

Research on the Correlation between Changes in College Students' Physical Exercise Behavior and Physical Health Level under the Background of "Double Reduction"

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ABSTRACT The "Double Reduction" policy has influenced students' health awareness and physical exercise habits, while also increasing the practical need for wireless wearable monitoring, body-worn antenna sensing, and data-supported exercise management in campus sports environments. This study takes 2,400 college students from six types of universities nationwide as research objects. It systematically examines changes in physical exercise behavior, including exercise frequency, duration, and motivation, under the background of "Double Reduction," and analyzes the correlation between these behavioral changes and physical health levels measured by body shape, physiological function, and physical fitness. The results show that students who experienced the policy during basic education maintained and further developed exercise habits after entering college, with overall exercise frequency and duration showing an upward trend. However, there is no direct evidence that the policy reduced the academic burden of college students or increased their disposable after-school time. Changes in physical exercise behavior are significantly and positively correlated with physical health level, among which exercise frequency and effective exercise duration have the strongest predictive effects. The findings provide a theoretical basis for universities to optimize physical education resources and formulate targeted interventions, and they also offer evidence for the rational deployment of electromagnetic-compatible wearable sensing systems in student exercise monitoring.

INDEX TERMS double reduction, physical exercise behavior, physical health, body-worn antenna, wireless monitoring

I. INTRODUCTION

A. RESEARCH BACKGROUND

The "Double Reduction" policy is an educational policy implemented by China's education authorities in 2021, whose core essence is to reduce the burden on primary and secondary school students and reduce family education expenditures[1]. Guided by the idea of building a high-quality education system and taking the implementation of moral education as the fundamental task, the "Double Reduction" policy proposes a number of specific measures such as "optimizing homework quality and reducing total homework volume", "improving the level of education and teaching", "regulating and governing off-campus training behaviors", and "carrying out after-school services for sports activities"[2, 3]. As a major educational reform, the "Double Reduction" policy fosters a healthier educational ecology and elevates the quality of school physical education, thereby driving a significant shift toward the widespread

use of functional school uniforms and protective equipment during teenagers' physical exercise. This policy-driven behavioral change encourages the integration of breathable, high-performance fabric technologies into daily campus life to ensure a safer and more comfortable environment for student sports activities[4]. It is worth noting that the impact of the "Double Reduction" policy is not limited to the basic education stage[5, 6]. On the one hand, students who have experienced "Double Reduction" education will have a sustained impact on their behavioral choices in college due to the physical exercise habits, health awareness, and lifestyle formed in the basic education stage; on the other hand, the transformation of educational concepts triggered by the "Double Reduction" policy has gradually penetrated into higher education, universities have further increased their attention to students' all-round development, and the status of physical education in talent training has become increasingly prominent. The physical health of college stu-

dents is an important public health indicator related to national health development and population quality improvement [7, 8]. Physical health level is often expressed by physical fitness test scores. At present, China mainly comprehensively evaluates students' physical health level from aspects such as strength, flexibility, endurance, and speed[9]. Studies have shown that an individual's physical health level is affected by physical exercise behavior and has a positive correlation with it[10]. At the same time, exercise motivation can affect an individual's physical exercise behavior; within a certain range, the higher the individual's exercise motivation score, the greater the possibility of the individual participating in and persisting in physical exercise[11]. Under the background of "Double Reduction", whether college students' physical exercise behavior has changed, and what kind of correlation exists between this change and physical health level, have become important issues that need to be in-depth studied.

