



OPEN Impact of dietary habit changes on college students physical health insights from a comprehensive study

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College students' health and behavioral issues are gaining increasing global attention, with the optimization and choices of dietary structure becoming key factors affecting their physical and mental development. This study examines adolescents to explore the impact of dietary habit changes on their physical health. First, we investigated the factors influencing dietary habit changes after students entered college through questionnaires. Based on the theory of planned behavior, we constructed a structural equation model and found that perceived behavioral control had the greatest impact on college students' dietary choices. In addition, we investigated the patterns of dietary changes among adolescents and conducted an observational experiment on the impact of dietary changes on physical fitness. The results divided participants into three groups: those reducing high-calorie food intake, those increasing fiber intake, and those reducing high-fat and high-salt food intake. The findings showed that reducing high-calorie food intake had the most significant effect on students' physical health, resulting in a 7.5% improvement. Increasing fiber intake followed with a 5.68% improvement, while reducing high-fat and high-salt intake led to a 5.48% improvement in physical health. This study suggests that creating a supportive environment—within society, schools, and families—can encourage healthy eating habits among adolescents.

Keywords Dietary habits, College students, Dietary changes, Health and diet outcomes, Sustainable nutrition

The issue of college students physical health has long been a key concern of governments worldwide. The development of college students' physical health is directly linked to the overall quality of the population, making it crucial for promoting national health. College students' physical health has become an increasing global concern. According to the World Health Organization (WHO), adolescence is a critical period for developing physical fitness and establishing healthy behaviors. However, the physical health status of college students is alarming, particularly in developed countries and rapidly urbanizing regions. The WHO reports that over 80% of adolescents fail to meet the recommended 150 min of moderate to vigorous physical activity per week, leading to a continuous decline in physical health¹. Lifestyle changes are one of the most significant contributors to this trend, and research by Lobstein indicates that the prevalence of overweight and obesity in adolescents is rising, with nutritional imbalances and high-sugar, high-fat diets being the primary factors². The WHO's Global Strategy on Diet, Physical Activity, and Health, adopted at the 57th World Health Assembly in 2004, emphasizes that a healthy diet and regular physical activity are vital for promoting health and reducing non-communicable diseases³.

However, College students often have many pressures, such as academic challenges⁴, which represent a critical period when students are often away from home, adjusting to new environments and dietary structures that can influence their eating habits and health⁵. The reasons for changes in the eating habits of college students are manifold. A study of college students in four European countries reported that participants who were away from their parents' homes had a lower intake of healthy foods⁶. Kelly et al. noted that college students living together can negatively impact eating behaviors due to a lack of peer support for healthy eating⁷. Li et al. explored the detailed components of the college food environment and what shapes eating behaviors, and showed that in the college food environment, the taste of the food is the number one factor in students' choice of that food, followed by the availability and price of the food⁸. McArthur showed that American college students believe that

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the perception that their peers do not like to consume healthy food influences food choices⁹. Michelle's study showed that social media is also an important influence on college students' dietary choices¹⁰.

Changes in dietary habits have a great impact on college students themselves. Peter's study found that healthy dietary habits have a positive impact on college students' academic performance¹¹, and that a greater intake of fruits and vegetables can improve academic achievement¹². In addition, unhealthy dietary habits often cause serious mental health problems for college students¹³. And many college students are unaware of the role of diet on mental health. Sanjoy's study found that a healthy diet can alleviate the symptoms of depression in college students¹⁴. In addition to academic performance and mental health, a healthy diet also affects the physical health of college students. Although many studies have analyzed the association between diet and health^{15,16}, the impact of dietary choices after entering college on physical development, emotional stability, and long-term health risks requires further exploration. The changes in dietary habits among college students and their effects on physical health remain insufficiently studied¹⁷.

Structural equation modeling is a statistical method for analyzing the relationship between variables based on their covariance matrix. It is a fundamental tool for multivariate data analysis. It mainly consists of metric and structural models. Among them, both the metric and structural models are represented by linear regression functions¹⁸. Measurement modeling is mainly applied to study the relationship between observed variables and latent variables. In recent years, structural equation modeling has been widely used in the field of health. For example, Maryam used structural equation modeling to study the associations between Iranian workers' major dietary habits and stressful life events with mental health problems, and the results showed that there was a direct negative correlation between life stress and workers' mental health and that adherence to a healthy diet improves workers' mental health problems¹⁹. Raissa et al. assessed the impact of symbiosis on the eating patterns of Brazilian adolescents and observed a positive correlation between symbiosis and healthy eating patterns of Brazilian adolescents, with gender-specific effects. Dietary choices of college students are influenced by a variety of factors, so this paper chooses structural equation modeling as a method to explore the influences on college students' dietary choices²⁰.

Given that college students' dietary habits have a lasting impact on their future health, understanding the factors influencing dietary choices and their specific effects on physical health is not only of scientific interest but also of practical significance for developing effective interventions and improving adolescent health. This study aims to analyze the behavioral characteristics and influencing factors of college students in their daily dietary choices and explore their associations with physical health indicators. These findings will provide a foundation for dietary health guidance for college students and inform public health policy formulation.

Methods

Theoretical framework

The purpose of this study is to investigate the factors influencing dietary changes in college students and to examine the physical health effects of these changes. Grounded in the theory of planned behavior (TPB), this study explores how attitudes (beliefs about the benefits and barriers of healthy eating), subjective norms (social influences from peers, family, and media), and perceived behavioral control (access to healthy food and self-efficacy in maintaining dietary habits) shape students' dietary behaviors. To achieve this, we conducted a questionnaire survey to systematically analyze these factors and their impact on the adoption of healthy eating habits. Following this, a long-term follow-up study was carried out to assess the physical health effects of different dietary changes by tracking key indicators such as BMI and lung capacity. By integrating TPB into both the investigation of influencing factors and the analysis of health outcomes, this study establishes a strong theoretical foundation for understanding how psychological and social determinants shape college students' eating behaviors and provides empirical evidence on the role of diet in promoting physical health. The flowchart of this study is shown in Fig. 1.

Experimental design

Survey of dietary frequency changes

This study utilized the Food Frequency Questionnaire (FFQ) to investigate changes in the eating habits of adolescents after entering college²¹. Foods were categorized into 25 groups, including staple cereals, vegetables, eggs, meat, fish, snacks, and nuts. The questionnaire asked participants to indicate whether they regularly consumed each food item and to report the frequency. Additionally, students were asked to compare their current eating habits at school with those in their hometowns and to separately report the frequency and degree of change for each food item.

Factors influencing dietary habits choice

The Theory of Planned Behavior (TPB) was proposed by Ajzen in 1985, and is mainly used to predict and explain individuals' behavior²². The theory suggests that an individual's behavioral intention is the most direct predictor of his or her actual behavior, and that behavioral intention is influenced by three key factors: attitude, subjective norms, and perceived behavioral control. Based on this theory, the following hypotheses were proposed in this study to explore the factors influencing college students' eating behavior choice behavior (Fig. 2):

- H1: Attitude positively influences behavioral intention.
- H2: Subjective norms positively influence behavioral intention.
- H3: Perceived behavioral control positively influences behavioral intention.
- H4: Behavioral intention positively influences actual dietary choice behavior.
- H5: Perceived behavioral control directly influences actual dietary choice behavior.

