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Original Article

Youth and Sleep Quality: Association between Poor Sleep Quality and Depression among Senior High School Students in Ratchaburi Province, Thailand: A Cross-sectional Study

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ABSTRACT

Background: Poor Sleep Quality (PSQ) is one of the increasing public health problems and adolescents also constitute risk groups. The aims of this study were to explore the prevalence of PSQ and to examine the association between PSQ and depression among adolescents who studied in grades 10 through 12 in high schools. **Methods:** This cross-sectional study was conducted in Ratchaburi Province. A multi-stage sampling technique was used to enroll 777 adolescents from 8 schools from August-October 2016. The research instruments comprised demographic factors, the questionnaire of Pittsburgh Sleep Quality Index and the center for epidemiological studies depression scale. Multivariable logistic regression was used to calculate adjusted Odds Ratios (OR) and 95% Confidence Intervals (CI). **Results:** Prevalence of PSQ was 56.24%. The study samples were mostly 16-17 years old (67.82%) and females (70.39%). Multivariable logistic regression, after controlling for possible confounders showed that depression increased the risk of PSQ by a factor of 2.48 times (OR_{adj}=2.48, 95% CI=1.70-3.63). **Conclusion:** The surveillance system of depression and PSQ should be conducted accompanied with knowledge sharing on depression and associated factors among parents, teachers and adolescents. School activities should include a program for adolescents' stress management and conflict resolving skills. PSQ is recommended as one of the surveillance factors to prevent depression among adolescents.
Key words: Youth, Teenage, Poor sleep quality, Depression, Senior high school students.

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INTRODUCTION

Sleep is an essential part of life and plays roles in physical and mental health.[1,2] Adolescents experience significant changes including body and mind associated with sex hormones.[3] Concerning the aspect of sleep, a few of studies have found that PSQ was associated with the amount of daytime sleep, exhaustion, weight gain, obesity, impaired memory and motor vehicle accidents.[4-6] PSQ is currently a widespread issue in most societies. The prevalence of PSQ among adolescents was reported as ranging from 32 to 62%[7-11] reflecting a wider range of PSQ prevalence. In Thailand, the prevalence of PSQ among adolescents was reportedly 32 to 48%.[7,8] Youth is one risk group of mental health including depression. Depression may affect individuals at any stage of the life span, although the incidence is highest in the middle ages. However, depression during adolescence and young adulthood is increasingly recognized.[12] Depression is the most common mental illness among youths and the main contributor to the burden of disease, responsible for Disability Adjusted Life Years (DALYs) lost in those aged 15 to 24 years leading to suicide and life-threatening behaviors.[12] The World Health Organization (WHO) reported the global estimate of depression prevalence among males (5.8%) and females (9.5%) in 2015; therefore, it anticipated depression will constitute 5.7% of the total burden of disease and would be ranked the second highest disease of DALYs lost (after heart disease) in 2020.[13] In Thailand, a survey of Thai Mental Health from 2008 to 2009 showed an increasing morbidity rate of depression among Thais (250.8/100,000 in 2009 compared with 55.9/100,000 in 1997).[14] Additionally, a related study found the prevalence of depression among senior high school students in Bangkok was 17.4%.[15] Notably, studies on depression and PSQ among adolescents in Thailand seemed relatively limited; a better understanding of them is essential for planning solutions. Hence, the aims of the present study were to study the prevalence of PSQ and examine the association between depression and PSQ among senior high school students in Ratchaburi Province. The author selected Ratchaburi Province as the area of study because of its characteristics as a proxy of western provinces of Thailand. Ratchaburi is one of the western provinces of Thailand with an area of about 5,196 sq km. It lies 80 km west of Bangkok, the capital of Thailand and borders Myanmar to the

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west with the Tenasserim Hills as a natural border containing a population of 871,714 and density 170/km^2 in 2017.[16,17] The map of Ratchaburi Province was showed in Figure1.

MATERIALS AND METHODS

Study Design and Setting

A cross-sectional analytic study was conducted in December 2012 to explore PSQ and identify the association between depression and PSQ occurrence among senior high school students in Ratchaburi Province, Thailand.

