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Study on the correlation between physical exercise and sleep quality of normal university students

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Abstract: This study explores the correlation between physical exercise and sleep quality among college students in normal universities, providing reference for improving the level of physical exercise and enhancing sleep quality. The study used a stratified cluster sampling method and surveyed 240 college students from two normal universities in Guangxi using the Physical Activity Readiness Survey (PARS-3) and the Pittsburgh Sleep Quality Index (PSQI) questionnaires. The results show that physical exercise is higher in male students, rural students, and third-year students compared to other types of students within the group (t/F values of 2.03, 6.62, and 6.87, $P<0.05$). Sleep quality scores are higher in female students and fourth-year students compared to other categories within the group (t/F values of -2.23 and 5.42, $P<0.05$). The correlation coefficient between physical exercise and sleep quality is $r=-0.259$ ($P<0.01$), and the regression model indicates that physical exercise has a significant negative predictive effect on sleep quality ($\beta=-0.25$, $P<0.01$). In conclusion, there are significant differences in physical exercise among college students in normal universities based on gender, hometown, and grade. There are also significant differences in sleep quality among college students in normal universities based on gender and grade. Furthermore, there is a significant negative correlation between physical exercise and sleep quality. It is recommended that schools encourage students to participate in physical exercise to improve their sleep quality and achieve physical and mental health.

1. Introduction

In recent years, with the continuous development of the economy and the rapid advancement of technological automation, people's lives have become increasingly hectic and fast-paced[1]. However, this fast-paced lifestyle has had a series of negative impacts on people's health, especially among college students, where the condition of sleep deprivation has attracted widespread attention in society. In China, 44% of adults have sleep disorders, and even more concerning is that the incidence of insomnia among college students is as high as 39.4%[2]. Among college students, sleep problems often manifest as frequent awakenings at night, difficulty falling asleep, or frequent dreaming[3,4]. Over time, poor sleep can lead to abnormal brain cortex function, directly affecting physical and intellectual development, and seriously impacting the learning and quality of life of college students[5]. Research has indicated that there is a certain correlation between the sleep

quality of college students and overweight and obesity. Physical exercise is an effective way to improve obesity and overweight and has a certain promoting effect on improving sleep quality[6]. Teacher training institutions, as the cradle of cultivating teachers, have the mission of future educational development. The health issues of college students in teacher training institutions should be given due attention. However, currently, there is a relative lack of research on the relationship between physical exercise and sleep quality among teacher training institution students. Therefore, this study aims to investigate the relationship between physical exercise and sleep quality among college students in teacher training institutions through a survey, and propose reasonable suggestions to provide more specific guidance for the health of college students in teacher training institutions, thereby helping them develop good lifestyle habits and improve their physical and mental health.

2. Objects and methods

2.1 Research object

This study used a stratified cluster sampling method to select students from two teacher training universities in Guangxi Province as research subjects. In order to ensure sample diversity, we stratified the population according to different grades, dividing it into four levels. One class was randomly selected from each grade, and four classes were selected from each school, making a total of eight classes. All the students selected were surveyed online, and the plan was to collect 286 questionnaires. In actuality, 269 questionnaires were collected, and 29 incomplete questionnaires were deleted, leaving 240 valid questionnaires, with an effective rate of 89.21%. Inclusion criteria: undergraduate students, good psychological and physical conditions, and voluntary participation in this survey. Exclusion criteria: non-undergraduate students, those with severe physiological or psychological illnesses unsuitable for participation in this survey. These accurate selection criteria help ensure the effectiveness and reliability of the research.

2.2 Method

2.2.1 Basic Information

Includes gender, source of students and grade.

2.2.2 Sleep Quality Scale

The Pittsburgh Sleep Quality Index (PSQI) scale [7] was used as the research tool. PSQI is a commonly used scale for evaluating sleep quality by scholars. The scale consists of 19 questions, including 7 factors: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. The cumulative scores of each factor make up the total score of the Pittsburgh Sleep Quality Index scale, with a range of 0 to 21. A higher score indicates poorer sleep quality. A total score of ≥8 on the PSQI is considered as low sleep quality. The Cronbach's α coefficient of the scale in this study is 0.734, indicating good reliability.

2.2.3 Physical Exercise Scale

This physical exercise scale was revised and validated by Liang Deqing et al. [8] to assess individuals' physical exercise in the past month. It measures exercise intensity, exercise time, and exercise frequency. Each dimension is scored on a Likert 5-point scale, with intensity and frequency

scored from 1 to 5, and time scored from 0 to 4. The total exercise amount is calculated by multiplying the scores of the three dimensions, i.e., "Exercise Amount = Intensity × Time × Frequency." The final score ranges from 0 to 100, with a higher score indicating a higher exercise amount. Based on the total score, individuals' exercise amounts are divided into three levels: "Low exercise amount" with a total score less than or equal to 19, "Moderate exercise amount" with a total score between 20 and 42, and "High exercise amount" with a total score greater than or equal to 43. Multiple studies have shown that PARS-3 has reliability in assessing college students' exercise amount. The Cronbach's α coefficient of the scale in this study is 0.76, indicating good reliability.