In the study of the influence of dietary habit choices, convenience sampling was employed to obtain samples, with survey respondents consisting of college students. All data collected in this study were gathered through an

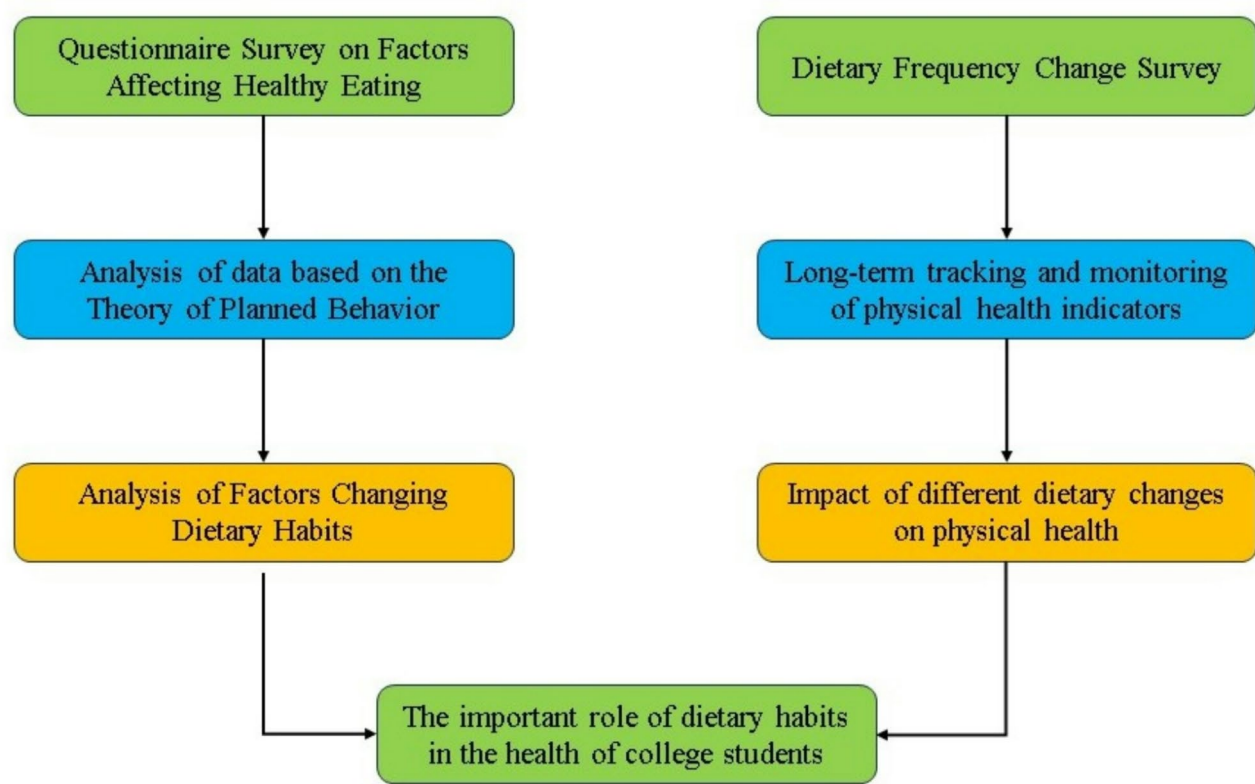


Fig. 1. Flowchart of the study.

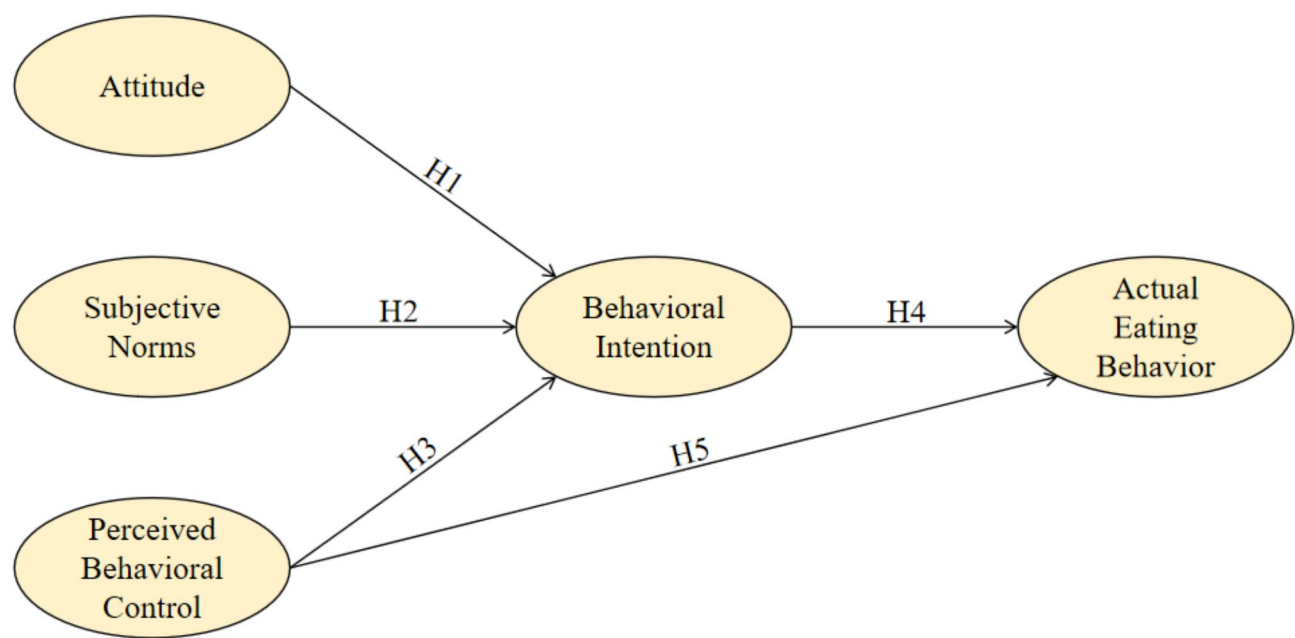


Fig. 2. Theoretical framework diagram.

online questionnaire, which was designed based on the model of this research and specifically informed by the TPB to characterize the factors influencing college students' dietary habit choices. The questionnaire is presented in Table 1. All data were self-reported. Prior to formal data collection, the questionnaire was piloted by five volunteers holding a minimum of a Bachelor's degree in related disciplines (nutrition, physical education, etc.) to provide feedback on the initial design, allowing for appropriate modifications.

NO.	Dimension	Item
BI1	Behavioral intention (BI)	I plan to increase my healthy food intake over the next month
BI2		I plan to cut down on junk food
BI3		I have the will to change my eating habits to be healthier
SN1	Subjective norms (SN)	My friends encourage me to make healthy food choices
SN2		My family expects me to eat healthy food
SN3		My classmates support me in maintaining healthy eating habits
PBC1	Perceived behavioral control (PBC)	I feel empowered to choose and prepare healthy foods
PBC2		I can make healthy eating choices even when I'm pressed for time
PBC3		I have enough resources (e.g., time, money) to maintain a healthy diet
AEB1	Actual eating behavior (AEB)	I eat at least two servings of fruits and vegetables a day
AEB2		I eat fast food at least once a week
AEB3		I often choose whole grains over refined grains
AEB4		I eat a lot of light foods
ATT1	Attitude (ATT)	I think making healthy food choices is good for me
ATT2		I enjoy eating healthy foods
ATT3		Eating healthy makes me feel positive
ATT4		I choose that healthy eating makes me happy

Table 1. Questionnaire on factors affecting the choice of eating habits.

Impact of dietary changes on physical health

In order to verify the effect of dietary changes on physical fitness, the participants will be grouped into different diet categories, and the dietary changes will be based on the results of the questionnaire mentioned above. It is worth noting that the dietary changes are not completely mandatory, but are based on the principle of nutritional balance. The study provides healthy and balanced recipes for each group as a reference, which can be adapted by the participants according to their personal situation, but do not need to be strictly followed. By comparing the effects of different dietary adjustments, combined with the results of regular physical fitness tests, it is hoped that evidence related to the significant impact of diet on physical fitness can be drawn. In terms of variable control, all participants maintained relatively consistent levels of exercise and daily routines over the course of the study, ensuring that diet was the main variable influencing physical fitness indicators. This dietary intervention, which favors flexibility, is not only more consistent with real-life scenarios, but also helps participants better integrate long-term habits of healthy eating.