Sample Size and Sampling Technique

A sample size was calculated using a formula to estimate the population proportion with specified absolute precision[18] according to the following assumption: 32% of PSQ among adolescents (P),[7] with 95% confidence interval and 5% specified absolute precision (d). As a multistage sampling technique was employed to identify study subjects, a design effect of 2 was used. The calculated sample size was 709. Also, approximately 10% was added to adjust for non-responses. Thus, the final sample size was at least 777.

A multi-stage stratified sampling technique was used to identify study subjects from senior high schools in Ratchaburi Province. Schools were stratified by student numbers, namely, extra-large (>2,500), large (1,500-2,499) and medium (500-1,499). We randomly selected at least one school from the list of three school categories: urban and rural public schools and private schools. The selection of schools was based on a list of schools obtained from the Provincial Education Offices and willingness of school administrators to participate in the study. For each of the schools, the student sample size was calculated proportional to the size of the schools.

Measurements and Instruments

Information was collected using a self-administered, anonymous questionnaire comprising three parts, namely, demographics, consumption behavior relating to sleep quality, sleep quality assessment and depressive evaluation. Sleep quality was evaluated using the Pittsburgh Sleep Quality Index (PSQI) translated to Thai with a cutoff point of scores greater than five and classified as poor sleepers,[19-21] Cronbach's alpha=0.86. Depression was evaluated using the center for Epidemiological Studies Depression Scale (CES-D) with cutoff point indicating depression ≥22.[22,23] Reliability was tested revealing a Cronbach's alpha of 0.86, respectively.

Ethics Consideration

The study was reviewed and approved by the Ethics Committee for Research in Human Subjects of the Faculty of Public Health, Mahidol University (COA. No. MUPH 2016-097). The purpose of this study was explained to school principals and teachers of the target schools. Permission was obtained from these schools and students, eligible to participate, provided informed consent or consent was obtained from their parents or legal guardians after informing the details of study. Parents or legal guardians were told that participation in the survey was voluntary and the survey would be anonymous. Confidentiality was maintained throughout the study using anonymous technique (schools and respondents were identified by code numbers to ensure confidentiality and the results were analyzed as a whole group).

Data Analysis

Categorical variables were given as frequency and percentage, crude odds ratio (OR_c), 95 % CI of OR and *p*-value. Moreover, numerical variables were expressed in mean, median, minimum and maximum, standard deviation and quartile deviation. Univariate analysis was performed using univariable logistic regression to differentiate proportional exposures between poor and good sleepers for categorical variables. Adjusted odds ratio (OR_{adj}) and 95% CI of OR were calculated from multivariable logistic regression to examine associations between depression factors and PSQ occurrence, adjusted for potential confounders. A criteria of $p < 0.05$ was judged to be statistically significant.

RESULTS

Demographic Characteristics

A total of 777 participants were selected for the present study. The majority were females (70.39%), aged 16 to 17 years (67.82%) mean age was 16.51 (SD=0.96) years, were studying in Grades 10 to 12 (35.39%), GPA 3.01-3.50 (40.14%), monthly family income ≤10,000 THB (44.67%), non-smoking (98.33%) and no alcoholic consumption (85.33%), as shown in Table 1.

The prevalence of PSQ was 56.24%. Using univariable logistic regression analysis, associated demographic factors of PSQ among adolescents was illness history during last month, social media, reading, coffee consumption, tea consumption, annoyance, poor ventilation, stress and depression ($p<0.05$). Risks of developing PSQ among adolescents with illness history during the last month was 1.61 times (OR=1.61, 95% CI=1.18-2.20). On the contrary, adolescents with reading were 0.40 times more likely to develop PSQ than adolescents without any reading (OR=0.40, 95% CI=0.18-0.91. Coffee and tea consumers were at risk 1.86 times (OR=1.86, 95% CI=1.12-3.10) and 1.39 times (OR=1.39, 95% CI=1.05-1.85) to develop PSQ than noncoffee and nontea consumers, respectively. Environmental factors significantly associated with PSQ included annoyance (OR=2.17, 95% CI=1.39-3.41) poor ventilation (OR=2.61, 95% CI=1.36-5.08). Additionally, stress and depression were significantly associated with PSQ (stress (OR=3.14, 95% CI=2.24-4.41), depression (OR=3.31, 95% CI=2.32-4.72), as shown in Table 2. Multivariable logistic regression analysis indicated the model fit well (Hosmer-lemeshow goodness of fit test, $p>0.05$). In regarding the association between depression and PSQ among adolescents (adjusted for illness history during the last month, social media, reading, coffee and tea consumption, annoyance, poor ventilation and stress), those with depressors were at risk 2.48 times those without depressors (OR=2.48, 95% CI=1.70-3.63), as shown in Table 3.

