

# The status of college students' sleep quality and its relationship with internet addiction, anxiety and depression

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## Research article

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# Abstract

**Background:**The problem of the decline of college students' sleep quality has gradually become a major factor affecting the physical and mental health of college students. The present study mainly explored the status of college students' sleep quality and its relationship with internet addiction, anxiety and depression.

**Methods:**A sample of 5794 college students( $18.89 \pm 1.10$ ) from two randomly selected college from Anhui in China completed the measurement of sleep quality,Internet addiction,anxiety and depression.Sleep quality was measured by the Pittsburgh Sleep Quality Index (PSQI).

**Results:**The total detection rate of sleep disorder was 31.30% and the average score of PSQI was  $6.27 \pm 2.62$  in 5794 college students. Sleep disorders rate of females( $\chi^2 = 76.503, P < 0.001$ ) and PSQI average scores ( $t = -11.915, P < 0.001$ ) were significantly higher than those of males. Students in non-medical colleges had higher sleep disorders rate ( $\chi^2 = 6.880, P < 0.001$ ) and PSQI average scores ( $t = -3.668, P < 0.001$ ) than medical college students.The sleep quality of college students was positively correlated with internet addiction ( $r = 0.197, P < 0.05$ ), anxiety ( $r = 0.227, P < 0.05$ ) and depression ( $r = 0.268, P < 0.05$ ). The probability of females having sleep disorders was 1.726 times than that of males(OR = 1.726,  $P < 0.001$ ).Third grade students were more prone to have sleep disorders(OR = 1.240,  $P < 0.05$ ).Internet addiction (OR = 1.336,  $P < 0.001$ ), anxiety (OR = 1.695,  $P < 0.001$ ) and depression (OR = 1.964,  $P < 0.001$ ) were risk factors of sleep quality. Extroverted personality was a protective factor (OR = -0.689,  $P < 0.001$ ).

**Conclusion:**These findings suggested that college students had a high rate of sleep disorders. Schools and related departments should take appropriate measures to improve the sleep quality and promote physical and mental health of college student. **Keywords :** Sleep quality,College student,Internet addiction, Anxiety, Depression

## 1 Background

Sleep is an important part of the rhythm of human life, and it is the basic necessities for satisfying physical and mental health [1], accounting for about one-third of a person's life.Sleep disorders is defined as abnormal sleep quality or some clinical symptoms during sleep, such as insomnia or sleepiness or poor sleep quality.It is also a manifestation of normal rhythmic alternation disorders of sleep and wakefulness. Silber MH [2]believed that sleep disorders involve a wide range of diseases ranging from obstructive sleep apnea syndrome to chronic insomnia.Early research showed poor sleep may reduce the chance of physical relief from physical symptoms and prolong or aggravate the disease process[3]. Moreover,current evidence indicates inadequate sleep and poor quality can affect peoples' optimal daytime functioning and are associated with risky behavior, accidents, increased mortality and decreased quality of life [4–5].There are also studies showing that sleep disorders are high risk factors for health outcomes such as schizophrenia, attention deficit hyperactivity disorder,autoimmune encephalitis,hypertension,obesity and type 2 diabetes [6–9]. Therefore, in a broader context, insufficient sleep can seriously affect individual's health, well-being and safety.

Recent study found that the rate of sleep disorders is high.A study shows that the incidence of insomnia and daytime sleepiness was 29.83% and 17.00%, respectively [10]. In 2016, a study from Georgia revealed that the rate of poor sleep quality (PSQI>5) was 43%, and 41% of them had low sleep efficiency, 27.6% slept 6 hours or less, 10.6% taken sleep medication before going to bed and 26.8% had sleep maintenance problems [11]. A Chinese research showed that 22.41% of the students reported poor sleep quality [12]. Adequate sleep has become one of the recognized health standards,and sleep problems have become an important research hot-spot in psychology and physiology research at home and abroad.Therefore,the World Health Organization (WHO) has designated March 21st of each year as "World Sleep Day" since 2001 to remind people to pay attention to sleep health and improve life satisfaction.

