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A Study on the Correlation between Nutrition Status and Physical Fitness Test of College Students in Liuzhou

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Abstract: Objective: To understand the correlation between physical health and nutrition status of college students in a university in Liuzhou, and to propose practical measures to improve the physical health of college students in Liuzhou based on the survey results, with the aim of enhancing their physical health. Methods: An online questionnaire was distributed to 161 college students in a university in Liuzhou through Wenjuanxing, covering personal information, various physical test items (height, weight, lung capacity, 800/1000-meter run, 50-meter run, standing long jump, sit-ups/pull-ups, and sit-and-reach), nutrition knowledge, nutrition attitudes, and nutrition behaviors. Data analysis was conducted. Results: the average physical fitness test score of the surveyed college students was 71.84 ± 9.61. the correct response rate for nutrition knowledge ranged from 31.06% to 96.89%, with an overall accuracy rate of 64.39%. the surveyed students had a relatively positive attitude towards nutrition. However, most students exhibited unhealthy eating behaviors. There was no statistical significance between nutrition knowledge, attitudes, and behaviors and BMI values or total physical fitness test scores (P > 0.05). Conclusion: College students in the surveyed university in Liuzhou possess a certain level of nutrition knowledge and have a positive attitude towards nutrition, but they struggle to translate this knowledge into action, showing poor initiative in nutrition behaviors. Therefore, measures should be taken based on the nutrition status of college students in the university to improve their physical health.

Keywords: Physical Health; Nutrition Status; KAP; College Students

1 Introduction

1.1 Research Background, Objectives, and Significance

1.1.1 Research Background

1.1.1.1 National and Social Emphasis on Student Physical Health

Physical fitness is a characteristic inherent to an individual's morphological structure and functional activities, formed by both genetic inheritance and acquired experiences, and it has relative stability [1]. the physical fitness of citizens is not only closely related to individual health but also to the prosperity of the nation's economy. Adolescents, as the mainstay of national development, bear the important mission of leading citizens to achieve a happy life and are the future of the country and the hope of the nation. In general, the physical health of adolescents is a symbol of social and economic progress [2]. the "Healthy China 2023" plan proposes a target of "more than 25% excellent rate in the National Student Physical Fitness and Health Standard, " indicating that enhancing the physical fitness of college students is a pathway to realizing a healthy China.

1.1.1.2 Declining Physical Fitness of College Students in Recent Years

College students are in a critical period for learning scientific knowledge and acquiring social skills, as well as for physical growth and development. Therefore, their physical fitness is closely linked to the future of the nation. It is of great importance to improve the physical health of college students, both at the individual and national levels. However, an analysis of the health test data of students from some universities in Anhui Province from 2015 to 2021 shows that the rates of overweight and obese college students increased from 2015 to 2021, while the average scores in the 50-meter run test, muscle explosive power demonstrated by standing

long jump, endurance test in the 800-meter or 1000-meter run, and the proportion of students with normal vision all showed a downward trend [3].

1.1.1.3 Importance of Nutrition for Improving Student Physical Health

Reasonable nutrition plays a vital role in the physical and mental health of students, shaping a strong physique, and enhancing intelligence. Recent studies have shown that many college students have unhealthy dietary habits, such as rarely eating breakfast, irregular meals, frequent snacking and late-night meals, and lack of physical exercise [4]. All physiological activities in the human body require energy, and diet is the most direct and simple way to obtain energy. If college students can adopt healthy eating habits, they can effectively improve their physical health and fitness levels.

1.1.2 Research Objectives

This thesis, based on the KAP model and nutrition theory, investigates the basic information of college students in a university in Liuzhou in four dimensions: personal information, physical test items, nutrition knowledge, nutrition attitudes, and nutrition behaviors. It aims to explore the correlation between the physical health and nutrition status of college students. Based on the survey results, the reasons for the continuous decline in college students' physical health are analyzed in detail. Measures are proposed to help college students adjust their nutrition concepts and improve their eating habits, thereby achieving the goal of improving their nutrition and enhancing their physical health.

