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Habitual Physical Activity and Suboptimal Health Status Among College Students

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Abstract: Objective: This study explored the relationship between regular exercise and sub-health status among college students, with the aim of providing evidence for exercise promotion and health education in colleges and universities. **Methods:** Based on questionnaire data from 1,091 college students in Zhuhai, Guangdong Province, the Physical Activity Rating Scale and the Sub-Health Measurement Scale were used as the main instruments. Descriptive statistics, Spearman correlation analysis, and linear regression analysis were conducted to examine the relationship between regular exercise and sub-health status. **Results:** Correlation analysis showed that physical activity level was significantly positively correlated with the total sub-health score ($r = 0.449$, $p < 0.001$), as well as with the scores of physical sub-health, psychological sub-health, and social sub-health. Regression analysis showed that physical activity level significantly and positively predicted the total sub-health score ($\beta = 0.549$, $t = 21.697$, $p < 0.001$, $R^2 = 0.302$). **Conclusion:** Regular exercise is closely associated with sub-health status among college students. The higher the level of physical activity, the better the health status and the lower the degree of sub-health. Colleges and universities should pay attention to insufficient exercise among students and promote long-term, stable exercise habits through the optimization of physical education courses, the construction of campus sports environments, and health education guidance.

Keywords: Regular Exercise; Physical Activity; Sub-Health Status; Health Promotion

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1. Introduction

The university stage is an important period during which individuals transition from adolescence to early adulthood. Compared with secondary school, college students face obvious changes in learning patterns, daily routines, interpersonal communication, and self-management. After entering university, some students leave the direct supervision of their families, and their sleep schedules, eating habits, and exercise habits may be more easily influenced by academic tasks, electronic media use, social activities, and employment pressure. Without stable health behaviors, long-term fatigue, decreased sleep quality, mood fluctuations, reduced attention, and difficulties in social adaptation may gradually accumulate and manifest as sub-health status. Sub-health is not equivalent to a clearly diagnosed disease; rather, it is a transitional state between health and disease, usually characterized by declines in physical, psychological, and social functioning. Therefore, attention to sub-health status among college students can help universities carry out early health interventions before the onset of disease.

In recent years, insufficient physical activity among college students has become an important issue in university health

education. Existing research has indicated that college students' physical activity levels are affected by multiple factors, including personal motivation, environmental conditions, time arrangements, and campus support [1]. A systematic review of physical exercise among Chinese college students also found that academic pressure, facility conditions, insufficient exercise guidance, and gender differences may influence students' participation in exercise [2]. Although university campuses usually provide certain sports resources, whether college students can develop continuous and stable exercise habits is still constrained by multiple practical factors.

Regular exercise is an important behavioral means of maintaining physical and mental health among college students. Physical activity has been defined as any bodily movement produced by skeletal muscles that results in energy expenditure, whereas exercise refers to planned, structured, and repetitive physical activity performed to maintain or improve physical fitness [3]. In the present study, regular exercise is mainly reflected by physical activity level, which comprehensively considers exercise intensity, duration, and frequency. Compared with occasional physical activity, regular exercise emphasizes continuity, stability, and repeatability. Previous studies have shown that physical activity can not only improve physical fitness but may also promote overall health by relieving stress, improving sleep, regulating emotions, and enhancing self-efficacy [4–6].

Recent research has further supported the relationship between physical activity and health among college students. A study of undergraduate students found that a higher level of overall physical activity was associated with better mental health, and leisure-time physical activity played an important role in reducing mental health risks [5]. A study among Chinese college students found that higher physical fitness was associated with lower scores for psychological problems, suggesting that students with low physical fitness require greater attention in university health promotion [7]. Research based on college students in Zhuhai also indicated that insufficient physical activity was associated with physical and psychological health risks, and that increasing physical activity is an important direction for campus health promotion [8].

Compared with general health or mental health, sub-health status can better reflect non-disease-related health loss in college students' daily lives. Sub-health may manifest as physical fatigue, perceived decline in organ function, emotional instability, reduced cognitive efficiency, decreased social activities, and weakened social adaptation. Research on Tibetan college students in high-altitude regions found that students with shorter periods of moderate-to-vigorous physical activity had a higher risk of psychological sub-health [9]. Research on adolescents' psychological sub-health also showed a negative relationship between physical activity and psychological sub-health, and physical activity may improve psychological sub-health by enhancing self-control and reducing mobile phone addiction [10]. These findings jointly suggest that insufficient exercise is not only related to disease risk but may also be closely associated with early health problems such as sub-health, psychological distress, and reduced quality of life.