Many studies showing that there are many factors that affect sleep quality,such as

stress, rumination, repetitive thinking, negative affect, depression and anxiety [13–14]. As a special group, college students in special periods of late adolescence and early adulthood face pressure from many aspects such as study, life and employment, so the quality of sleep directly affects their physical and mental health and learning efficiency.

The high rate of sleep disorders can lead to a growing health burden in modern society and has a serious impact on health-related quality of life of college students. Thus,the sleep disorders of college students is one of the important public health problems. Although there are many studies of the relationship between sleep disorders and diseases, the importance of prevention and control of sleep disorders in college students is often overlooked.To fill this gap, this study conducted a questionnaire survey of college students to

assess the current status of college students' sleep quality and related influencing factors, in order to provide a scientific basis for improving the quality of sleep of college students.

## 2 Materials And Methods

### 2.1 Study sample

A total of 5794 college students were surveyed, including 3738 (64.5%) in Wannan Medical College and 2056 (35.5%) in An-Hui Engineering University. The average age of subjects was  $18.89 \pm 1.10$  years old. Among them, 2831 (48.9%) were male and 2963 (51.1%) were female. There were 4335 (74.8%), 928 (16.0%), 531 (9.2%) students in the first, second and third grade, respectively. 2145 (37.0%) of them are the only child. Among these students surveyed, 1658 (28.6%) were introverted, 2283 (39.4%) were neutral, and 1853 (32.0%) were extroverted. There are 1156 (20.0%),

3860 (45.8%), 308 (26.1%) and 470 (8.1%) students subjectively believe that their academic achievement is bad, general, good and not clear, respectively. The number of students who were alienated, general and intimated with their parents were 79 (1.4%), 621 (10.7%) and 5094 (87.9%), respectively. (Table 1)

### 2.2 Procedure

The study was approved by the Psychological Research Ethics Committee of Wannan Medical College. Prior to the formal investigation, the investigators received training in a uniform manner, with a clear understanding of the purpose, method and importance of the survey. And informed consent was given to the students who were surveyed. During the completion of the questionnaire, the investigators informed them of the significance and confidentiality of the investigation and reminded them of the precautions.

### 2.3 Measures

#### 2.3.1 Demographic information

Participants were asked to answer information such as age, gender, whether they were only children, personality, academic achievement, relationship with parents, etc.

##### 2.3.2 PSQI (Pittsburgh Sleep Quality Index)

PSQI was established in 1989 by Buysse [15], a psychiatrist at the University of Pittsburgh, to evaluate clinical and basic research on sleep quality. The scale contains nineteen items and they generate seven "component" scores: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. The scale indicates that PSQI score  $> 5$  to distinguish good and poor sleep quality and the sensitivity and specificity is 89.6% and 86.5%, respectively [15]. But Liu X C et al [16] discovered that PSQI score  $> 7$  to distinguish normal subjects from patients with sleep quality problems and the sensitivity and specificity is 98.3% and 90.2%. This article adopts the method of Liu X C et al.

##### 2.3.3 IAS (Internet addiction scale)

IAS was established by Young K et al [17] to investigate the degree of use and dependence on the network. The scale has a total of 20 questions, the answer is "almost no" counts 0 points, "occasionally" counts 1 point, "Sometimes" counts 2 points, "often" counts 3 points, "always" counts 4 points. The total score was less than 40 points, then it was judged to be a normal user of the network. If the total score exceeds 40 points, it was judged to be indulged in the Internet.

##### 2.3.4 SDS (Self-rating Depression Scale)

SDS was developed by Zung WW et al [18] in 1965. And it is one of the scales used for counseling, screening for depressive symptoms and severity, and psycho-pharmacological research. The scale consists of 20 items in four levels: no or very little time, a small amount of

time, quite a lot of time, most or all of the time. Depression severity index = total score / 80. If the depression severity index was less than 0.5, then it was evaluated as no depression.

