7, most of the sports are suitable for men and women, but in general, boys have high exercise intensity and are more suitable for confrontational and physical sports. No other exercise performs as well as flexible yoga for men's exercise. Although girls can also accept most sports, in general, light sports such as long-distance running, yoga, aerobics, and badminton are more suitable for girls. In terms of exercise frequency, boys can accept higher-intensity exercise, once a day or five times a week is a good choice. For girls, the amount of exercise can be smaller, five or three times a week is a good choice. However, it is not recommended to exercise three times a month. This kind of exercise is too small and the exercise effect is not good.

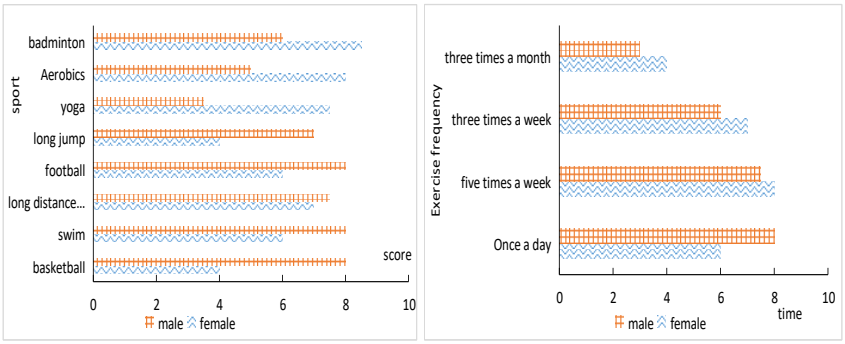

Figure 7: Comparison of sports events and sports frequency for men and women

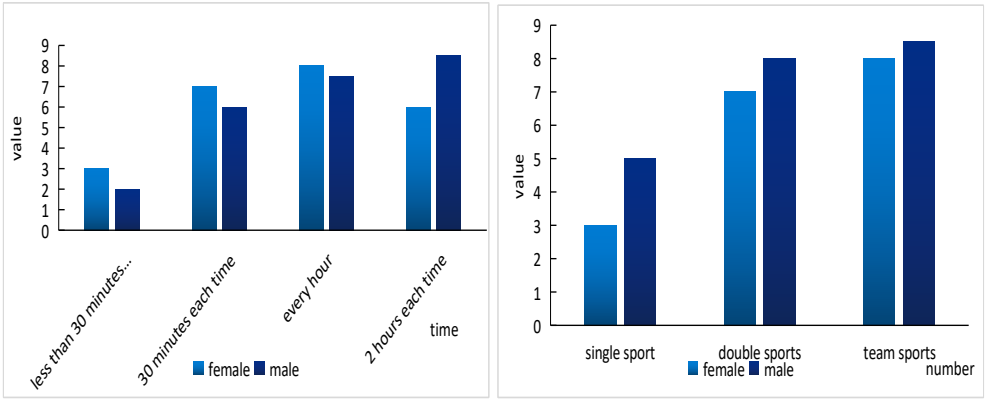

Figure 8: Comparison of sports time and number of men and women

From Figure 8, it can be seen that the exercise time is less than 30 minutes, regardless of men and women, the exercise effect is not good. The most suitable exercise time is at least 30 minutes. It is best for girls to take 1 hour each time, and the best for boys to take 2 hours each time. Moreover, compared with single-player sports, the exercise effect of accompanied sports is better. This may be because accompanied by people to meet people's safety needs, and there is a competitive effect, so the overall effect is better.

5. Discussion

In the experimental part, we verified the effect of sports APP on the mental health of normal college students. Experiments have shown that sports APP can improve the psychological status of college students by guiding exercise, eliminate negative emotions, and restore a healthy psychological state. And the exercise validity of men and women is better than that of women, and the recovery of mental state is faster. Further investigation of the optimal exercise factors, we found that there are also differences in sports between men and women, boys are more suitable for rigid sports, and girls are more suitable for flexible sports. For male and female college students, the frequency of exercise is not less than three times a week, and each time is 1 hour to achieve good exercise effect. And it is better to exercise with someone than to exercise alone. For other influencing factors of sports APP, further experimental verification is needed.

6. Conclusions

This paper studies the effect of sports APP on the mechanism of physical exercise and mental health of college students. This paper first introduces the principle of exercise recognition and the impact of exercise on mental health in detail, and then designs an experiment to verify the impact of

college students' experimental exercise APP on mental health. Experiments have shown that exercise can optimize students' psychological state, and exercise APP can guide exercise. In addition, this article aims to formulate a personalized exercise program to help students exercise reasonably. But the article also has some shortcomings: although physical exercise can promote the mental health of college students, it cannot completely avoid the occurrence of mental diseases. Some sports apps are not fully functional and cannot provide full-cycle exercise suggestions. The test time of some sports is too short, and sometimes it is impossible to measure the test indicators scientifically. Mental health monitoring should be a long-term test, and the two sets of data before and after may not be representative.

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