In the university context, the relationship between regular exercise and sub-health status is especially worthy of attention. On the one hand, college students face multiple pressures related to academics, interpersonal relationships, and employment, and sub-health problems may covertly affect their learning efficiency, social adaptation, and quality of life. On the other hand, exercise intervention is relatively safe, low-cost, and highly operable, and it can be promoted through physical education courses, club activities, campus sports facilities, and health education. Clarifying the relationship between regular exercise and sub-health status among college students will help universities improve students' health from the perspective of exercise promotion.

Based on the above background, this study used original survey data and focused only on two variables: regular exercise and sub-health status among college students. It aimed to answer two questions: first, whether college students' regular exercise level is significantly associated with sub-health status; and second, whether regular exercise can significantly predict college students' sub-health status. Through this analysis, the present study seeks to further clarify the role of regular exercise in improving sub-health among college students and to provide a reference for exercise-based health education and sub-health prevention in colleges and universities.

2. Methods

2.1 Participants

This study adopted a questionnaire survey method, and the participants were college students from universities in Zhuhai, Guangdong Province. Participants were recruited through on-campus announcements, student WeChat groups, QQ groups, and other online and offline channels. The inclusion criteria were as follows: aged 18 to 25 years, enrolled as full-time undergraduate students in Zhuhai, and voluntarily participating in the study after providing informed consent. The exclusion criteria were the presence of clearly diagnosed physical or mental disorders and experience of major traumatic events within the past three months.

A total of 1,176 questionnaires were distributed, and 1,091 valid questionnaires were ultimately recovered, with an effective response rate of 92.77%. Among the participants, 486 were male, accounting for 44.55%, and 605 were female, accounting for 55.45%. There were 356 only children, accounting for 32.63%, and 735 non-only children, accounting for 67.37%. Regarding place of origin, 510 students were from urban areas, accounting for 46.75%, and 581 were from rural areas, accounting for 53.25%. In terms of grade, 436 were freshmen, accounting for 39.96%; 274 were sophomores, accounting for 25.11%; 216 were juniors, accounting for 19.80%; 148 were seniors, accounting for 13.57%; and 17 were fifth-year students, accounting for 1.56%. The sample covered college students of different genders, grades, and academic backgrounds, and thus could reasonably reflect the basic situation of college students in Zhuhai universities.

2.2 Measures

2.2.1 Physical Activity Rating Scale

The level of regular exercise was measured using the Physical Activity Rating Scale [11]. This scale mainly evaluates individuals' physical activity from three aspects: exercise intensity, exercise duration, and exercise frequency. The exercise amount score is calculated jointly from exercise intensity, exercise time, and exercise frequency, with higher scores indicating a greater amount of exercise. According to the scoring standard, an exercise amount score of 19 or below indicates a low level of physical activity, a score of 20-42 indicates a moderate level of physical activity, and a score of 43 or above indicates a high level of physical activity. Because the scale contains relatively few items and has a special scoring method, the original study did not conduct Cronbach's α reliability analysis for this scale.

2.2.2 Sub-Health Measurement Scale

Sub-health status was measured using the Sub-Health Measurement Scale Version 1.0 (SHMS V1.0) [12]. The scale includes three subscales: physical sub-health, psychological sub-health, and social sub-health, with a total of 39 items. Some items require reverse scoring. The total score ranges from 35 to 175, and higher scores indicate better health status and lower levels of sub-health. In the present study, Cronbach's α coefficient for the Sub-Health Measurement Scale was 0.883, indicating good internal consistency.

2.3 Data Processing

SPSS 26.0 was used for data analysis in this study. First, the questionnaire data were organized and invalid questionnaires were excluded. Second, descriptive statistics were conducted for physical activity level and sub-health scores. Because the physical activity level and sub-health scores in the original study were mainly described using medians and quartiles, the present study also reports the main indicators in the form of M (P25, P75). Third, Spearman correlation analysis was used to examine the correlations between physical activity level and the total sub-health score and its three dimensions. Finally, linear regression analysis was used to further examine the predictive effect of physical activity level on sub-health status. The statistical significance level was set at $\alpha = 0.05$.

3. Results

3.1 Descriptive Results for Regular Exercise and Sub-Health Status Among College Students

The descriptive statistics showed that the physical activity level score of college students was 12 (6, 24), indicating that the overall exercise level of the participants was relatively low. According to the grouping standard of the Physical Activity Rating Scale, 738 students had a low level of physical activity, accounting for 67.6%; 263 students had a moderate level of physical activity, accounting for 24.1%; and 90 students had a high level of physical activity, accounting for 8.3%. These results indicate that more than two-thirds of the students in the sample were in a low-exercise state, suggesting that insufficient exercise among college students is relatively prominent.