### 2.3.5 SAS (Self-rating Anxiety Scale)

SAS was compiled by Zung WW et al [19] in 1971 to assess subjective perceptions of subject anxiety. The scale consists of 20 items in four levels: no or very little time, a small amount of time, quite a lot of time, most or all of the time. The standard anxiety score (Y) = [rough total score (addition of 20 item scores) \* 1.25]. If the standard score of anxiety was less than 50 points, then it was evaluated as no anxiety.

## 2.4 Statistics

Epidata3.0 was used to input data, SPSS version 24.0 was used for data analysis. Firstly, the t test or F test were used to compare the average scores of the PSQI and seven components of different gender, grade and institution. Then, to analyze the factors of influence the sleep quality of college students by chi-square test. Next, to analyze the correlation between sleep quality and influencing factors through Pearson correlation. Finally, multivariate logistic regression analysis was used to analyze the regression coefficients of influencing factors of sleep quality.  $P < 0.05$  was considered as statistically significant.

## 3 Results

### 3.1 Comparison of PSQI and scores of different genders, grades and professional students

The average score of PSQI for college students was  $6.27 \pm 2.62$ , and the average score of PSQI of female was higher than that for male ( $t = -11.915$ ,  $P < 0.001$ ). Among the components of PSQI, the differences in the average scores of daytime dysfunction ( $t = -7.739$ ,  $P < 0.001$ ), habitual sleep efficiency ( $t = -12.339$ ,  $P < 0.001$ ) and sleep disturbances ( $t = -5.121$ ,  $P < 0.001$ ) were statistically significant. The average score of PSQI in non-medical colleges is slightly higher than that of medical colleges ( $t = -3.668$ ,  $P < 0.001$ ). Except sleep duration and daytime dysfunction, the differences of other components between two institutions were statistically significant. (Table 2).

### 3.2 Single factor analysis of factors influencing sleep quality

The total rate of sleep disorders of college was 31.3%. The rate of female was higher than male, and the difference was statistically significant ( $\chi^2 = 76.503$ ,  $P < 0.001$ ). The difference of the sleep disorders rate between the three grades was statistically significant ( $\chi^2 = 13.139$ ,  $P < 0.001$ ). Students who are not only children have higher rate of sleep disorders than only children ( $\chi^2 = 10.147$ ,  $P < 0.001$ ). Students in non-medical colleges have higher sleep disorders rates than medical college students ( $\chi^2 = 6.880$ ,  $P < 0.001$ ). The difference in the rate of sleep disorders of different personality was statistically significant ( $\chi^2 = 42.423$ ,  $P < 0.001$ ), and among them, the personality of highest sleep disorders rate is introverted. The difference of sleep disorders rate of different academic achievement was statistically significant ( $\chi^2 = 9.121$ ,  $P < 0.001$ ), and among them, the sleep disorders rate of bad academic achievement is highest. Students who are alienated from their parents have the highest rate of sleep disorders ( $\chi^2 = 8.666$ ,  $P < 0.001$ ). Students who are addicted to the Internet have higher sleep disorders rates than the students who use the Internet normally ( $\chi^2 = 84.880$ ,  $P < 0.001$ ). Students with anxiety ( $\chi^2 = 121.530$ ,  $P < 0.001$ ) or depression ( $\chi^2 = 121.530$ ,  $P < 0.001$ ) have higher sleep disorders rate than normal students ( $\chi^2 = 189.779$ ,  $P < 0.001$ ). (Table 3)

### 3.3 Correlation analysis between PSQI and various components and internet addiction, depression and anxiety

The total scores of college students' PSQI and various components and Internet addiction, anxiety and depression were tested by bivariate correlation. The sleep quality of college students was positively correlated with Internet addiction ( $r = 0.197$ ,  $P < 0.05$ ), anxiety ( $r =$

0.227,  $P < 0.05$ ) and depression ( $r = 0.268$ ,  $P < 0.05$ ). Except for few PSQI components, the rest are positively related to Internet addiction, depression and anxiety. (Table 4).