1.1.3 Research Significance

1.1.3.1 At the National Level

College students are the main force for the future development of the country, and their physical health is related to the prosperity of the nation. the physical health of college students is crucial to the future of the motherland. the state should formulate relevant policies to actively promote the improvement of college students' physical health. At the same time, all social forces should join hands to develop specific measures to achieve the goal of improving college students' physical health.

1.1.3.2 At the University Level

The socialist cause in China has put forward higher requirements for the development of well-rounded talents. Universities play an irreplaceable foundational role in this regard. the body is the container for knowledge and intelligence. Without a good container, knowledge cannot be fully absorbed or utilized effectively. This would be a great waste to the nation and society. Therefore, it is urgent for universities to implement various nutritional measures to improve the physical health of college students.

1.1.3.3 At the Individual Level

Good health is an essential foundation for all activities. College students, during their university years, are away from their parents and relatives. the nutrition they intake for three meals a day shifts from being taken care of by their parents to being left to their own discretion. Therefore, understanding the basic situation of students' nutrition knowledge, attitudes, and behaviors is conducive to formulating measures to improve the physical health of college students based on the relevant circumstances.

1.2 Literature Review

1.2.1 Domestic Research Review

1.2.1.1 Research on the Current Status of College Students' Physical Health

In recent years, data from student physical health tests have shown that due to the widespread use of mobile phones and computers, the myopia rate among students has increased year by year, and the obesity rate has also been on the rise. However, students exhibit an imbalance in physical function, body shape, and physical fitness [4]. the reasons for these phenomena are mainly due to college students staying up late, having irregular diets, and being addicted to games, which lead to a sub-healthy state in students. Their meals are based on personal preferences, with a diet mainly consisting of high-calorie, fried foods, and carbonated beverages.

Wen Xiantao [5] reported that China has been monitoring the physical health of college students since 1985. Over these 30 years, although the height of Chinese college students has increased, the number of obese and underweight students has risen. the physical test scores in items such as lung capacity, standing long jump, 50 meters, and 800 meters have shown a downward trend year by year.

Wu Wei [6] analyzed the physical condition of 800 students from universities in Zhejiang and found that college students exhibit a

"knowledge-behavior discrepancy" in sports cognition and behavior. They have a low frequency of sports activities, insufficient intensity, and short duration. Their lifestyle is unscientific, with many students skipping breakfast, having insufficient sleep, and having an unreasonable dietary structure.

Wu Mengjiao and Li Kehua [7] surveyed 100 students from Shaanxi Preschool Normal University and found that although the height of male and female college students increased year by year, both were lower than the national average. the average lung capacity of male college students was higher than the general level, but that of female college students was lower than that of peers. the standing long jump scores of both male and female college students were below the national physical fitness and health standard. It is urgent to improve their physical fitness, which is lower than the average level of Chinese peers. In general, the height of college students has increased with the improvement of the national economic level, but the overall level of physical fitness and health of college students has shown a downward trend year by year.

1.2.1.2 Research on College Students' Nutrition Status and KAP

With the implementation of China's reform and opening-up policy, the national economy has developed rapidly, and people's living standards have improved accordingly. However, this has also brought various health problems related to diet. Most studies have found that Chinese college students generally lack knowledge and understanding of nutrition, leading to unreasonable dietary behaviors, which in turn affect their physical health status.

Shu Li, Zhao Wenhong, and Li Ting [8] found that college students currently have a poor grasp of nutrition knowledge and a significant imbalance in their dietary structure. Female and senior college students scored higher in nutrition knowledge than male and junior students.

Feng Wenlin, Qiao Xiaoming, Peng Jiaojiao, et al. [9] found in their research on college students that the level of knowledge regarding nutrients and food classification among college students is insufficient. Only 26.51% of the surveyed students were able to answer all the nutrition-related questions correctly. Most students lack understanding of how to combine a diet to promote health. However, college students have a strong desire to learn about nutrition and are eager to improve their health through nutrition knowledge.

Han Lirong and Guo Hongzhen [10] conducted a random check on the level of nutrition knowledge among college students in Langfang. the survey results indicated that male college students had a lower level of nutrition knowledge compared to female students, suggesting that female students place more emphasis on nutrition knowledge than male students. This may be related to the fact that female students pay more attention to their physical appearance.