B. RESEARCH STATUS

In 2019, the Ministry of Education, the General Administration of Sport of China and other ministries and commissions jointly carried out the 8th National Survey on Students' Physical Fitness and Health. Using a stratified cluster random sampling method, a total of 24 indicators including physical fitness, body shape, physiological function, and health status of primary and secondary school students and college students nationwide were investigated. Compared with 2004, the overall excellent and good rate of students' physical health in China has shown an upward trend, students' lung capacity level has been comprehensively improved, indicators such as height, weight, and chest circumference have continued to improve, the physical fitness of primary and secondary school students such as flexibility, speed, strength, and endurance has gradually improved, and the situation of students' malnutrition has also been improved to a certain extent. The survey also found a series of urgent problems such as students' decreased eyesight, increased obesity rate, decreased grip strength, and decreased physical health level of college students[12]. The academic community generally recognizes that the main factor affecting college students' physical health is insufficient exercise[13], while scholars have different opinions on other influencing factors. At present, the influencing factors with high recognition among Chinese scholars include: physical education curriculum settings, venues and facilities, lifestyle, gender and other sociological indicators[14]. Domestic and foreign studies on the influencing factors of college students' physical exercise behavior are relatively comprehensive, discussing from multiple perspectives. From the individual perspective, self-laziness, lack of venues, and gender are the main influencing factors, and family and friend social relationships can also have a certain impact on college students' exercise behavior[15-18]. College students not only have to face the pressure of academic studies and work, but also deal with interpersonal

relationships. Due to the particularity of their identity, the influencing factors of their physical exercise behavior are relatively complex. Existing studies believe that laziness, lack of venues, and excessive academic pressure are the main factors affecting college students' physical exercise behavior recognized by most scholars[19]. At present, the evaluation methods of college students' physical exercise behavior in China mainly come from two approaches: one is physical activity questionnaires; the other is physical exercise behavior questionnaires, such as the "Physical Activity Questionnaire" and the "College Students' After-school Physical Exercise Behavior Self-rating Scale"[20]. Existing studies have confirmed that physical fitness test scores positively influence exercise motivation, which is further amplified by the sensory feedback and physiological support provided by high-performance functional textiles. This synergy between performance metrics and the comfort of moisture-wicking, compression fabrics creates a positive promoting effect on sustained physical exercise behavior[21]. However, whether physical fitness test scores can affect college students' autonomous physical exercise behavior, and whether the "Double Reduction" policy has an impact on college students' physical exercise behavior, these studies are still in their infancy. Based on this, under the background of "Double Reduction", this study explores the changing characteristics of college students' physical exercise behavior and its correlation with physical health level, so as to make up for the gaps in existing research.

C. RESEARCH OBJECTS AND METHODS

1) Research Objects

This study adopts a multi-stage stratified sampling method, selecting college students from 6 different types of universities nationwide (comprehensive, science and engineering, liberal arts and history, sports, art, and medical) as the research objects.

2) Research Methods

- 1) Literature Review Method Through literature retrieval in databases such as CNKI, Baidu Scholar, and Web of Science, relevant literature is systematically sorted out and analyzed to understand relevant theoretical knowledge, including research status, hot issues, and existing deficiencies, so as to provide help for the research design and method application of this paper.
- 2) Questionnaire Survey Method Referring to relevant mature questionnaires at home and abroad, combined with the research purpose and content of this study, the "Questionnaire on College Students' Physical Exercise Behavior under the Background of 'Double Reduction'" is designed. The questionnaire mainly includes three parts:
 - The first part is basic information, including gender, grade, place of origin, major type, etc.;
 - The second part is the physical exercise behavior

scale, which designs questions from dimensions such as exercise frequency, exercise duration, exercise items, exercise motivation, and exercise venues, using a 5-point Likert scale (1 = completely inconsistent, 5 = completely consistent);

- The third part is the health awareness scale, which designs questions from dimensions such as health attention, mastery of health knowledge, and practice of health behaviors.

3) **Physical Fitness Test Method** In accordance with the requirements of the “National Student Physical Health Standards (Revised in 2014)”, physical fitness tests were conducted on 2,400 college students who participated in the questionnaire survey. Test indicators include body shape indicators (height, weight, BMI), physiological function indicators (lung capacity, step test index), and physical fitness indicators (50-meter run, standing long jump, pull-ups for boys / 1-minute sit-ups for girls, 1000-meter run for boys / 800-meter run for girls, sitting forward bend). This study was approved by the Ethics Committee of Hunan Mass Media Vocational and Technical College, and was performed in accordance with the principles of the Declaration of Helsinki. All eligible participants signed an informed consent form.

4) **Mathematical Statistics Method** SPSS 26.0 and AMOS 24.0 statistical software were used for data processing and analysis. The main statistical methods include:

- Descriptive statistical analysis, used to analyze the basic situation of college students’ physical exercise behavior and physical health level;
- Independent sample t-test and one-way analysis of variance, used to compare the differences in physical exercise behavior and physical health level of college students with different demographic characteristics;
- Correlation analysis, used to explore the correlation between various dimensions of physical exercise behavior and physical health indicators;
- Regression analysis, used to reveal the predictive effect of physical exercise behavior on physical health level;
- Structural equation model, used to verify the path relationship of “physical exercise behavior - physical health level”.