### 3.4 Stepwise regression analysis

According to the results of single factor analysis, according to the criteria of inclusion ( $\alpha = 0.05$ ) and exclusion ( $\beta = 0.10$ ), 10 variables including gender, grade, only child, institution type, personality, academic achievement, relationship with parents, Internet addiction, anxiety level and depression level entered the multivariate logistic regression equation. The results show, the probability of female having sleep disorders is 1.726 times than that of male [ $OR = 1.726$ , 95%  $CI(1.528 \sim 1.950)$ ,  $P < 0.001$ ]. Third grade students are more prone to sleep disorders [ $OR = 1.240$ , 95%  $CI(1.011 \sim 1.521)$ ,  $P < 0.05$ ]. Extroverted students are less prone to sleep disorders [ $OR = 0.689$ , 95%  $CI(0.591 \sim 0.802)$ ,  $P < 0.001$ ]. Internet addiction [ $OR = 1.336$ , 95%  $CI(1.181 \sim 1.512)$ ,  $P < 0.001$ ], anxiety [ $OR = 1.695$ , 95%  $CI(1.43 \sim 1.998)$ ,  $P < 0.001$ ], depression [ $OR = 1.964$ , 95%  $CI(1.706 \sim 2.261)$ ,  $P < 0.001$ ] are risk factors for sleep quality. (Table 5).

## 4 Discussion

The results of this study showed that the detection rate of sleep disorders was 31.3% and the average score of PSQI was  $6.27 \pm 2.62$  in 5974 college students. The rate of sleep disorders was higher than that of other studies in China [20], but lower than that of other studies in Brazil [21] and Australia [22]. And the average score of PSQI was higher than the research results of Bang Z et al [23]. These differences may be caused by different demographic characteristics or different definition criteria for sleep disorders.

The survey found that female students have higher sleep disorders rate and PSQI average scores than male students, and the results were the same as Concepcion T's [24] study. This may be caused by periodic fluctuations in female hormone levels that have a certain impact on sleep [25]. And female are inherently sensitive, when faced with negative life events such as stress, the reaction is more intense and leads to sleep disorders. Third grade students are more prone to sleep disorders, and this was the same as Wang L's [26] result of students in higher grades are more likely to be poor sleepers. Probably because the third grade is the transition period of relaxed study life and stressful society life. The third grade students have some confusion about whether the future is to work or continue to improve their studies. The study also shows students in non-medical colleges have higher sleep disorders rate and PSQI average scores than medical college students, however, Veldi M [27] believed that sleep problems are common in young medical students. It may be there are many secondary colleges in comprehensive universities, and the colorful activities of various clubs lead to students not being able to reasonably allocate study and sleep time.

Studies revealed that the sleep quality of college students was positively correlated with internet addiction, anxiety and depression, and these factors are all risk factors. The results were the same as Canan F's [28] and Qi F's [29] studies, because students who are addicted to the Internet waste a lot of sleep time, as well as, the most common symptom of patients with anxiety and depression is sleep problems, and anxiety patients are mainly difficult to fall asleep, and depressed patients are mainly sleep disorders. The worse the quality of sleep, the more obvious the anxiety and depression of college students so that the students with anxiety and depression have sleep disorders. In addition, the study also found that extroverted students have a good quality of sleep. Generally, an extrovert people has a good mentality and when they are under stress, they can cope calmly so that sleep quality will not be affected [30].

This study, like other studies, has some limitations. The shortcoming of this study is that the research uses the method of questionnaire survey. It is difficult to ensure that each student can carefully fill out the questionnaire according to their own actual situation. If some respondents do not answer, it is difficult to know the reason for not answering, so it will affect validity of the questionnaire. Secondly, this study did not conduct detailed follow-up surveys of college students with sleep disorders and take appropriate measures to intervene in time.