Numerous studies have demonstrated that there is a relationship between nutrition status and physical fitness. Therefore, it is urgent to improve the physical health of college students from the aspect of nutrition status. the problems among college students mainly focus on three aspects: nutrition knowledge, attitude, and behavior, all of which have significant impacts on their physical health. To understand the correlation between nutrition status and physical health of college students in a university in Liuzhou, a survey was conducted based on the KAP (Knowledge, Attitude, Practice) concept. the factors influencing the nutrition status of college students were analyzed, and the correlation and influencing factors between nutrition status and physical health were studied to develop measures for improving the physical health of college students. Through publicity and education, it is possible to increase the nutrition knowledge of college students, change their attitudes towards nutrition, and improve their nutrition behaviors, thereby promoting their physical health.

1.2.2 International Research Review

Nutritional surveys require a significant amount of time and effort and cover a wide range of populations, from middle-aged and elderly individuals to infants. the methods used for these surveys are diverse, including dietary surveys, KAP questionnaires, and 24-hour dietary recall methods.

The KAP model was first proposed in the 1950s by Professor Mayo from Harvard University, encompassing three aspects: Knowledge, Attitude, and Practice. In the 1990s, Gao Quman et al. [11] further developed the KAP model, which has since been successfully applied to promote and change human health behaviors. the KAP

survey is widely recognized for its accuracy and is considered a reliable method for assessing human nutrition status.

Japan conducts a nationwide nutrition survey annually to provide data and information for the Health Promotion Law. This survey aims to gain a comprehensive understanding of the health status, lifestyle, and nutrient intake of the population [24]. As early as 1992, Sobal et al. [12] suggested that individuals can control their health awareness through nutrition knowledge, thereby guiding dietary behaviors towards healthier outcomes. With the advancement of the internet, Poddar K. H. et al. conducted a web-based nutrition education study that enhanced the self-efficacy and self-control of college students, increased their intake of nutrients, and subsequently improved their physical health. In addition, Freedman M. R. et al. provided health and nutrition information in universities through printed materials, audio recordings, and VCRs to help consumers quickly make healthy choices.

In some Western countries, such as the United States, the increasing prevalence of obesity among the population has led to poor physical health among students. the primary reasons for weight gain among American college students include excessive intake of high-calorie foods after entering university, low frequency of breakfast consumption, frequent late-night snacking, and a significant reduction in physical activity due to frequent use of food delivery services.

2.Research Methods

2.1 Research Subjects

All students from a university in Liuzhou were selected as the research subjects. Questionnaires were distributed randomly according to the random survey method. A total of 165 questionnaires were actually distributed, and 162 were returned, resulting in a response rate of 98.2%.

2.2 Research Methods

2.2.1 Review of Literature

Relevant literature on the nutrition status, physical fitness, and KAP (Knowledge, Attitude, Practice) theory of college students was reviewed through academic websites such as CNKI and VIP. Useful literature was classified and summarized to provide reference for the writing of this paper.

2.2.2 Questionnaire Survey Method

Questionnaires were distributed to college students at a university in Liuzhou to understand their nutrition status and physical fitness levels and to analyze whether there is a correlation between the two. Measures to improve physical fitness were discussed based on the results.

2.2.3 Statistical Analysis Method

Data were statistically analyzed using SPSS 25.0 software. For count data, the mean ±standard deviation was used, along with frequency and percentage. Multivariate correlation analysis methods were also employed. A p-value < 0.05 indicated statistical significance, while a p-value < 0.01 indicated significant difference.

3. Research Results

3.1 Overall Status of College Students' Physical Fitness Test

According to the evaluation criteria of the National Student Physical Fitness and Health Standard (revised in 2014), physical fitness test scores are divided into four levels: excellent (90 points and above), good (80.0-89.9 points), pass (60.0-79.9 points), and fail (below 59.9 points). As shown in Table 1, among the 161 surveyed college students, there were no male students with excellent scores. Six male students (16.7%) had good scores, 22(61.1%) had passing scores, and 8(22.2%) failed. Among female students, 1(0.8%) had an excellent score, 25(20.0%) had good scores, 88(70.4%) had passing scores, and 11(8.8%) failed.