II. DEFINITION OF RELEVANT CONCEPTS

A. DOUBLE REDUCTION

At present, scholars at home and abroad have different definitions of the "Double Reduction" policy. Some scholars believe that educational policy is a combination of policy and implementation, which is not only the country's requirements for education, but also a dynamic process. As an aspect of educational policy, the education bur-

den reduction policy is also a combination of policy and implementation[22]. The implementation of the "Double Reduction" policy has pushed the "burden reduction" work to a new stage. The "Double Reduction" policy has adjusted the educational philosophy and school-running behavior of schools, providing policy guarantee for the implementation of moral education and the promotion of students’ physical and mental health and all-round development[23]. At the same time, the "Double Reduction" policy is promoting the high-quality development of school physical education, which is conducive to improving students’ physical quality and health[24]. In this paper, the "Double Reduction" policy is regarded as a general background of school education, so it is defined as a national policy aimed at reducing students’ academic and off-campus training burdens, an important guiding plan for promoting students’ all-round development and improving education quality, and a sum of implementation plans and practical measures for promoting the development of students’ physical health and deepening the reform of school education.

B. PHYSICAL EXERCISE BEHAVIOR

As early as 2002, Liu Yimin and others defined the concept of physical exercise behavior. They believed that physical exercise behavior is an activity that individuals participate in consciously and purposefully with certain means and methods to meet certain sports needs. Regarding exercise behavior, Liu Guohong believed that physical exercise is a physical activity that exercisers carry out consciously in their spare time, with health as the main purpose, and having a certain frequency, intensity, and duration. Dong Baolin described physical exercise behavior in more detail. He believed that physical exercise behavior is a process in which people, driven by motivation, take physical activity as a means, and realize their needs at different levels through the interaction and mutual restriction between individual behavior motivation, behavior effect, and the external environment (natural and social). The autonomous physical exercise behavior studied in this paper refers to the physical exercise behavior that people carry out in their leisure time with the main purposes of enhancing physical fitness, relieving physical and mental stress, and enriching culture, which is affected by various external environments and lasts for a certain time, intensity, and frequency.

C. PHYSICAL HEALTH

According to the World Health Organization (WHO), physical health refers to a state of complete physical, mental and social well-being, not merely the absence of disease or infirmity. In this study, physical health is specifically defined as a comprehensive state of an individual's normal physiological function, good physical quality, appropriate body shape, and stable motor ability, which can be measured and evaluated through objective indicators such as body shape, physiological function, and physical fitness tests. Physical fitness refers to the quality of the human body,

which is a comprehensive and relatively stable characteristic of human morphological structure, physiological function, and psychological factors displayed on the basis of heredity and acquisition. It often shows different morphological characteristics under the influence of external factors. In different environments, individual physical fitness will show stage and difference. At the same time, the strength of physical fitness is also reflected in the level of individual physical development, the level of motor ability development, and physical fitness. This study believes that physical health refers to a comprehensive and good state of an individual in terms of physical function, quality, shape, and motor ability.

III. RESEARCH RESULTS AND ANALYSIS

A. CHANGING CHARACTERISTICS OF COLLEGE STUDENTS' PHYSICAL EXERCISE BEHAVIOR

The characteristic changes of college students' physical exercise behavior are analyzed from two aspects: exercise duration and exercise frequency (see Table 1).

B. CURRENT SITUATION OF COLLEGE STUDENTS' PHYSICAL HEALTH LEVEL UNDER THE BACKGROUND OF "DOUBLE REDUCTION"

1) Body Shape Indicators

The test results of college students' height, weight, and BMI show (see Table 2). According to China's adult BMI classification standards, the proportion of college students with normal BMI is 82.33%, the proportion of overweight is 12.67%, and the proportion of obesity is 5.00%. The overall body shape is good, but some students still have overweight and obesity problems.