## 5 Conclusions

In summary, the 5,794 students in this survey have a high rate of sleep disorders and female are more prone to sleep disorders than male. Internet addiction, anxiety and depression were risk factors of sleep quality, and extroverted personality was a protective factor. For students with poor sleep quality, teachers should help them find the reason and eliminate various factors that affect the quality of sleep, so as to avoid further anxiety and depression. For Internet addiction students, the time spent on the network should be reduced and controlled to ensure adequate sleep. For students with anxiety and depression, psychological counseling should be carried out in time to alleviate or eliminate bad emotions and avoid affecting the quality of sleep and cultivate students to have an outgoing personality.

## Abbreviations

PSQI: Pittsburgh Sleep Quality Index; IAS: Internet addiction scale; SDS: Self-rating Depression Scale; SAS: Self-rating Anxiety Scale; *CI*: confidence interval; *OR*: odds ratio.

## Declarations

## Ethics approval and consent to participate

All participants' caregivers provided informed consent to participate in this research, and participants provided informed assent.

## Consent for publication

Not applicable

## Availability of data and materials

The datasets used and analysed during the current study are available from the corresponding author on reasonable request. The survey was approved by Wannan Medical College.

## Competing interests

The authors declare that they have no competing interests.

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## Tables

Table1 Survey student characteristics ( $n=5794$ )

Variable	(M±SD) / n(%)
Age (years)	18.89±1.10
Gender	Male 2831(48.9)
	Female 2963(51.1)
Grade	First grade 4335(74.8)
	Second grade 928(16.0)
	Third grade 531(9.2)
Only child	Yes 2145(37.0)
	No 3649(63.0)
Institution type	Medical 3738(64.5)
	Non-medical 2056(35.5)
Personality	Introverted 1658(28.6)
	Neutral 2283(39.4)
	Extroverted 1853(32.0)
Academic achievement	Bad 1156(20.0)
	General 3860(45.8)
	Good 308(26.1)
	Not clear 470(8.1)
Relationship with parents	Alienation 79(1.4)
	General 621(10.7)
	Intimate 5094(87.9)

Table 2 Comparison of PSQI and scores of different genders and professional students

Variable		Subjective sleep quality	Sleep latency	Sleep duration	Daytime dysfunction	Habitual sleep efficiency	Use of sleeping medication	Sleep disturbances	PSQI
Gender	Male	0.83±0.71	0.97±0.48	0.74±0.80	1.29±0.93	1.30±1.46	0.04±0.27	0.69±0.56	5.86±2.62
	Female	0.86±0.70	0.97±0.45	0.80±0.81	1.47±0.90	1.77±1.45	0.03±0.26	0.77±0.55	6.67±2.56
<i>t</i>		-1.472	0.173	-3.026	-7.739	-12.339	1.146	-5.121	-11.915
<i>P</i>		0.141	0.863	0.002	<0.001	<0.001	0.252	<0.001	<0.001
Institution type	Medical	0.78±0.69	0.70±0.78	0.98±0.45	1.36±0.90	1.65±1.46	0.03±0.25	0.66±0.56	6.18±2.55
	Non medical	0.94±0.72	0.89±0.84	0.95±0.49	1.42±0.95	1.34±1.46	0.05±0.28	0.85±0.53	6.44±2.75
<i>t</i>		-7.290	-8.873	2.971	-2.742	-27.323	7.722	-12.791	-3.668
<i>P</i>		<0.001	<0.001	0.003	0.006	<0.001	<0.001	<0.001	<0.001

Table 3 Single factor analysis of factors influencing sleep quality of college students(n/%)