Physical fitness indicators

Physical fitness indicators include the following four items:

- (1) Blood pressure (BP): BP is a critical indicator of cardiovascular function and health²³, encompassing systolic blood pressure (SBP) and diastolic blood pressure (DBP). SBP measures the maximum pressure in the arterial blood vessels during heart contraction, while DBP represents the lowest pressure during heart relaxation. Monitoring BP in adolescence is important for predicting future cardiovascular disease risk. Measurements are taken while the subject is seated, following at least 5 min of rest. BP is measured on the upper arm using either an electronic sphygmomanometer or a mercury column sphygmomanometer. Each measurement is repeated three times, and the average is calculated to ensure data accuracy.
- (2) Body mass index (BMI): BMI is a commonly used indicator for assessing the relationship between weight and height in college students and determining whether weight is within a reasonable range. The formula is: BMI = weight (kg)/height² (m²). In adolescence, BMI reflects an individual's nutritional status and degree of obesity, which can be associated with the development of several chronic diseases²⁴. The measurement method is straightforward, and subjects are usually asked to wear lightweight clothing and remain barefoot during the measurement to ensure accurate height and weight data.
- (3) Lung capacity: Lung capacity is the total amount of air exhaled after maximal inhalation and reflects the health of the respiratory system and lung function. Vital capacity is crucial for assessing cardiorespiratory endurance and respiratory development in college students. For measurement, the subject should stand and be tested with a spirometer. The subject is instructed to inhale deeply and then exhale forcefully to record the maximum expiratory volume. This measurement is typically repeated three times, with the highest value taken as the final data point to minimize measurement error.
- (4) 6-Minute Walk Test (6MWT): This test is a simple, economical, and practical method for assessing aerobic endurance. By measuring the distance walked continuously for 6 min on a flat surface, the 6MWT reflects the cardiorespiratory fitness and exercise endurance of college students²⁵. During the test, the subject is instructed to walk continuously for 6 min at the fastest possible pace on a designated walkway, with the total distance recorded. Clear instructions must be provided before the test, and the safety and physical condition of the subjects should be monitored throughout.

Dimension	Cronbach's α	AVE	CR
BI	0.703	0.58	0.73
SN	0.834	0.64	0.84
PBC	0.814	0.61	0.82
AEB	0.768	0.52	0.74
ATT	0.846	0.57	0.84

Table 2. Results of the questionnaire’s reliability and validity testing.

Factors	BI	SN	PBC	AEB	ATT
BI	1				
SN	0.134**	1			
PBC	0.333**	0.027**	1		
AEB	0.293**	0.203**	0.402**	1	
ATT	0.269**	0.139**	0.376**	0.540**	1

Table 3. Results of pearson correlation analysis between factors. **Indicates significant p–value less than 0.01..

Participants

The study distributed questionnaires to college students via an online platform, collecting a total of 498 questionnaires. After excluding invalid responses, 445 questionnaires were deemed valid, resulting in an effective response rate of 89.36%. Among the valid responses, 240 were from males and 205 from females. Before the survey commenced, the purpose and requirements of the questionnaire were explained to each student, and the survey was conducted under the principles of informed consent and voluntary participation.

Based on the investigation and analysis of the influencing factors of dietary habits and the frequency of changes, 240 male college students from Fuzhou University were recruited to study the effects of changes in dietary habits on physical health. Participants were aged between 18 and 25 years and came from various majors, reflecting diverse lifestyle habits and dietary preferences, thus providing a varied sample for the study. The study period is from March 2024 to September 2024. In the baseline survey, all participants were preliminarily assessed for physical health indicators, including BMI, blood pressure, lung capacity, and the 6MWT. The majority of participants had a BMI within the normal range (18.5–24.9), though some students were classified as slightly overweight or underweight.

Before the study commenced, all participants were thoroughly informed about the study’s purpose, process, potential risks, and benefits. The study was approved by the University Human Research Ethics Committee. Informed consent was obtained throughout the study, with participants signing a written consent form after being fully briefed on the study’s details. They were also informed that they could withdraw from the study at any stage without any negative consequences. Ethical approval was obtained from the university human research ethics committee before commencement. The study was conducted in accordance with the Declaration of Helsinki.

Results
Dietary choice behavior results

Reliability and validity are critical indicators for assessing the quality of a questionnaire. Reliability refers to the consistency and stability of the questionnaire across different contexts, typically evaluated through internal consistency tests. In this study, Cronbach’s α coefficient was employed to assess the internal consistency of the questionnaire²⁶. The results indicated that the α coefficients for all dimensions were above 0.68, signifying high internal consistency. Validity, on the other hand, serves as an essential measure of the questionnaire’s accuracy. Initially, several domain experts were invited to review the various items of the questionnaire, resulting in a content validity index (CVI) of 0.82, which indicates good content validity²⁷. Subsequently, the average variance extracted (AVE) and composite reliability (CR) for each dimension were calculated. The results showed that the CR values for all dimensions were above 0.7, and the AVE values exceeded 0.5, indicating strong convergent and discriminant validity. The findings of the questionnaire reliability test are presented in Table 2. In summary, the reliability and validity of the questionnaire in this study meet the necessary requirements.

Finally, Pearson correlation analysis was used to test the relationship between the questionnaire and the mean values of the factors. As shown in Table 3, the significant correlation of the mean values of the factors is at the 0.01 level of significance, which indicates that all the factors of the questionnaire are significantly related to each other.

Based on the complexity characteristics of the structural equation model, the overall fit of the model is usually judged on the basis of a comprehensive evaluation of multiple fit indices. The cardinal degrees of freedom ratio (χ^2/df) should be between 2 and 5. The comparative fit index (CFI) value, goodness of fit index (GFI), adjusted goodness of fit index (AGFI), etc., should be > 0.9, and the closer these values are to 1, the better the structural equation model fit is. The root mean square error of approximation (RMSEA) value is in the range of 0 to 1, and

Fit indexes	χ^2/df	CFI	GFI	AGFI	TLI	RMSEA
Final model	2.773	0.927	0.927	0.902	0.913	0.063

Table 4. Model fit indexes.