Table 1. Physical Fitness Test Scores of College Students

Score Level	Male Students	Female Students
Excellent	0(0.0%)	1(0.8%)
Good	6(16.7%)	25(20.0%)
Pass	22(61.1%)	88(70.4%)
Fail	8(22.2%)	11(8.8%)

3.2 Analysis of Nutrition Knowledge and Its Correlation with Physical Fitness

Among the surveyed college students at the university in Liuzhou, the correct response rate for nutrition knowledge ranged from 31.06% to 96.89%, with an overall accuracy rate of 64.39%. Only 31.06% of students were aware of the types of nutrients required by the human

body. the scores for nutrition knowledge showed no statistical significance with either the total physical fitness test scores or BMI values ($p > 0.05$), as shown in Table 3.

Table 2. Correct Response Rates for Nutrition Knowledge

Question	Correct Responses	Correct Rate
Types of Nutrients	50(31.06%)	31.06%
Daily Salt Intake	101(62.73%)	62.73%
Main Energy-Providing Substance	123(76.4%)	76.40%
Dangers of Skipping Breakfast	156(96.89%)	96.89%
Energy Proportion of Three Meals	101(62.73%)	62.73%
Vitamin-Related Knowledge	91(56.52%)	56.52%

Table 3. Correlation Analysis of Nutrition Knowledge with BMI and Total Physical Fitness Test Scores

Variable	p-value
BMI	0.278
Total Physical Fitness Test Score	0.749

3.3 Analysis of Nutrition Attitude and Its Correlation with Physical Fitness

Among the surveyed college students, 133 students (82.6%) considered nutrition knowledge to be important, 27(16.8%) thought it was somewhat important, and 1(0.6%) considered it unimportant. For breakfast, 137 students (85.1%) believed it was important for health, 24(14.9%) thought it was somewhat important, and 1(0.6%) considered it unimportant. In terms of meal sources, 128 students (79.5%) ate at the school cafeteria, 17(10.6%) relied on takeout, 12(7.5%) ate from street vendors, and 4(2.5%) used snacks as meals. Correlation analysis between nutrition attitude scores and BMI or total physical fitness test scores showed no statistical significance ($p > 0.05$), as detailed in Table 4.

Table 4. Correlation Analysis of Nutrition Attitude with BMI and Total Physical Fitness Test Scores

Variable	BMI	Total Physical Fitness Test Score	Nutrition Attitude Score
BMI	1	-0.14	-0.054
Total Physical Fitness Test Score	-0.14	1	0.011
Nutrition Attitude Score	-0.054	0.011	1

3.4 Analysis of Nutrition Behavior and Its Correlation with Physical Fitness

Table 5. Detailed Dietary Behavior of Surveyed Students

Question	Options (Percentage)			
Do you eat breakfast?	Every day (20.4%)	Often (38.5%)	Sometimes (38.5%)	Never (2.4%)
Do you eat late-night snacks?	Every day (7.0%)	Often (15.5%)	Sometimes (73.9%)	Never (6.2%)
What is your drinking habit?	Often (54.0%)	Rarely (19.9%)	When thirsty (26.1%)	
Do you often eat snacks?	Often (37.3%)	Occasionally (55.9%)	Almost never (6.8%)	
Do you often eat vegetables?	Often (75.2%)	Occasionally (24.2%)	Almost never (0.6%)	
Do you often eat fruits?	Often (64.0%)	Occasionally (34.8%)	Almost never (1.2%)	
Do you often eat meat?	Often (75.2%)	Occasionally (23.0%)	Almost never (1.9%)	
Do you often eat seafood	Often (16.8%)	Occasionally (69.6%)	Almost never (13.7%)	

The detailed dietary behavior of the surveyed college students is shown in Table 5. the top three breakfast choices were soy milk, milk; rice, steamed buns, bread, and other legume products; and porridge. the main reason for skipping breakfast was oversleeping and lack of time, accounting for 76.4% of the reasons for not eating breakfast. Only 62.11% of students had regular meal patterns, and only 34.16% could focus while eating, with the rest often eating while watching TV, chatting, or using their phones. When choosing food, taste was the primary consideration, followed by flavor, nutritional value, price, and advertising. Among the surveyed students, 41.61% exercised three or more times per week, 23.6% exercised twice a week, and 24.78% exercised once a week. Correlation analysis between nutrition behavior and BMI or total physical fitness test scores showed no statistical significance ($p > 0.05$), as detailed in Table 6.

