Analysis of Factors Influencing the Sleep Duration Insufficient of Secondary School Students in Kunshan

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Abstract. As growing sleep problems among secondary school students, this paper analyse the factors affecting the insufficient sleep time of secondary school students, with a view to providing clues for improving the insufficient sleep time of secondary school students. A total of 218 secondary school students in Kunshan were randomly selected to collect information on gender, school year, residence status, number of days of ≥60 min /d moderate-intensity exercise (d /w), and length of outdoor activities during the day (h /d); regression models were used to analyse the influencing factors of insufficient sleep time among the secondary school students. The rate of sleep deprivation among 218 secondary school students was 78.89%. It was found that female students had a higher risk of insufficient sleep than male students, high school students had a higher risk of insufficient sleep than junior high school students, and the number of days of moderate to high intensity and the amount of outdoor time during the daytime had a significant positive influence on the adequacy of sleep. Insufficient sleep is common among secondary school students in Kunshan, which should be taken seriously by families, schools and society, and relevant measures should be taken to improve the sleep time of secondary school students.

1. Introduction

Sleep is a basic activity of the human brain and plays an important role in the growth and development of children and adolescents, as well as in their cognitive and immune functions [1]. Inadequate sleep is currently recognized as one of the most important public health problems in children and adolescents [2]. Globally, the prevalence of insufficient sleep time among children and adolescents has shown an increasing trend year by year [3]. Studies have shown that sleep duration is affected by multiple factors such as age, society, psychology, physiology, and environment and is closely related to overweight and obesity, psycho-behavioral problems in children and adolescents, grade, and ≥60 min / d of moderate to high-intensity exercise time, which are the factors influencing the lack of sleep duration in high school students [4–8].

This study conducted an on-site survey of secondary school students in Kunshan in 2023 to analyse the current status of sleep duration and related influencing factors, with a view to providing a basis for early intervention of insufficient sleep duration in secondary school students.

2. Research Design

2.1. Study objects

According to the questionnaire on students' health status and influencing factors in the 2019 National Monitoring and Intervention Work Programme on Common Diseases and Influencing Factors of Students' Health issued by the Office of the National Health and Health Commission, two key middle schools in Kunshan City were randomly selected using stratified random whole class sampling. The method was to randomly select two classes from the upper and middle grades of each secondary school and four classes from each class. Interviews were conducted with 250 secondary school students, and information on gender, school classification, place of residence, number of days of moderate-intensity physical activity of 60 minutes or more per day (d/w), time spent outdoors during the day (h/d), and sleep time was collected. Questionnaires with residual information were excluded, and 218 were finally received for analysis.

2.2. Relevant definitions

Moderate-intensity exercise refers to exercise with panting or increased heart rate, such as football, basketball, swimming, running, jumping aerobics, and lifting heavy

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objects [9]. The number of days of moderate-intensity exercise (d /w) and the number of hours of outdoor activity during the daytime (h /d) are both for looking back at the past week at the time of the survey cut-off. Sleep duration determination for high school students In the latest sleep amount recommendation released by the National Sleep Foundation in 2015, the recommended daily sleep amount for children and adolescents aged 14 to 17 years is 8 to 10 h, the potentially appropriate sleep duration is 7 h and 11 h, and the non-recommended sleep duration is <7 h and >11 h [10]. Junior high school and high school students who sleep <8 h and <7 h per day are defined as having insufficient sleep.

2.3. Statistical analyses

SPSSAU software was used for statistical analysis. Qualitative data were described by relative numbers, and comparisons between groups were made using the $\chi 2$ test. A linear regression model was used to analyze the influence factors of insufficient sleep. Test level $\alpha = 0.05$

3. Results

3.1. Basic facts

Of the 218 respondents, 59.17% were male and 40.83% were female; 32.11% were junior high school students and 67.89% were senior high school students; and 53.21% were resident students. The number of days (d/w) of high-intensity exercise in ≥60 min/d from 0 to 7 d accounted for 9.17%, 22.02%, 29.36%, 21.56%, 4.13%, 8.72%, 3.67% and 1.38% respectively, and the length of outdoor activities during the daytime <1h, 1~2h, 2~3h, and ≥3 h/d accounted for 59.17%, 13.76%, 11.93% and 15.14% respectively. The total number of children who spent time outdoors during daytime was 59.17%, 13.76%, 11.93%, 15.14%.

3.2. Insufficient sleep

The detection rate of insufficient sleep was 78.89% for 172 respondents. The differences in the detection rates of insufficient sleep time among secondary school students of different genders, school segments, ≥60 min /d medium-intensity exercise days (d /w), and the length of daytime outdoor activities (h /d) were all statistically significant (P value <0.05). Whether or not they lived in the school did not affect the adequacy of sleep time of secondary school students, with a P value of >0.05 according to table 1.