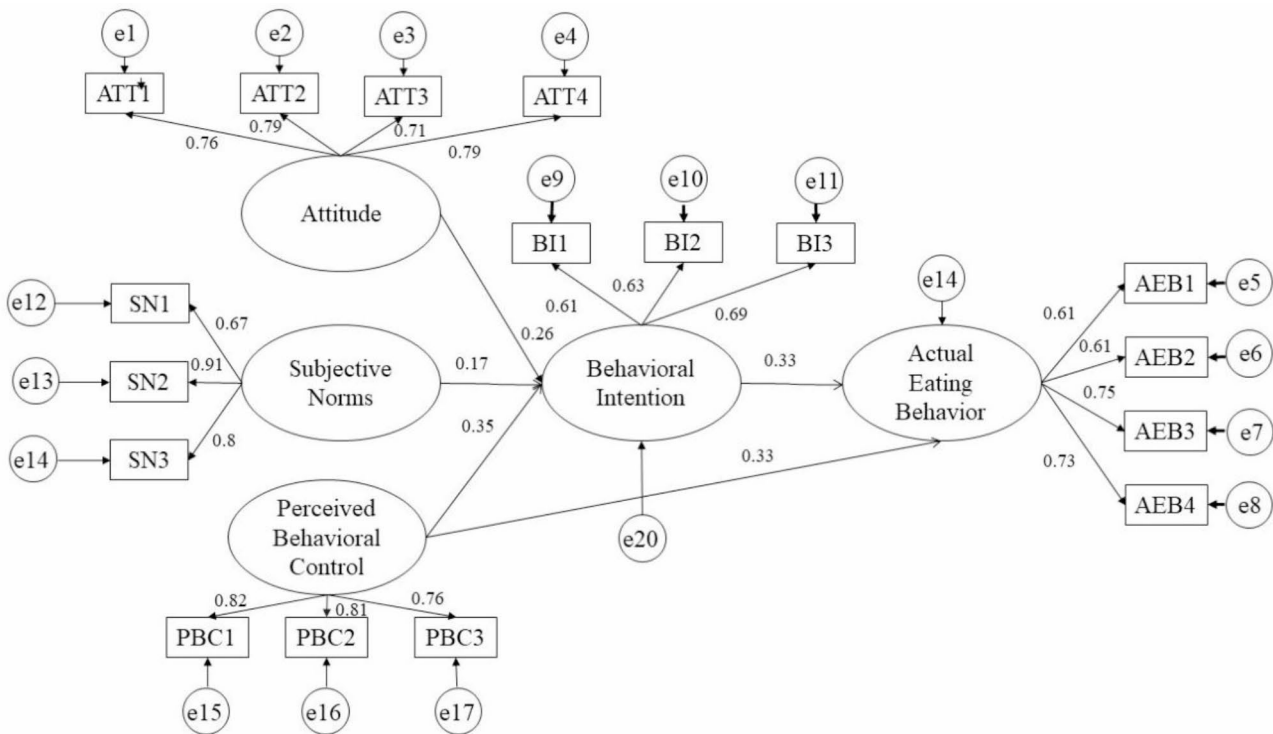


Fig. 3. Dietary choice intention model.

Latent variables	Direct effect	Indirect effect	Total effect
Behavioral intention	0.326	–	0.326
Subjective norm	–	0.055	0.055
Perceived behavioral control	0.327	0.114	0.441
Attitude	–	0.086	0.086

Table 5. Direct, indirect and overall impact of factors on actual eating behavior.

the closer it is to 0, the smaller the structural equation modeling error²⁸. The model fitting indices of this study are shown in Table 4, which are all within the acceptable range, and the fitting indices are basically appropriate. To explore the comprehensive effects of various factors on dietary behavior, we combined the results of the final dietary behavior influencing factors model (Fig. 3) and conducted a total effect analysis, as shown in Table 5. The results indicate that perceived behavioral control has the greatest influence on college students' dietary habit choices. Additionally, dietary behavioral intention is also a significant factor influencing their dietary choices. This suggests that college students can effectively maintain healthy eating habits if they possess both the confidence to make healthy choices and the intention to adhere to these behaviors in their daily diet²⁹.

Dietary change frequency analysis

Through the FTQ, the frequency of dietary changes among college students since entering college was statistically analyzed. As shown in Table 6, it can be observed that students have experienced notable changes in their staple food consumption, particularly in their pasta habits. This is likely due to students from northern provinces, where noodles are a staple food, adapting to the southern region, where rice is more commonly consumed. Among other foods, instant noodles and snacks exhibited the most frequent changes, likely because of their affordability and convenience, making them preferred options when college students face time constraints. Additionally, significant changes were observed in the consumption of mixed grains, potatoes, cruciferous vegetables, and nuts, which may reflect a general shift among students toward healthier eating habits. Lastly, the

Food	Changed	Unchanged	Food	Changed	Unchanged
Rice	20.6%	79.4%	Nuts	51.8%	48.2%
Pasta	31.9%	68.1%	Poultry	29.3%	70.7%
Vegetables with chili	11.7%	88.3%	Livestock	16.5%	83.5%
Fresh bean vegetables	16.7%	83.3%	Eggs	24.7%	75.3%
Mixed grains	59.8%	40.2%	Meat products	39.5%	60.5%
Potatoes	52.6%	47.4%	Offal	24.6%	75.4%
Melon vegetables	21.9%	78.1%	Fish	31.9%	68.1%
Green leafy vegetables	45.1%	54.9%	Instant noodles	71.8%	28.2%
Cruciferous vegetables	49.8%	50.2%	Snacks	53.4%	46.6%
Onion and garlic	13.4%	86.6%	Carbonated beverages	51.6%	48.4%
Fungus and algae	21.8%	78.2%	Deep fried foods	42.6%	57.4%
Dehydrated vegetables	15.4%	84.6%	Pickled foods	46.4%	53.6%
Fruits	36.9%	63.1%			

Table 6. Survey on changes in eating habits.

Test metrics	Group	Mean difference	SD	T-value	P-value
SBP	Group1	6.36	1.38	41.33	<0.001
	Group2	3.51	1.03	30.53	<0.001
	Group3	7.94	0.96	74.42	<0.001
DPB	Group1	4.12	0.74	49.49	<0.001
	Group2	1.49	0.26	51.42	<0.001
	Group3	6.82	1.25	48.96	<0.001

Table 7. Results of paired samples t-test for BP.

frequency of consuming fried and preserved foods also changed, possibly due to limited access to such foods in the college’s geographic region.

Results of dietary change

After identifying the main motivations for dietary changes among college students, the next step was to analyze the impact of these changes on their physical health. As outlined in “[Dietary change frequency analysis](#)”, Through the above survey, we found that the change in eating habits is concentrated in high-calorie foods, high-fiber foods, and high-oil and high-salt foods. To investigate the effect of these dietary changes, 240 male college students participated in a 6-month follow-up experiment. The students were divided into three groups, each corresponding to one of the three dietary changes:

- Group 1: Transition from high-calorie foods to low-calorie foods.
- Group 2: Transition from low dietary fiber to high dietary fiber.
- Group 3: Transition from high-oil and high-salt foods to low-oil and low-salt foods.

Physical fitness tests, including BMI, blood pressure, lung capacity, and the 6MWT, were conducted before and after the dietary changes to assess their impact on the participants’ physical fitness. The results were compared to determine which dietary change had the greatest influence on the college students’ health.

SBP and DBP

The physical fitness test results after different dietary changes were evaluated. To analyze the impact of these changes on the participants’ BP, a paired samples t-test was conducted on their SBP and DBP before and after the dietary modifications. The results, shown in Table 7, reveal a decreasing trend in BP across all three dietary changes, with a significant correlation between the changes and the decrease in BP ($P<0.001$).

As shown in Figs. 4 and 5, the most pronounced reduction in BP occurred in the group that reduced their intake of high-oil and high-salt foods. This group showed a 6.6% reduction in mean SBP and a 6.9% reduction in mean DBP. The group that reduced their intake of high-calorie foods experienced a 5.3% decrease in mean SBP and a 5.1% decrease in mean DBP. The smallest reduction was observed in the group that increased dietary fiber intake, with a 3.9% reduction in mean SBP and a 2.8% reduction in mean DBP.

These results suggest that a high-salt diet is one of the primary contributors to elevated BP. Previous research has demonstrated that reducing salt intake can significantly lower both SBP and DPB³⁰. Additionally, reducing high-oil food intake helps prevent elevated blood lipids and improves vascular health. Thus, reducing the consumption of high-oil and high-salt foods appears to be the most effective approach for controlling BP.