Table 6. Correlation Analysis of Nutrition Behavior with BMI and Total Physical Fitness Test Scores

Variable	BMI	Total Physical Fitness Test Score
Nutrition Behavior	0.028	-0.029
BMI	1	-0.025
Total Physical Fitness Test Score	-0.029	1

4. Discussion

4.1 Low Physical Fitness Test Scores of Surveyed Students

The analysis of 161 data sets revealed that the majority of students had passing scores (68.3%), but only 0.6% achieved excellent results. This indicates that the physical fitness test scores of college students at a university in Liuzhou are not optimistic, and their physical health is under severe threat. Urgent measures are needed to manage and improve the physical health of college students. Studies have shown that in recent years, the physical fitness of college students in China has been declining year by year [. the decline is particularly evident in lung capacity, standing long jump, 50-meter run, and 800-meter run. This is closely related to the daily diet and lifestyle habits of college students. the analysis suggests that with the continuous development of the national economy, people are pursuing a better quality of life. the increasing availability of food choices and the rapid development of the takeout industry have led most students to prefer foods that taste good while neglecting their nutritional value. Additionally, the widespread use of the internet and mobile phones has led to a decrease in physical activities among college students. Therefore, the physical fitness test scores of the surveyed students are affected by various factors, including lifestyle habits and personal behaviors. Only a few students achieved excellent or good results. College students need to start with themselves and enhance their awareness of physical health.

4.2 Nutrition Knowledge of Surveyed Students

The survey revealed that the overall correct response rate for nutrition knowledge was 64.39%, indicating that the surveyed students had a relatively poor level of nutrition knowledge. This finding is consistent with other domestic studies. It is essential to further strengthen the guidance and education of nutrition knowledge. the questions with the highest correct response rates were related to the dangers of frequently skipping breakfast, the most important energy-providing substances for the human body, the daily salt intake for adults, and the energy proportion of three meals a day. However, some common knowledge questions had high error rates, such as the types of nutrients required by the human body and the vitamin deficiency that causes night blindness. the survey suggests that the health education and publicity efforts at the university in Liuzhou are far from sufficient and need to be further enhanced. Statistical analysis showed that there was no statistical significance between nutrition knowledge scores and BMI values or total physical fitness test scores, indicating no correlation. This result is different from other studies, which showed that nutrition knowledge scores were negatively correlated with BMI and positively correlated with total physical fitness test scores.

4.3 Nutrition Attitude of Surveyed Students

Correlation analysis between nutrition attitude scores and BMI or total physical fitness test scores showed no statistical significance ($P>0.05$). This finding is consistent with other studies. Although college students generally have a positive attitude towards nutrition, it is difficult to change the unhealthy eating habits that have been formed over a long period. In general, there is a phenomenon of "knowing but not acting. " For example, the prevalence of ordering takeout, irregular meal times, and the frequent consumption of unhealthy beverages such as milk tea are all detrimental to physical health.

4.4 Nutrition Behavior of Surveyed Students

The survey showed that the overall dietary behavior of college students at the university was not satisfactory. the behaviors with better nutrition, such as "eating breakfast every day, " "never eating late-night snacks, " and "drinking water regularly, " had low proportions. the analysis revealed that only 20.4% of students ate breakfast every day, and 38.5% ate breakfast often. Overall, the frequency of eating breakfast among college students was low. Statistical analysis showed that there was no statistical significance between nutrition knowledge and BMI values or total physical fitness test scores, indicating no correlation. This result is different from other studies, which showed that nutrition behavior scores were negatively correlated with BMI and positively correlated with total physical fitness test scores.