The total score on the Sub-Health Measurement Scale was 108 (101, 118). Specifically, the physical sub-health score was 45 (42, 49), the psychological sub-health score was 36 (34, 41), and the social sub-health score was 27 (22, 32). Because higher scores on this scale indicate better health status, the current sample's total sub-health score was at an intermediate level, suggesting that college students still had certain risks of sub-health.

Table 1: Descriptive results for physical activity level and sub-health status among college students (N = 1,091)

Variable	*P*25	*P*50	*P*75
Physical activity level	6.0	12.0	24.0
Total sub-health score	101.0	108.0	118.0
Physical sub-health	42.0	45.0	49.0
Psychological sub-health	34.0	36.0	41.0
Social sub-health	22.0	27.0	32.0

Table 2: Distribution of physical activity among college students (N = 1,091)

Physical activity level	*n*	Percentage
Low physical activity	738	67.6%
Moderate physical activity	263	24.1%
High physical activity	90	8.3%

3.2 Correlation Analysis of Regular Exercise and Sub-Health Status

Spearman correlation analysis showed that physical activity level was significantly positively correlated with the total sub-health score ($r = 0.449$, $p < 0.001$). Because higher scores on the Sub-Health Measurement Scale indicate better health status, this result suggests that the higher the level of physical activity among college students, the better their overall health status and the lower their degree of sub-health.

Further analysis of different dimensions of sub-health showed that physical activity level was significantly positively correlated with the physical sub-health score ($r = 0.273$, $p < 0.001$), the psychological sub-health score ($r = 0.437$, $p < 0.001$), and the social sub-health score ($r = 0.322$, $p < 0.001$). Among these correlations, the relationship between physical activity level and psychological sub-health was the strongest, suggesting that regular exercise may be closely related to college students' emotional state, cognitive efficiency, and psychological adaptation.

Table 3: Correlation analysis between physical activity level and sub-health status (N = 1,091)

Variable	Correlation coefficient with physical activity level
Physical sub-health	0.273^{***}
Psychological sub-health	0.437^{***}
Social sub-health	0.322^{***}
Total sub-health score	0.449^{***}

Note: *** $p < 0.001$. Higher sub-health scores indicate better health status.

3.3 Predictive Effect of Regular Exercise on Sub-Health Status

To further examine the predictive effect of regular exercise on sub-health status among college students, linear regression analyses were conducted with physical activity level as the predictor and the total sub-health score and its three dimensions as outcome variables. The results showed that physical activity level significantly and positively predicted the total sub-health score ($\beta = 0.549$, $t = 21.697$, $p < 0.001$, $R^2 = 0.302$), indicating that physical activity level explained 30.2% of the variance in the total sub-health score.

At the dimensional level, physical activity level significantly and positively predicted the physical sub-health score ($\beta = 0.334$,

$t = 11.688$, $p < 0.001$, $R^2 = 0.111$), psychological sub-health score ($\beta = 0.550$, $t = 21.717$, $p < 0.001$, $R^2 = 0.302$), and social sub-health score ($\beta = 0.379$, $t = 13.405$, $p < 0.001$, $R^2 = 0.142$). Among these dimensions, the predictive effect of physical activity level on psychological sub-health was the strongest, indicating that the relationship between regular exercise and college students' psychological health status was especially prominent.

Table 4: Regression analysis of physical activity level predicting sub-health status (N = 1,091)

Outcome variable	R^2	F	β	t
Total sub-health score	0.302	470.753	0.549	21.697***
Physical sub-health	0.111	136.615	0.334	11.688***
Psychological sub-health	0.302	471.615	0.550	21.717***
Social sub-health	0.142	179.686	0.379	13.405***

Note: *** $p < 0.001$.

4. Discussion

4.1 College Students' Regular Exercise Level Was Generally Low

This study found that the median physical activity level score among college students was 12, and students with low physical activity accounted for 67.6% of the sample, indicating that most students had insufficient exercise. This result is generally consistent with recent research on insufficient physical activity among college students. Previous studies have indicated that academic pressure, lack of time, facility limitations, insufficient exercise guidance, and low exercise motivation are important factors affecting physical exercise among college students [2,1].

The insufficient exercise level among college students has certain practical causes. After entering university, students' learning and life arrangements become more autonomous, and the constraints of physical education courses are reduced. If students lack self-management ability, their exercise frequency may easily decline. At the same time, coursework, examinations, internships, and employment preparation may also reduce the time available for exercise. Some students may also be less willing to participate because of a lack of exercise partners, sports resources, or exercise skills. Therefore, increasing the exercise level of college students cannot rely only on individual self-awareness; universities also need to provide support in terms of curricula, facilities, student clubs, and institutional environments.