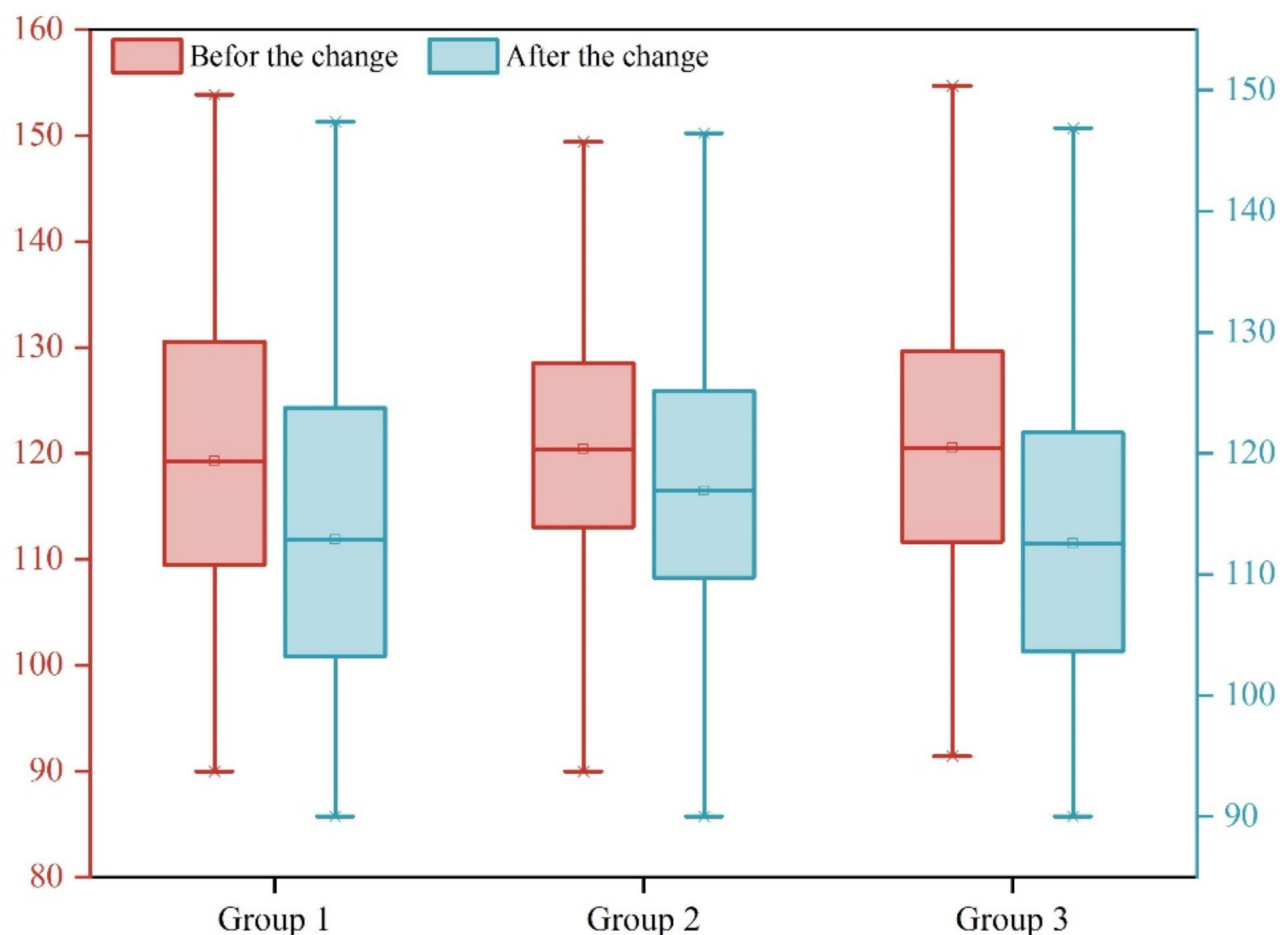


Fig. 4. SBP before and after two measurements (in mmHg).

BMI

Figure 6 illustrates the changes in BMI values of the participants after different dietary adjustments, while Table 8 presents the paired samples t-test results for BMI changes. The statistical analysis revealed significant changes in BMI across all three groups ($p < 0.001$), indicating that dietary modifications had a measurable impact on the BMI of the college students.

Reducing high-calorie food intake led to the most significant reduction in BMI, with a 6.8% decrease. This was followed by a 4.8% decrease in BMI for the group that increased dietary fiber intake, while the group that reduced high-oil and high-salt food intake saw the smallest reduction, at 2.1%.

High-calorie foods, such as sugary drinks, fried items, and desserts, are key contributors to excessive calorie intake and subsequent weight gain. By cutting down on these foods, participants directly reduced their overall calorie consumption, resulting in more effective BMI control³¹. Increasing dietary fiber intake also played a notable role in BMI reduction, as fiber promotes satiety, reduces overall calorie intake, and supports gut health and metabolism. Research supports the finding that sufficient dietary fiber intake can effectively lower body fat percentage and body weight³².

In contrast, reducing high-oil and high-salt food intake was less impactful on BMI because such foods primarily affect water retention and BP rather than directly influencing calorie intake. This suggests that merely lowering oil and salt intake may not be as effective in controlling BMI unless coupled with efforts to reduce overall caloric intake.

Lung capacity

The lung capacity test results are illustrated in Fig. 7, and the paired samples t-test analysis results are presented in Table 9. The analysis demonstrated that all three groups, which underwent dietary changes, experienced significant improvements in their lung capacity test results ($p < 0.001$). This suggests that the dietary modifications had a substantial positive impact on lung function. It is evident that reducing high-calorie food intake (Group 1) led to the largest increase in lung capacity, with a 4.2% improvement in the mean test value. This was followed by the group that increased dietary fiber intake (Group 2), which saw a 3.1% improvement, and lastly, the group that reduced high-oil and high-salt food intake (Group 3), which experienced a 2.5% increase.

The greater improvement in lung capacity from reducing high-calorie foods can be attributed to the prevention of weight gain. Excessive body weight places an additional burden on the respiratory system, limiting