2.3 Statistical Methods

Data input and effective organization were performed using Excel, and invalid data were excluded. Data processing and analysis were conducted using SPSS 23.0. One-way analysis of variance (ANOVA) and independent samples t-tests were used to analyze the relationship between demographic characteristics and physical exercise and sleep quality. Pearson correlation and linear regression analysis were used to analyze the correlation between physical exercise and sleep quality in college students. The significance level was set at $\alpha=0.05$.

3. Results

3.1 Comparison of physical exercise of college students in different groups

The results of physical exercise indicate that male students have higher scores in physical exercise than female students ($P<0.05$), which is statistically significant. Rural students have higher scores in physical exercise than urban and metropolitan students ($P<0.05$), which is statistically significant. Third-year college students have higher scores in physical exercise than students in other three grades ($P<0.05$), and this difference is statistically significant (show as table 1).

Table 1: Comparison of physical exercise of college students in different groups

Group		Quantity	Value	Physical Exercise
Gender	Male	89		29.56±24.04
	Female	151		23.24±22.79
			T	2.03
			p	0.043
Source of students	Village	87		32.64±27.35
	Town	90		20.75±16.89
	City	63		22.74±23.55
			F	6.62
			p	0.002
Grade	1	42		16.42±18.90
	2	61		28.86±23.78
	3	64		34.06±26.12
	4	73		20.68±20.05
			F	6.87
			P	0.000
Note: $^{*}P<0.05$, $^{**}P<0.01$, $^{***}P<0.001$				

3.2 Comparison of sleep quality of college students in different groups

Table 2 shows that the sleep quality score of females is higher than that of males (P<0.05), indicating that the sleep quality of male students is better than that of female students. There is no significant difference in sleep quality scores among students from different hometowns (P>0.05), but there is a significant difference in sleep quality scores among students in different grades (P<0.05). Among them, fourth-year college students have the highest sleep quality score and the worst sleep quality.

Table 2: Comparison of sleep quality of college students in different groups

Group		Quantity	Value	Sleep Quality
Gender	Male	89		6.12±4.02
	Female	151		7.52±5.07
			T	-2.23
			p	0.026
Source of students	Village	87		6.60±4.65
	Town	90		6.58±4.38
	City	63		8.15±5.24
			F	2.53
			p	0.081
Grade	1	42		5.23±4.16
	2	61		6.55±4.45
	3	64		6.71±4.18
	4	73		7.00±4.75
			F	5.42
			P	0.001
Note: *P<0.05, **P<0.01, ***P<0.001				

3.3 Correlation analysis

Table 3: Correlation analysis between physical exercise and mobile phone addiction among college students

	Physical Exercise	Sleep Quality
Physical Exercise	1	-0.259**
Sleep Quality	-0.259**	1
Note: *P<0.05, **P<0.01, ***P<0.001		

Table 4: Linear regression with sleep quality as the dependent variable

Dependent variable	Independent variable	Partial Regression Coefficient				Adjusted R^2	F	P
		Coefficient	SE	t	P			
PSQI	PARS-3	-0.25	0.06	-4.12	0.00	0.16	17.05	<0.01
Note: PARS-3: Physical Exercise; PSQI: total score of sleep quality.								

The Pearson correlation analysis shows that the correlation coefficient between physical exercise and sleep quality of students in normal colleges is r=-0.259 (P<0.01), indicating a significant negative correlation. The regression model shows that β=-0.25, adjusted R2=0.16, F=17.05 (P<0.01), which means that as physical exercise increases, the sleep quality score of college

students decreases, indicating a gradual improvement in sleep quality (show as tables 3 and 4).

4. Discuss

This study investigated the physical exercise and sleep quality of college students in Guangxi Normal Colleges and Universities, and discovered the underlying mechanisms between physical exercise and sleep quality. It aims to provide a basis for improving the physical exercise level and sleep quality of college students in the future, with the goal of promoting their physical health. The research results showed that male college students had significantly higher levels of physical exercise compared to female students, which is consistent with previous research[9]. Compared to female college students, male students had higher enthusiasm for participating in sports, and their muscle strength and cardiovascular health were better. They were more likely to engage in high-intensity physical activities, thus increasing their level of physical exercise. In terms of different grade levels, first-year students had the lowest level of physical exercise due to being new to the school environment and having limited time and frequency for physical exercise. Compared to rural college students, urban college students tended to spend more time in sedentary activities, which also contributed to their lower level of physical exercise[10].

In terms of sleep quality, male students had better sleep quality than female students, which is related to their better psychological health[11]. Additionally, fourth-year students had the highest sleep scores, indicating the poorest sleep quality[12]. This is consistent with the research results of Rongyu Huang, as fourth-year students face multiple pressures such as graduation design, job selection, and further education, which can lead to anxiety and poorer sleep quality. The correlation and regression analysis confirmed that physical exercise has a positive impact on improving the sleep quality of college students in normal colleges and universities. Through participating in physical exercise activities, college students can consume excess energy, reduce anxiety and stress, promote blood circulation, improve metabolism, and thus improve sleep quality.

5. Conclusion

There is a close relationship between physical exercise and sleep quality among college students in normal colleges and universities, but there are differences among different groups. Based on these results, it is recommended to develop personalized health intervention plans to meet the needs of different groups and improve the overall health level of college students. Future research can conduct intervention experiments to find further methods to improve the physical exercise and sleep quality of college students.

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