4.2 Regular Exercise Was Significantly Associated with Sub-Health Status

The results showed that physical activity level was significantly positively correlated with the total sub-health score. Because higher scores on the Sub-Health Measurement Scale indicate better health status, it can be inferred that the higher the level of regular exercise, the lower the degree of sub-health among college students. This suggests that exercise is not only related to improvements in physical function but also associated with students' psychological state and social adaptation.

In terms of potential mechanisms, regular exercise may influence sub-health status in several ways. First, exercise can improve cardiopulmonary function, muscle strength, sleep quality, and fatigue, thereby alleviating physical sub-health. Second, exercise can promote positive emotions and reduce anxiety and stress, thus exerting a protective effect on psychological sub-health. Third, physical activity has a certain social interaction function; group exercise and club training can increase opportunities for peer communication and enhance social adaptation.

In this study, the relationship between physical activity level and psychological sub-health was particularly prominent, suggesting that regular exercise is important for improving the psychological state of college students. This finding is consistent with studies on the relationship between physical activity and mental health among college students [5,7]. For college students facing academic, interpersonal, employment, and self-development pressures, regular exercise is a low-cost and easily promoted way to relieve stress.

4.3 Regular Exercise Significantly Predicted Sub-Health Status

The regression analysis showed that physical activity level significantly and positively predicted the total sub-health score,

indicating that regular exercise is an important behavioral factor closely related to sub-health status among college students. Although a cross-sectional study cannot directly infer causality, the positive effect of regular exercise on health status is reasonably supported by existing research and theory.

Further analysis showed that physical activity level predicted physical, psychological, and social sub-health dimensions. Physiologically, exercise helps improve physical function and reduce fatigue and somatic discomfort. Psychologically, exercise may improve psychological status through emotion regulation, stress buffering, and enhanced self-efficacy. Socially, participation in exercise can increase peer interaction and collective belonging. Related studies have also shown that insufficient physical activity is associated with an increased risk of psychological sub-health among college students [9,10].

At the same time, sub-health status is influenced by many factors, such as sleep, diet, academic pressure, interpersonal relationships, and electronic device use. This paper analyzed only two variables, namely regular exercise and sub-health status; therefore, sub-health cannot be attributed entirely to insufficient exercise. A more reasonable explanation is that regular exercise is an important correlate of sub-health status among college students and is also a relatively accessible entry point for health promotion intervention.

4.4 Implications for Health Promotion in Colleges And Universities

First, colleges and universities should incorporate physical activity into sub-health prevention systems. Health screening, physical fitness assessment, and mental health education can be combined to identify students with insufficient exercise and a high risk of sub-health in a timely manner. Second, the accessibility of physical activity should be improved. Universities can extend the opening hours of sports venues, increase low-threshold sports activities such as walking, jogging, yoga, badminton, and rope skipping, and form stable exercise support networks through classes, dormitories, and student clubs. Third, the regularity of exercise should be emphasized. Health promotion among college students should not focus only on high-intensity exercise; rather, students should be encouraged to develop stable and sustainable exercise habits. For students who have long lacked exercise, moderate- to low-intensity exercise can begin with 20-30 minutes per session, 2-3 times per week, followed by a gradual increase in exercise volume. Recent research has also emphasized the importance of bridging the gap between evidence and practice in promoting physical activity among college-aged students [13].

5. Limitations and Future Directions

Based on cross-sectional questionnaire data, this study can indicate significant correlations and predictive relationships between regular exercise and sub-health status among college students; however, several limitations remain. First, the cross-sectional design cannot strictly determine causal direction. Although the results showed that higher physical activity level was associated with better sub-health status, it is also possible that students with better health status are more willing to participate in exercise. Future studies may use longitudinal tracking or exercise intervention experiments to further test the relationship between the two variables. Second, this study used self-report scales to assess exercise behavior, which may be affected by recall bias and subjective judgment. Future studies could combine data from fitness trackers, mobile phone activity records, or campus exercise platforms to more objectively record college students' daily steps, moderate-to-vigorous physical activity duration, and sedentary time.

Conclusion

This paper analyzed the relationship between regular exercise and sub-health status among college students. The results showed that the overall exercise level of college students was relatively low, with a relatively high proportion of students reporting low physical activity. Physical activity level was significantly positively correlated with the total sub-health score and with the physical, psychological, and social dimensions of sub-health. Physical activity level also significantly and positively predicted the total sub-health score and scores on all dimensions. Because higher scores on the Sub-Health Measurement Scale indicate better health status, it can be concluded that the higher the level of regular exercise, the better the health status of college students and the lower their degree of sub-health.

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Conflict of Interests

The authors declare that there is no conflict of interest regarding the publication of this paper.

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