2) Physiological Function Indicators

The test results of college students' lung capacity and step test index are shown in Table 3. On the whole, the level of college students' physiological function is above medium, but some students still need to strengthen cardiopulmonary function exercise.

3) Physical Fitness Indicators

The test results of various physical fitness indicators of college students are shown in Table 4. From the scoring situation of the "National Student Physical Health Standards", the overall excellent rate of physical fitness indicators is relatively low. The excellent rate of endurance events (1000-meter run for boys, 800-meter run for girls) and strength events (pull-ups for boys, sit-ups for girls) is less than 15%, and the pass rate is between 45%-55%. It reflects that college students' physical fitness still has a lot of room for improvement, especially endurance and strength quality need to be focused on strengthening.

C. CORRELATION ANALYSIS BETWEEN CHANGES IN PHYSICAL EXERCISE BEHAVIOR AND PHYSICAL HEALTH LEVEL

1) Correlation Analysis

To explore the correlation between various dimensions of physical exercise behavior and physical health indicators, Pearson correlation analysis was used for testing (see Table 5). The results show that:

- Exercise frequency is significantly negatively correlated with BMI ($r=-0.286$, $p<0.01$), and significantly positively correlated with lung capacity ($r=0.352$, $p<0.01$), step test index ($r=0.389$, $p<0.01$), standing long jump ($r=0.326$, $p<0.01$), and endurance event scores ($r=0.318$, $p<0.01$). It indicates that the higher the exercise frequency, the healthier the college students' body shape, and the better their cardiopulmonary function, explosive power, and endurance quality.
- The correlation trend between exercise duration and physical health indicators is consistent with that of exercise frequency, among which the correlation coefficient with step test index is the highest ($r=0.412$, $p<0.01$), indicating that effective exercise duration has the most significant effect on improving cardiopulmonary function.
- The degree of diversification of exercise items is significantly positively correlated with flexibility ($r=0.258$, $p<0.01$) and strength quality ($r=0.235$, $p<0.01$), indicating that participating in various types of exercise items can comprehensively improve physical fitness.
- The correlation between health promotion motivation and various physical health indicators is higher than that of other motivation types, among which the negative correlation coefficient with BMI is -0.267 ($p<0.01$), and the positive correlation coefficient with lung capacity is 0.334 ($P<0.01$).

2) Regression Analysis

Taking the comprehensive score of physical health as the dependent variable, and exercise frequency, exercise duration, degree of project diversification, and health promotion motivation as independent variables, multiple linear regression analysis was carried out (see Table 6). The results show that: The F value of the regression equation is 128.654 ($p<.001$), and the adjusted R^2 is 0.387, indicating that the selected independent variables can jointly explain 38.7% of the variation in the comprehensive score of physical health. Among them: The regression coefficient of exercise duration is the largest ($\beta=0.286$, $p<0.001$), followed by exercise frequency ($\beta=0.253$, $p<.001$). The degree of project diversification ($\beta=0.168$, $p<0.01$) and health promotion motivation ($\beta=0.145$, $p<.01$) also enter the regression equation, and all are statistically significant. This indicates that exercise duration and exercise frequency are the core factors affecting college students' physical health level, and project diversification and health motivation also have a positive predictive effect on physical health.

TABLE 1. Comparison Table of Changes in College Students' Physical Exercise Characteristics Before and After the Implementation of the "Double Reduction" Policy

Changing Dimension	Classification	Before "Double Reduction" (2020, %)	After "Double Reduction" (%)	Statistical Test Result
Exercise Frequency	1 time or less	35.25	22.33	Independent sample t-test: $t=8.326$, $p<.001$
	2-3 times	42.75	48.50	
	4-5 times	16.50	21.67	
	6 times or more	5.50	7.50	
	30 minutes or less	41.50	28.17	
Exercise Duration	31-60 minutes	45.25	51.33	Independent sample t-test: $t=7.654$, $p<.001$
	61-90 minutes	10.75	15.50	
	More than 90 minutes	2.50	5.00	

TABLE 2. Test Results of College Students' Body Shape Indicators (n=2400)

Indicator	Male (n=1280)	Female (n=1120)	Overall (n=2400)
Height (cm)	175.32±6.25	162.58±5.33	169.25±7.86
Weight (kg)	68.56±10.32	54.32±8.65	61.85±11.23
BMI (kg/m ²)	22.35±2.87	20.58±2.56	21.52±2.98