5.Recommendations and Conclusions

5.1 Recommendations

College students, as a special group, bear significant responsibility for the future

development of the country. Good physical health is crucial for both individuals and society. Since most of the body's energy comes from diet, improving the physical health of college students through nutrition has become an important means. Based on the analysis data in this paper, the following recommendations are made for college students at a university in Liuzhou to improve their physical health.

5.1.1 Strengthen Nutrition Education

The living environment of college students includes the family, school, and society. Enhancing family nutrition education, ensuring school nutrition education, and increasing social nutrition education are the main ways to improve the nutrition education of college students.

The family plays an indispensable role in improving the nutrition status of college students because it has a crucial impact on their nutrition knowledge, attitudes, and behaviors. Regular nutrition and health education should be conducted to help parents gain a deeper understanding of healthy nutrition knowledge, thereby enhancing their health awareness and quality of life. Students can obtain sufficient nutrition from the meals cooked by their parents. Moreover, when parents have a higher level of nutrition knowledge, they can recognize the importance of nutrition and adjust the dietary structure of family members to meet different health needs. Schools, as the main activity venues for students outside the family, play an important role in shaping students' behaviors and attitudes. Therefore, it is recommended that schools increase publicity efforts, actively promote nutrition education, and offer more courses related to nutrition to teach students professional nutrition knowledge. This will help them develop healthy eating habits and good nutrition behaviors. Schools can also organize nutrition-related lectures, bulletin boards, and posters to enable college students to acquire nutrition knowledge unconsciously, thereby promoting good nutrition status. Society is the main environment for the daily life of every citizen. By using the dissemination power of modern networks for nutrition publicity and education, the coverage of publicity can be expanded, nutrition knowledge can be updated in a timely manner, and the level of public health nutrition knowledge can be improved.

5.1.2 Balanced Diet

Human physical health is influenced by both genetic factors and lifestyle habits. Insufficient dietary intake can have negative effects on both the body's nutritional status and overall health. the primary way for the human body to obtain energy is through food intake, and a scientific and balanced diet is crucial for health. To meet the body's energy needs and promote physical development, college students should focus on diversity in their daily diet. the following points should be noted in the diet of college students:

5.1.2.1 Develop the Habit of Eating Breakfast

A nutritious breakfast should include grains and tubers, meat and eggs, dairy and legumes, and fruits and vegetables. If necessary, students can drink a cup of soy milk or milk during class breaks.

5.1.2.2 Avoid Unhealthy Eating Habits

Unhealthy eating habits such as overeating, picky eating, using snacks as main meals, and unhealthy weight loss methods should be avoided. Additionally, the intake of snacks should be limited to avoid affecting the intake of main meals.

5.1.2.3 Consume More Whole Grains

To provide the body with sufficient energy, it is recommended to consume more whole grains, especially those that are less processed and can retain most of the B vitamins.

5.1.2.4 Increase Intake of Protein-Rich Foods

Foods such as fish, meat, eggs, dairy, legumes, vegetables, and fruits should be consumed regularly. In particular, adolescents should increase their protein intake.

5.1.3 Enhance Physical Activity Among College Students

To improve the physical health of college students, schools can actively offer a variety of sports courses, allowing students to choose sports courses based on their interests and thereby increasing their enthusiasm for physical exercise. Media software such as sports apps, mini-programs, and sports-related short videos can also be fully utilized to add a competitive element to WeChat step-counting functions, thereby enhancing college students' awareness of physical exercise and cultivating their enthusiasm for sports.

5.2 Conclusions

With the continuous development of the national economy, the variety of foods

available to people has increased. However, certain foods such as barbecues, fried foods, and snacks pose certain health risks. Moreover, the serious addiction of college students to electronic products and the lack of physical activity are undoubtedly a double-edged sword for their nutrition status and physical health. Therefore, it is urgent to improve the physical health of college students. This paper conducted a questionnaire survey of 161 college students at a university in Liuzhou, investigating their physical fitness test results, nutrition knowledge, nutrition attitudes, and nutrition behaviors. Statistical software was used to analyze whether there is a correlation between nutrition status and physical fitness. Based on the analysis results, improvement measures were proposed to enhance the physical health of college students.

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