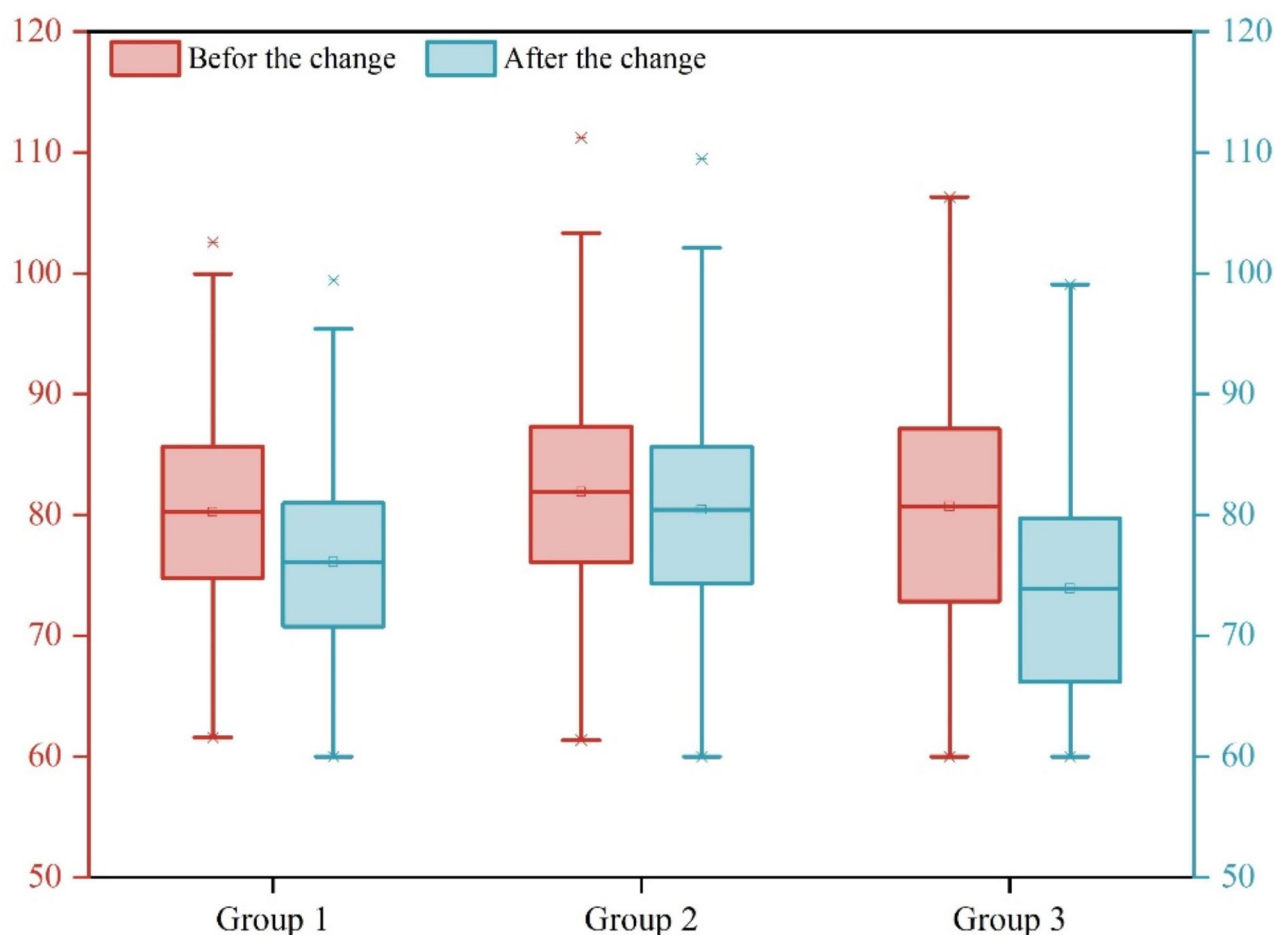


Fig. 5. DPB before and after two measurements (in mmHg).

lung function. Reducing calorie-dense foods like sugary drinks, desserts, and fried foods directly aids in weight loss, which, in turn, alleviates stress on the chest and respiratory muscles, leading to improved lung capacity. Obesity is often linked with respiratory issues such as asthma and shortness of breath, and weight reduction can mitigate these conditions, resulting in enhanced lung function.

Additionally, increasing dietary fiber not only promotes better digestive health and helps maintain body weight, but it may also support overall respiratory health. Fiber-rich foods often accompany a diet richer in fruits, vegetables, and whole grains, which are high in antioxidants and essential nutrients that can positively influence lung function. Therefore, the improvements seen in lung capacity for Group 2 may be a result of both weight maintenance and the overall nutritional benefits of a higher fiber diet.

6MWT

The results of the 6MWT are shown in Fig. 8, and the results of the paired-samples t-test are shown in Table 10, which shows that the test results of the three groups of subjects changed significantly after the dietary changes ($p < 0.001$), which indicates that decreasing the intake of high-calorie foods, increasing the intake of dietary fibers, and decreasing the intake of foods high in oil and salt can improve the performance of the college students in the walking test.

Among the three dietary changes, reducing the intake of high-calorie foods had the most significant impact on the results of the 6MWT (16.1%). Reducing the intake of high-calorie foods (such as sugary beverages, desserts, and deep-fried foods) can effectively control body weight and prevent obesity, which in turn reduces the burden on the heart and muscles. Improve exercise endurance and cardiorespiratory fitness. Therefore, reducing the intake of high-calorie foods is expected to result in better outcomes in the 6MWT. The immediate impact of this intervention is to reduce excess energy intake, which contributes to improved overall exercise performance. This was followed by an increase in dietary fiber intake (13.8%), which promotes digestive health, enhances satiety, reduces overeating, and contributes to weight management in the long term. A healthy weight and digestive function can improve cardiorespiratory endurance and exercise capacity, which in turn will positively affect the results of the 6MWT. In contrast, reducing the intake of foods high in oil and salt may have a smaller impact (9.3%) relative to the two dietary changes mentioned above.

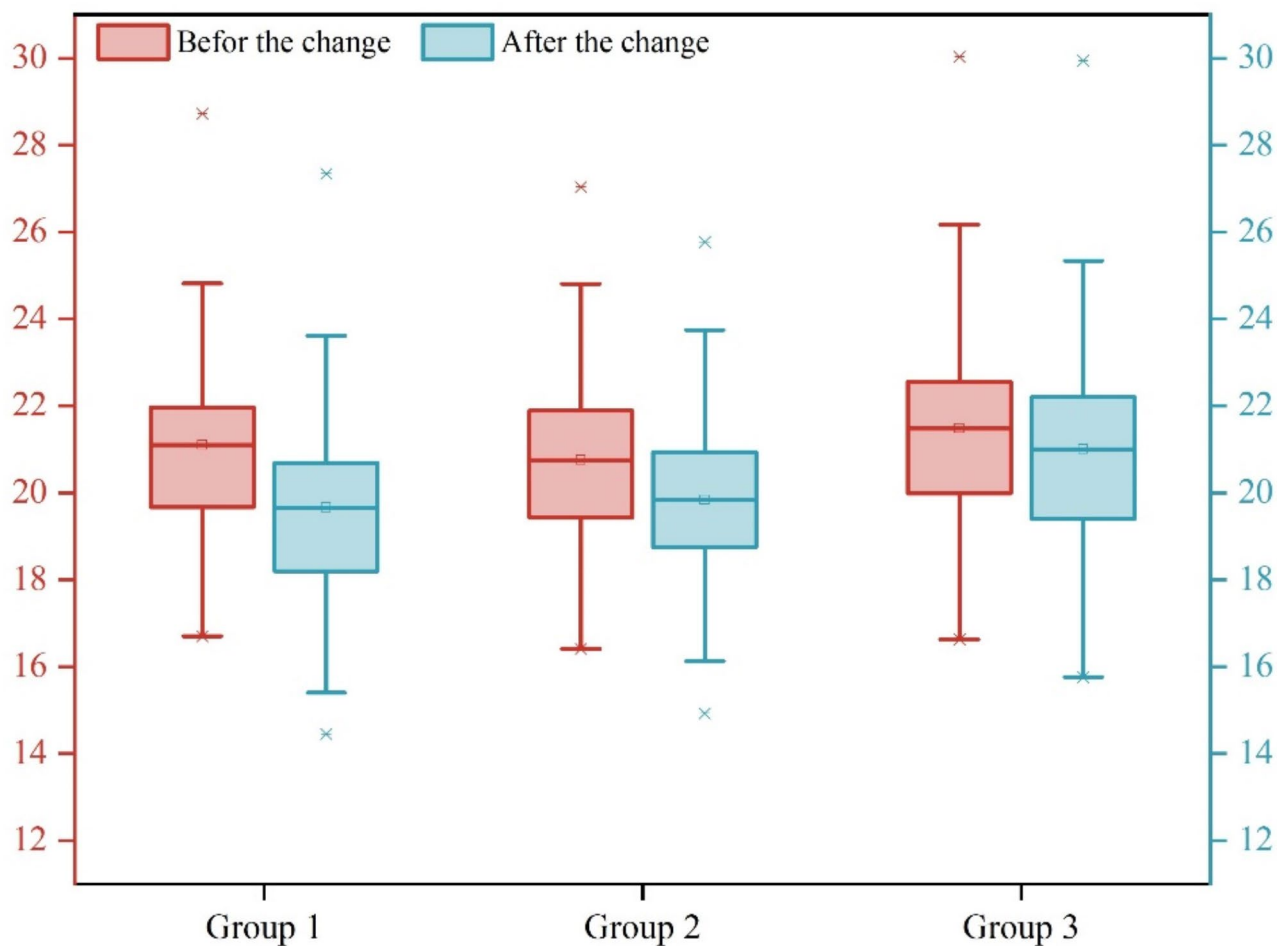


Fig. 6. BMI before and after two measurements (in kg/m²).

Test metrics	Group	Mean difference	SD	T	P
BMI	Group1	0.79	0.87	16.44	<0.001
	Group2	0.55	0.61	15.04	<0.001
	Group3	0.28	0.31	15.43	<0.001

Table 8. Results of paired samples t-test for BMI.

Discussions
Dietary choice behavior

Good eating habits significantly affect college students’ physical and mental health, while unhealthy eating habits can lead to problems such as obesity³³. As college students transition to college, changes in their nutritional needs and social environments make it critical to maintain a balanced and healthy diet. However, due to being away from home and shifts in mindset, their eating habits are prone to change. Despite this, few studies have explored the reasons behind these changes.