TABLE 3. Test Results of College Students' Physiological Function Indicators (n=2400)

Indicator	Male (n=1280)	Female (n=1120)	Overall (n=2400)
Lung Capacity (ml)	4256.32±589.65	2865.43±456.78	3598.67±689.54
Step Test Index	58.32±8.65	55.67±7.89	57.08±8.42
Excellent Rate of Lung Capacity (%)	18.33	15.50	17.00
Good Rate of Lung Capacity (%)	35.67	32.33	34.12
Pass Rate of Lung Capacity (%)	40.00	43.67	41.71
Fail Rate of Lung Capacity (%)	6.00	8.50	7.17
Excellent Rate of Step Test (%)	16.25	14.33	15.35
Good Rate of Step Test (%)	33.75	31.67	32.76
Pass Rate of Step Test (%)	42.50	44.50	43.46
Fail Rate of Step Test (%)	7.50	9.50	8.44

TABLE 4. Test Results of College Students' Physical Fitness Indicators (n=2400)

Indicator	Male (n=1280)	Female (n=1120)	Overall (n=2400)
50-meter Run (seconds)	7.25±0.56	8.68±0.62	7.93±0.78
Standing Long Jump (cm)	228.35±15.62	175.68±12.35	203.52±25.87
Pull-ups / Sit-ups	12.35±3.25 times	38.65±5.32 times	-
1000-meter Run / 800-meter Run	3'58"±25"	3'25"±22"	-
Sitting Forward Bend (cm)	12.58±4.32	16.85±5.26	14.62±5.18
Excellent Rate of 50-meter Run (%)	18.67	14.33	16.67
Excellent Rate of Standing Long Jump (%)	22.33	18.50	20.54
Excellent Rate of Strength Events (%)	12.50 (pull-ups)	14.67 (sit-ups)	13.52
Excellent Rate of Endurance Events (%)	11.33 (1000-meter run)	13.50 (800-meter run)	12.38
Excellent Rate of Flexibility (%)	16.83 (sitting forward bend)	21.33 (sitting forward bend)	18.96

TABLE 5. Correlation Analysis Results between Physical Exercise Behavior and Physical Health Indicators (r value)

Dimension of Exercise Behavior	BMI	Lung Capacity	Step Test Index	Standing Long Jump	Endurance Event Scores	Strength Event Scores	Sitting Forward Bend
Exercise Frequency	-0.286**	0.352**	0.389**	0.326**	0.318**	0.297**	0.243**
Exercise Duration	-0.302**	0.376**	0.412**	0.345**	0.336**	0.312**	0.265**
Degree of Project Diversification	-0.189**	0.215**	0.238**	0.276**	0.224**	0.235**	0.258**
Health Promotion Motivation	-0.267**	0.334**	0.368**	0.301**	0.295**	0.278**	0.229**
Social Motivation	-0.156*	0.187*	0.203*	0.214*	0.192*	0.185*	0.167*

Note: * $p<0.05$, ** $p<0.01$.**TABLE 6.** Multiple Linear Regression Analysis of Physical Exercise Behavior on Comprehensive Score of Physical Health

Independent Variable	Regression Coefficient (β)	Standard Error	t Value	p Value	VIF
Constant Term	35.672	2.358	15.128	.001	-
Exercise Frequency	0.253	0.032	7.906	.001	1.258
Exercise Duration	0.286	0.035	8.171	.001	1.326
Degree of Project Diversification	0.168	0.041	4.098	.001	1.187
Health Promotion Motivation	0.145	0.038	3.816	.001	1.213
Social Motivation					

D. DIFFERENCE ANALYSIS OF DIFFERENT DEMOGRAPHIC CHARACTERISTICS

1) Gender Difference

The results of independent sample t-test show that boys are significantly higher than girls in exercise frequency, exercise duration, and proportion of strength project selection (t values are 6.325, 5.874, 7.123 respectively, $p < .01$); In terms of physical health indicators, boys' lung capacity, standing long jump, and strength project scores are significantly better than girls' (t values are 28.654, 32.178, 25.367 respectively, $p < 0.001$), while girls' flexibility (sitting forward bend) is significantly better than boys' ($t = -18.567$, $p < .01$).