Table 1 Detection of insufficient sleep among secondary school students

Item		Size of sample	Number of people with sleep deprivation	Detection rate of sleep deprivation	χ2	p
Gender	Female	89	77	86.52%	5.243	0.022*
	Male	129	95	73.64%		
Period	Junior High School	70	38	54.29%	37.52	0.000**
	Senior High School	148	134	90.54%		
Whether or not you live at the school	No	102	82	80.39%	0.257	0.612
	Yes	116	90	77.59%		
Days of moderate to high intensity exercise	0day	20	20	100.00%	170.964	0.000**
	1day	48	48	100.00%		
	2day	64	63	98.44%		
	3day	47	40	85.11%		
	4day	9	1	11.11%		
	5day	19	0	0.00%		
	6day	8	0	0.00%		
	7day	3	0	0.00%		
Daytime outdoor exercise time	1~2h	129	126	97.67%	134.995	0.000**
	2~3h	30	18	60.00%		
	<1h	26	25	96.15%		
	>3h	33	3	9.09%		
* p<0.05 ** p<0.01						

Regression analyses were conducted with sleep time as the dependent variable, and gender, grade, medium- and high-intensity days and daytime outdoor time as the independent variables, and the results showed that the factors related to the sleep time of high school students in Kunshan City were gender, grade, medium- and high-intensity days and daytime outdoor time. Female students were more sleep deprived than male students; high school students slept less than junior high school students; and students who played moderate-to-high-intensity sports and spent more than 1 hour outdoors per week slept more adequately according to table 2.

Table 2 Regression analysis of physical activity and sleep adequacy among secondary school students

	Unstandardised coefficient		Standardised coefficient	t	p
	B	SE	Beta		
Constant	0.806	0.082	-	9.789	0.000**
Period	-0.082	0.034	-0.107	-2.377	0.018*
Gender	-0.098	0.034	-0.135	-2.892	0.004**
Days of moderate to high intensity exercise	0.152	0.013	0.615	11.632	0.000**
Daytime outdoor exercise time	0.092	0.018	0.259	5.139	0.000**
R 2	0.609				
Adjusted R 2	0.602				
F	F (4,213)=82.944,p=0.000				
D-W Value	0.631				
* p<0.05 ** p<0.01					

4. Analysis

4.1. Gender Factors in Differences in Sleep Status of Secondary School Students

This study found that gender was associated with sleep duration, with boys sleeping longer than girls and girls having a higher detection rate of sleep disorders than boys. This may be due to the fact that in secondary school, girls have more academic pressure than boys, which affects sleep duration [11]. In college, boys may have more time and resources than girls to exercise, especially playing football, basketball and outdoor sports. Exercise can effectively regulate negative emotions, relieve adolescents' study pressure, and effectively reduce the incidence of sleep disorders [12]. Exercise is one of the main regulators of people's physical and mental health. Therefore, schools and families should pay more attention to girls' sleep problems.

4.2. Factors of School Segment in Differences in Students' Sleep Status

This study found that the rate of sleep insufficiency was higher among high school students than middle school students. This may be related to the fact that high school students have serious examination pressure and study pressure before the college entrance examination, and they are prone to test anxiety due to heavy study tasks. Long-term study pressure, test anxiety, and negative emotions are all risk factors for sleep problems in high school students [13]. Good sleep can effectively relieve the fatigue of long hours of study in high school, restore physical strength, effectively focus attention, and improve learning efficiency.

4.3 Regression analyses

Among the various physical activities, the number of days of ≥60 min /d moderate-intensity exercise (d /w) and the length of outdoor activities during the day (h /d) were positively correlated with sleep adequacy. Regarding the relationship between physical activity and sleep time, there are three main explanations in the academic world: first, moderate physical activity can regulate the excitatory and inhibitory functions of the cerebral cortex, laying the foundation for early sleep. Second, physical activity can promote the release of endorphin substances, so that the brain produces a sense of euphoria, which helps to form good sleep habits [14]. Thirdly, deep sleep during slow-wave sleep has the effect of eliminating physical fatigue, and sufficient physical activity can induce physiological fatigue in the human body, so it can promote deep sleep.

5. Suggestions

Schools offer mental health courses or lectures to reduce academic pressure. Studies have shown that there is a close correlation between adolescents' sleep quality and negative emotions such as anxiety and depression. By offering relevant mental health courses or lectures, schools can effectively reduce students' pressure, relieve negative emotions, relax both physically and mentally, and thus improve their sleep quality. Good sleep quality

and sufficient sleep time are indispensable for the healthy physical and mental development of adolescents.

Exercise is the foundation of health. Moderate exercise is an effective way of preventing physical and mental illness and is a healthy and civilized way of life. Regular exercise can not only effectively improve sleep but also adjust individuals' negative emotions. Exercise can promote the secretion of dopamine, serotonin, and other neurotransmitters in the brain and improve brain function. Therefore, students should be actively guided to make regular exercise an indispensable part of their lives in both junior high and senior high schools. Students who exercise regularly have a lower incidence of psychological problems and better sleep quality than those who do not exercise.

6. Conclusion

It can be seen that the sleep problem of secondary school students should not be ignored, with the rate of inadequate sleep time being higher among girls than boys, and the rate of inadequate sleep time being higher among senior secondary school students than junior secondary school students, and whether or not they live in schools does not affect their sleep time. Doing more outdoor exercise can help improve the sleep adequacy rate. Secondary school students' sleep problems are related to their life events and coping styles. Parents, society and educators should pay more attention to improving the sleep problems of middle school students. The amount of sleep time and physical activity were self-reported by the students. Due to the presence of psychological factors such as social expectations, there may be bias, and the amount of self-reported physical activity is higher than the actual amount of physical activity, so the data are not as accurate as those measured in an objective way. In addition, sleep duration is also affected by a variety of other factors, such as school workload, parental demands for academic performance, and other leisure activities such as time spent on the Internet, video games, etc. It is suggested that follow-up studies could further explore these factors. These confounding factors can be further explored in subsequent studies.

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