This study aims to examine the main factors influencing dietary choices among college students after entering college. The findings indicate that several factors—college students’ attitudes towards food, the surrounding environment, perceived behavioral control, and behavioral intention—affect their dietary choices. Among these, perceived behavioral control has the most significant impact on their choices³⁴. This suggests that students who believe they have control over their dietary decisions, such as choosing healthy foods, preparing nutritious meals, or avoiding unhealthy options, are more likely to improve their eating habits.

Additionally, dietary behavioral intention plays a crucial role in maintaining healthy eating habits³⁵. Once students set specific health goals, like controlling weight or improving fitness, and form a clear dietary intention, they tend to make food choices that align with these objectives. This indicates the importance of self-awareness and intentionality in promoting healthier eating habits among college students.

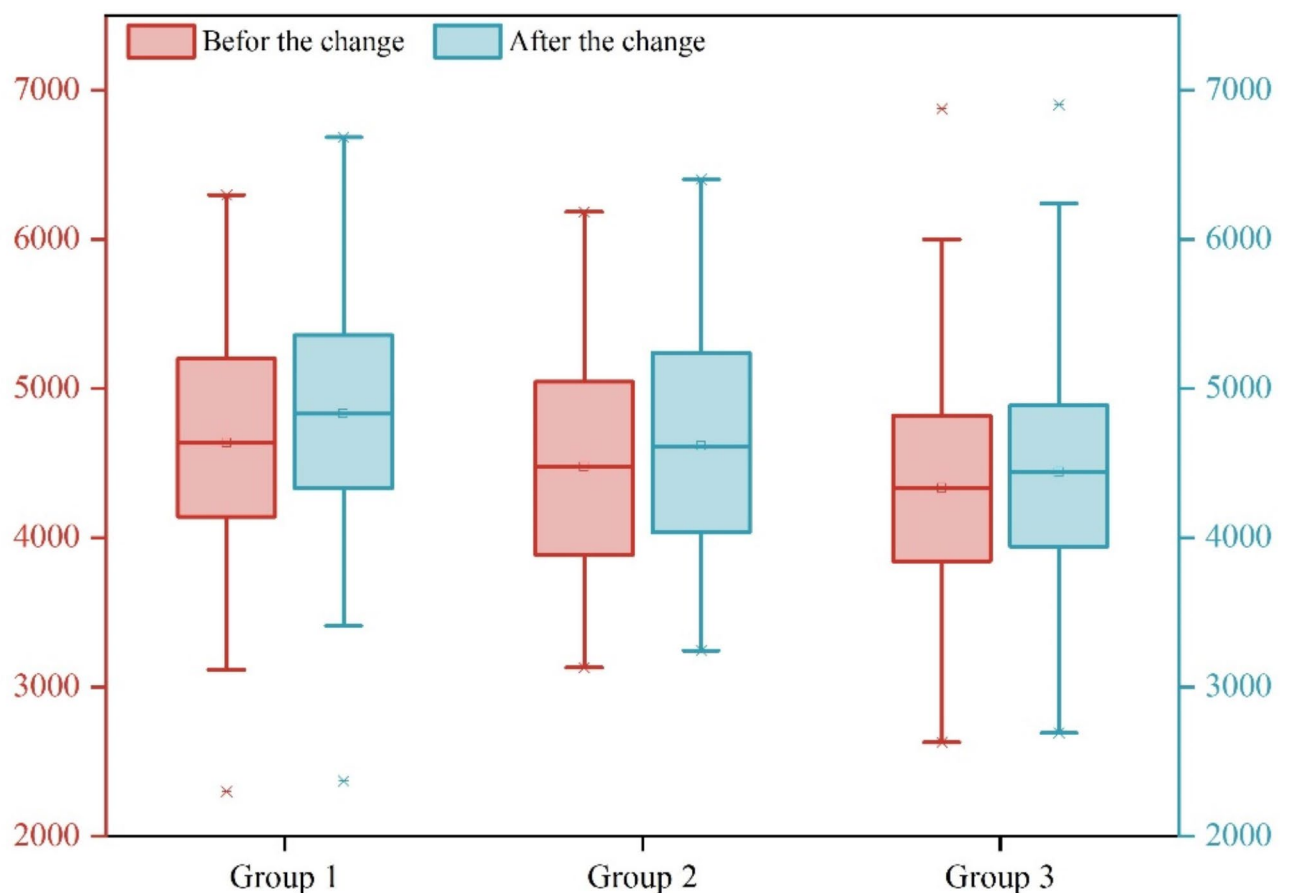


Fig. 7. Lung capacity before and after two measurements (in ml).

Test metrics	Group	Mean difference	SD	T	P
Lung capacity	Group1	193.17	113.06	15.28	<0.001
	Group2	137.62	76.50	16.09	<0.001
	Group3	105.00	65.31	14.47	<0.001

Table 9. Results of paired samples t-test for lung capacity.

Dietary changes and physical health

Changes in dietary habits can significantly impact physical health³⁶. This study found that after entering college, many students experience changes in their staple food consumption. For example, in southern China, where rice is the main staple food, students from northern regions, used to eating noodles, may change their eating habits accordingly³⁷. Moreover, the convenience and easy access to instant noodles and snacks encourage frequent consumption of these items by college students, particularly when under time constraints, which contrasts with their eating habits prior to arriving at college.

Additionally, as students become more health-conscious³⁸, many opt for healthier dietary choices to maintain optimal physical condition. This transition leads to an increased intake of fiber-rich foods, such as grains, cereals, and potatoes, while the consumption of fried and pickled foods tends to decrease.

To assess these changes, the study divided dietary changes into three categories: high-calorie to low-calorie food, low-fiber to high-fiber food, and high oil/salt to low oil/salt food. A 6-month tracking experiment was conducted to measure the impact of these changes on physical health. Key health indicators, including BP, BMI, lung capacity, and the 6MWT, were monitored. The results showed that reducing the intake of high-oil and high-salt foods was most effective in lowering blood pressure. High-salt foods contribute to excess sodium, which increases water retention, leading to elevated blood volume and higher BP^{39,40}. Additionally, high-fat diets, especially those rich in saturated and trans fats, contribute to atherosclerosis, increasing vascular resistance and raising BP further.

For BMI, lung capacity, and the 6MWT, the greatest improvements were seen when college students reduced their high-calorie food intake. Lowering daily calorie intake helped control or reduce body weight, leading to better BMI outcomes⁴¹. Excess weight negatively impacts lung capacity and performance in the 6MWT⁴². Thus,