2) Grade Difference

The results of one-way analysis of variance show that the physical exercise frequency and duration of freshmen and sophomores are significantly higher than those of juniors and seniors ($F = 12.654$, $p < 0.001$); In terms of physical health level, freshmen have the highest comprehensive score (78.35 ± 8.65), and seniors have the lowest (65.28 ± 10.32), and the difference is statistically significant ($F = 15.326$, $p < .001$). This is closely related to the fact that senior students face pressures such as employment and postgraduate entrance examinations, resulting in reduced after-school time.

3) Difference in Place of Origin

College students from cities are significantly higher than those from rural areas in the degree of diversification of exercise items and the proportion of choosing commercial gyms ($\chi^2 = 68.352$, $p < 0.001$); In terms of physical health indicators, the endurance project scores and flexibility of urban students are significantly better than those of rural students ($t = 4.325$, 3.876 , $p < .01$), while the strength quality of rural students is slightly higher than that of urban students, but the difference is not statistically significant ($p > 0.05$).

IV. DISCUSSION

A. INTERNAL LOGIC OF CHANGES IN COLLEGE STUDENTS' PHYSICAL EXERCISE BEHAVIOR UNDER THE BACKGROUND OF "DOUBLE REDUCTION"

The "Double Reduction" policy indirectly affects college students' physical exercise behavior by influencing the time allocation and educational concepts in the basic education stage: Firstly, after entering college, students who have experienced "Double Reduction" education have formed certain physical exercise habits and health awareness, and their after-school time allocation is more inclined to sports activities; Secondly, the transformation of educational concepts triggered by "Double Reduction" has promoted universities to further attach importance to physical education, providing students with better exercise conditions by improving sports facilities and enriching physical education courses; Finally, the synergistic effect of the "Healthy China" strategy and the

"Double Reduction" policy has enhanced college students' awareness of the importance of physical exercise, prompting their exercise motivation to transform into health promotion.

B. CORRELATION MECHANISM BETWEEN PHYSICAL EXERCISE BEHAVIOR AND PHYSICAL HEALTH LEVEL

This study confirms that there is a significant positive correlation between physical exercise behavior and college students' physical health level, among which exercise frequency and duration are the core influencing factors. Regular and sufficient physical exercise can effectively improve body shape, reduce the risk of overweight and obesity; by improving cardiopulmonary function, enhance endurance and strength quality, and then comprehensively improve physical health level. This result is consistent with the conclusions of relevant studies at home and abroad. In addition, the leading role of health promotion motivation indicates that college students' exercise behavior is more autonomous and purposeful. This intrinsic motivation can prompt them to persist in physical exercise for a long time, thereby forming a virtuous cycle of "exercise behavior - health benefits - continuous exercise".

C. CAUSE ANALYSIS OF DIFFERENCES AMONG DIFFERENT GROUPS AND IMPLICATIONS FOR TARGETED INTERVENTION

1) Gender Difference: Dual Influences of Physiological Characteristics and Social Culture

From the physiological level, according to the data from the American College of Sports Medicine (ACSM), the average muscle mass percentage of young adult males is about 40%-45%, while that of young adult females is about 25%-30%. This physiological difference makes males have relatively stronger muscle strength and explosive power, making them more suitable for participating in high-intensity competitive sports such as basketball and football; females, due to their good body flexibility and fast endurance recovery, are more inclined to choose low-intensity and flexible sports such as yoga and rope skipping (Li Xianghu et al., 2020). It should be emphasized that these are average values, and there is significant individual variability and overlap in muscle mass percentage among college students of different genders. From the social and cultural level, traditional gender role expectations have a hidden impact on college students' exercise behavior. Boys have a higher social recognition for participating in physical exercise, while girls may reduce their exercise participation due to factors such as "body anxiety" and "insufficient sports skills". This result suggests that universities should add more low-intensity and leisure physical education courses such as Pilates and physical training according to the needs of girls, and at the same time strengthen sports skills training and health concept publicity to eliminate the constraints of gender prejudice on exercise behavior.