Variable		Sleep quality		$\chi^2$	P
		Normal	Disorder		
		3980(68.7)	1814(31.3)		
Gender	Male	2099(74.1)	732(25.9)	76.503	<0.001
	Female	1881(63.5)	1082(36.5)		
Grade	First	3033(70.0)	1302(30.0)	13.139	0.001
	Second	599(64.5)	329(35.5)		
	Third	348(65.5)	183(34.5)		
Only child	YES	1528(71.2)	617(28.8)	10.247	0.001
	NO	2452(67.2)	1197(32.8)		
Institution type	Medical	2612(69.9)	1126(30.1)	6.880	0.009
	Non-medical	1368(66.5)	688(33.5)		
Personality	Introverted	1057(63.8)	601(36.2)	42.423	<0.001
	Neutral	1554(68.1)	729(31.9)		
	Extroverted	1369(73.9)	484(26.1)		
Academic achievement	Bad	761(65.8)	395(34.2)	9.121	0.028
	General	1834(69.1)	820(30.9)		
	Good	1073(70.9)	441(29.1)		
	Not clear	312(66.4)	158(33.6)		
Relationship with parents	Alienation	50(63.3)	29(36.7)	8.666	0.013
	Ordinary	397(63.9)	224(36.1)		
	Intimate	3533(69.4)	1561(30.6)		
Internet addiction	Normal use	2543(73.3)	927(26.7)	84.880	<0.001
	Addiction	1437(61.8)	887(38.2)		
Anxiety level	Normal	3396(71.9)	1328(28.1)	121.530	<0.001
	Anxiety	584(54.6)	486(45.4)		
Depression level	Normal	1532(80.7)	366(19.3)	189.779	<0.001
	Depression	2448(62.8)	1448(37.2)		

Table 4 Correlation between college students' PSQI total score and scores of each dimension and internet addiction, depression and anxiety (*r* value)

	Internet addiction	Anxiety level	Depression level	PSQI	Sleep latency	Sleep duration	Sleep disturbances	Use of sleeping medication	Subjective sleep quality	Daytime dysfunction	Habitual sleep efficiency
Internet addiction	1										
Anxiety level	0.347**	1									
Dpression level	0.368**	0.431**	1								
PSQI	0.197**	0.227**	0.268**	1							
Sleep latency	0.182**	0.187**	0.261**	0.662**	1						
Sleep duration	0.098**	0.041**	0.075**	0.182**	0.100**	1					
Sleep disturbances	0.250**	0.285**	0.285**	0.548**	0.333**	0.054**	1				
Use of sleeping medication	0.033*	0.110**	0.159**	0.199**	0.079**	0.028*	0.117**	1			
Subjective sleep quality	0.204**	0.197**	0.285**	0.624**	0.457**	0.165**	0.379**	0.116**	1		
Daytime dysfunction	0.329**	0.230**	0.249**	0.560**	0.244**	0.186**	0.336**	0.045**	0.384**	1	
Habitual sleep efficiency	0.182**	0.077**	0.117**	0.471**	0.090**	-0.265**	0.013	0.005	0.073**	-0.136**	1

\*\* At the 0.01 level (two-tailed), the correlation is significant.

\* At the 0.05 level (two-tailed), the correlation is significant.

5 Multiple logistic regression analysis of factors influencing sleep quality of college students

Variable	Assignment	$\beta$	S.E.	Wald $\chi^2$	P	OR	95%CI
Gender	Male=1					1	
	Female=2	0.546	0.062	76.905	0.000	1.726	1.528-1.950
Grade	First grade=1					1	
	Second grade=2	0.156	0.080	3.806	0.051	1.169	0.999-1.367
	Third grade=3	0.215	0.104	4.261	0.039	1.240	1.011-1.521
Personality	Introverted=1					1	
	Neutral=2	-0.139	0.071	3.826	0.050	0.871	0.758-1.000
	Extroverted=3	-0.373	0.078	23.002	0.000	0.689	0.591-0.802
Internet addiction	Normal use=0					1	
	Addiction =1	0.290	0.063	21.264	0.000	1.336	1.181-1.512
Anxiety level	Normal=0					1	
	Anxiety=1	0.528	0.084	39.457	0.000	1.695	1.438-1.998
Depression level	Normal=0					1	
	Depression=1	0.675	0.072	88.019	0.000	1.964	1.706-2.261
Constant		-1.532	0.263	33.986	0.000	0.216	