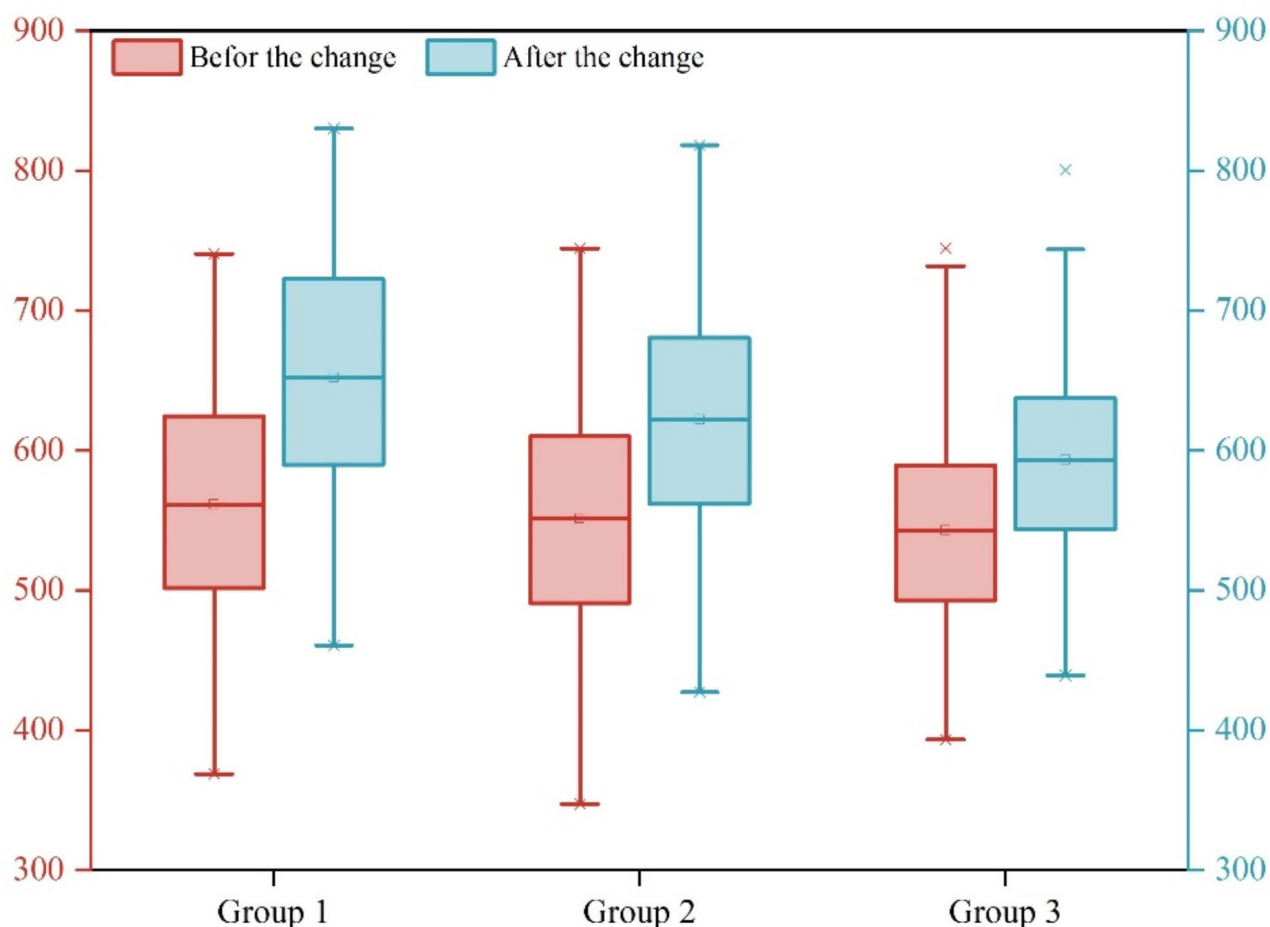


Fig. 8. 6MWT before and after two measurements (in m).

Test metrics	Group	Mean difference	SD	T	P
6MWT	Group1	90.51	6.33	127.96	<0.001
	Group2	70.71	6.15	102.90	<0.001
	Group3	50.37	5.96	75.59	<0.001

Table 10. Results of paired samples t-test for 6MWT.

reducing high-calorie intake was found to be the most effective way to improve physical fitness, followed by increasing fiber intake, and lastly, decreasing the consumption of high-oil and high-salt foods.

Recommendations

Based on the survey and analysis results, the study offers the following recommendations to improve the physical health of college students affected by changes in dietary habits after entering college:

(1) Cultivation of healthy eating habits.

Factors influencing college students' dietary choices include perceived behavioral control, dietary behavioral intention, social environment, and individual cognition. Perceived behavioral control refers to the individual's ability to perceive that they can make healthy dietary choices. When college students feel confident in their ability to choose healthy foods, they are more likely to do so. Dietary behavioral intention reflects health consciousness, where students with stronger intentions to eat healthily are more inclined to make healthy food choices. To foster these behaviors, health education should aim to raise awareness of healthy eating and enhance students' sense of autonomy and control. Both schools and families should encourage the establishment of healthy eating habits through positive reinforcement rather than coercion⁴³. Providing healthy recipes and allowing flexibility in food choices will help students adapt to and voluntarily choose a healthier diet over time.

(2) Improvement of dietary structure.

College students should develop a balanced meal plan that ensures the intake of adequate nutrients on a daily basis. High-calorie foods are associated with weight gain and increased BMI. Therefore, students should reduce the consumption of high-sugar and high-fat foods and prioritize low-calorie, nutrient-dense options such as fruits, vegetables, whole grains, and lean meats. Dietary fiber helps increase satiety, control body weight, promote gut health, and enhance lung capacity and athletic performance. Conversely, diets high in oil and salt contribute to elevated blood pressure and compromised cardiovascular health. Reducing the intake of such foods can improve cardiorespiratory fitness.

(3) Supportive environment for healthy eating.

Colleges should foster healthier food environments by reducing the availability of foods high in oil, salt, and sugar, while increasing access to healthier options such as fresh fruits, vegetables, and whole grains⁴⁴. Additionally, broader social, school, and family support systems should promote healthy eating among college students. A supportive atmosphere can be cultivated through educational campaigns, healthy eating activities, and community engagement, encouraging students to make more nutritious dietary choices.

Limitations

This study has several limitations. Firstly, the findings and the structural equation modeling of eating habit choices are based on self-reports from college students, which can be somewhat subjective. Social desirability bias is a key issue in self-reported data, as participants may not always provide honest or accurate responses regarding their behavioral intention⁴⁵. This may affect the reliability of the data on dietary changes and health outcomes. Secondly, the participants in the study were from a local group, which limits the generalizability of the findings. The results of the study may not be applicable to other populations, as dietary habits and health behaviors can vary greatly across regions and cultures. Finally, this paper tests college students' physical health using only a few indicators, such as BP and BMI, and does not reflect the effects of diet on other aspects of their physical fitness.

Conclusion

College students' physical health has long been a significant concern for society, as this period marks a crucial stage for developing physical fitness and establishing lifelong healthy habits. With evolving nutritional needs and social dynamics, maintaining balanced and healthy eating habits becomes essential. However, upon entering college, students often undergo inevitable changes in their eating habits due to factors like living away from home, which can lead to shifts in their physical condition.

This study examines changes in college students' dietary habits through the framework of the TPB. By utilizing the Motivation and Frequency of Dietary Habit Change Questionnaire, the research identified the primary motivations behind students' dietary choices. The study also developed a structural equation model, which highlighted perceived behavioral control and dietary behavioral intention as the key factors influencing dietary decisions. Findings from the dietary frequency questionnaire revealed three significant changes in dietary habits after students entered college: shifts in the consumption of high-calorie foods, increased intake of dietary fiber, and reduced consumption of foods high in oil and salt.

Through a follow-up survey on dietary changes, the results indicated that the most significant improvement in physical health was observed from reducing high-calorie foods, which enhanced health by 7.5%. Increasing dietary fiber intake resulted in a 5.68% improvement, while reducing the intake of high-oil and high-salt foods led to a 5.48% improvement. Additionally, the study underscores the importance of regularly monitoring and recording key health indicators, such as blood pressure (BP) and body mass index (BMI), to enable individuals to adjust their diets in real-time and maintain optimal health. Furthermore, the influence of external environments—such as schools, families, and broader social contexts—plays a crucial role in shaping dietary choices. Providing positive social support and creating a healthy eating environment are essential for fostering good eating habits among college students.

Data availability

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

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Author contributions

Y.Z wrote the main manuscript text and completed all work. All authors reviewed the manuscript.

Declarations

Competing interests

The authors declare no competing interests.

Institutional review board statement

The study was approved by the University Human Research Ethics Committee. Our research is exempt from formal ethical review in China. According to the Ethical Review Measures for Life Science and Medical Research Involving Human Beings (Article 32), the use of anonymous data does not require review. Therefore, our research was approved, but without an approval number.

Informed consent

Informed consent was obtained from all subjects involved in the study.

Additional information

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