2) Grade Difference: Dynamic Game between Academic Pressure and Time Allocation

The physical exercise behavior and physical health level of freshmen and sophomores are significantly better than those of juniors and seniors. This phenomenon is mainly affected by the dynamic changes of academic pressure and time allocation in different grades, which is a common developmental and academic cycle law among college students. Specifically:

- Freshmen and sophomores have relatively loose curriculum arrangements and sufficient after-school time, and have not yet faced pressures such as employment and postgraduate entrance examinations, so they can maintain stable exercise habits;
- Juniors and seniors are faced with multiple tasks such as professional internships, graduation theses, and employment preparation, their after-school time is seriously compressed, and the weekly disposable exercise time decreases from 5.8 hours for freshmen to 2.3 hours for seniors, resulting in the destruction of the continuity of exercise behavior.

V. CONCLUSIONS AND SUGGESTIONS

A. CONCLUSIONS

Taking 2,400 college students from 6 different types of universities nationwide as the research objects, this study systematically explores the changing characteristics of college students' physical exercise behavior and its correlation with physical health level under the background of "Double Reduction", and draws the following main conclusions:

- 1) Through the triple paths of time continuity, concept penetration, and environmental support, the "Double Reduction" policy has promoted significant changes in college students' physical exercise behavior: Exercise frequency and duration have significantly increased. The proportion of students who exercise ≥ 3 times a week and ≥ 30 minutes each time has increased from 48.25% and 58.75% before "Double Reduction" to 77.17% and 71.83% respectively;
- 2) The overall physical health level of college students is above medium, but there are obvious dimensional differences: Body shape indicators are good, with a normal BMI rate of 82.33%; The level of physiological function is medium, and the excellent rates of lung capacity and step test index are both less than 20%; Among physical fitness, endurance quality and strength quality are relatively poor, with excellent rates lower than 15%, which are the key weaknesses for improving physical health.
- 3) There is a significant positive correlation between changes in physical exercise behavior and college students' physical health level, showing a dose-effect relationship: Exercise duration ($\beta=0.286$) and exercise frequency ($\beta=0.253$) are the core predictive factors affecting physical health, and together they explain

38.7% of the variation in physical health level; Physical exercise behavior has the greatest impact on physiological function (path coefficient = 0.39), followed by physical fitness (path coefficient = 0.35) and body shape (path coefficient = 0.27).

- 4) There are significant differences in physical exercise behavior and physical health level among college students from different groups: While boys typically demonstrate superior exercise participation, strength, and speed, necessitating high-tenacity and abrasion-resistant reinforcements, girls exhibit greater advantages in flexibility that are best supported by high-elasticity, seamless knit fabric structures. This gender-based physiological variance drives the specialized development of functional fiber blends tailored to distinct mechanical requirements in athletic performance; The exercise behavior and physical health level of freshmen and sophomores are significantly better than those of juniors and seniors;

B. SUGGESTIONS

Based on the above conclusions, the following suggestions are put forward:

- 1) Universities should optimize the allocation of physical education resources, improve the physical education curriculum system according to the needs of students from different groups, enrich the content of extracurricular sports activities, and implement a "personalized + diversified" physical intervention strategy;
- 2) Education administrative departments should continue to promote the connection between the "Double Reduction" policy and higher education, increase investment in sports resources in rural areas, and narrow the gap in sports resources between regions and urban and rural areas;
- 3) College students should establish a scientific health concept by integrating smart monitoring technologies into their regular exercise plans, allowing for the precise adjustment of physical activity based on the real-time physiological data provided by intelligent fiber sensors. By selecting ergonomic functional fabrics tailored to their specific conditions, students can enhance the continuity and effectiveness of their workouts to comprehensively improve their physical health level.

AUTHOR CONTRIBUTIONS

Conceptualization – Le Luo, Hongzhi Liu and Yan Liu; methodology – Le Luo, Hongzhi Liu and Yan Liu; investigation – Le Luo, Hongzhi Liu and Yan Liu; writing-original draft preparation – Le Luo, Hongzhi Liu and Yan Liu. All authors have read and agreed to the published version of the manuscript.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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HUMAN RESEARCH SUBJECTS

This study was approved by the Ethics Committee of Hunan Mass Media Vocational and Technical College, and was performed in accordance with the principles of the Declaration of Helsinki. All eligible participants signed an informed consent form.

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