DISCUSSION

Our findings demonstrated that the prevalence rate of PSQ was about 56% higher than related studies conducted in Thailand.[7,8] Evidence from related studies on PSQ among college students showed the prevalence of PSQ was approximately from 32 to 62%.[7-11] The difference of PSQ occurrence might have various factors, namely, the environment, lifestyle, household characteristics, social media, social activities etc. Our results showed that depression played a critical role in the development of PSQ and confirmed a strongly significant association between depression and PSQ among adolescents. Multivariable logistic regression analysis revealed adolescents who had depression had 2.48 times higher odds ratios for PSQ than those adolescents with non-depression (OR=2.48, 95% CI=1.70-3.63), consistent with related studies.[24-26] The results of study showed severe sleep problems and depression among adolescents, explaining that sleep disturbance and depression were common causes of sleep disorder and sleep disturbances were able to forecast depressive symptoms one-year later. Therefore, sleep problems were an indicator of depression.[25] The researchers indicated sleep problems among depressed adolescents may be due to family stress, academic failure and financial difficulty whereas a study by Chiang *et al*.[27] found that students who had more stressful events about family were associated with more depressive symptoms and this relationship was found among adolescents who

Table 1: Demographic characteristics of senior high school students

Characteristic	No. (%)
Sex (n=777)	
Female	547 (70.39)
Male	230 (29.61)
Age (yr) (n=777)	
<16	123 (15.83)
16 – 17	527 (67.82)
>17	127 (16.35)
Mean (SD)	16.51 (0.96)
Min - Max	14 - 19
Education level (Grade) (n=777)	
10	247 (31.79)
11	255 (32.82)
12	275 (35.39)
Parental marital status (n=777)	
Married	517 (66.54)
Widowed, divorced, separated	260 (33.46)
Monthly family income (baht) (n=647)	
≤10,000	289 (44.67)
10,001 - 30,000	280 (43.28)
30,001 – 50,000	47 (7.26)
50,001 – 70,000	9 (1.39)
>70,000	22 (3.40)
Median	10,000
Min-Max	1,800-300,000
Grade point average (n=715)	
<2.50	58 (8.11)
2.51 – 3.00	242 (33.85)
3.01 – 3.50	287 (40.14)
≥3.50	128 (17.90)
Mean (SD)	3.09 (0.42)
Median (QD)	3.10 (0.29)
Min-Max	1.33 – 3.99
Underlying diseases (n=777)	
No	668 (85.97)
Yes	109 (14.03)
Smoking (n=774)	
No	764 (98.33)
Yes	10 (1.67)
Alcohol consumption (n=777)	
No	663 (85.33)
Yes	114 (14.67)
Illness history during last month (n=777)	
No	537 (69.11)
Yes	240 (30.89)

Figure 1: Map of Ratchaburi Province.[17]

had lower sleep efficiency. In addition, sleep deprivation also increased risk of depressive symptoms. A few studies showed relationship between sleep duration and depression among adolescents who had sleep duration <6 hr and were at risk of depression.[28,29] Our findings showed a relationship between PSQ and sleep duration, so inadequate sleep duration and poor sleep quality could increase depressive symptoms. In addition, adolescents with higher depression levels were at increased risk for sleep problems in the future. Our findings indicated that school guidance and psychological counseling services should be provided which might include mental health care prevention. Therefore, monitoring social risk factors among adolescents including screening for depression and cooperating with parents, caregivers, teachers and also the adolescents themselves is recommended for resolution. In addition, providing educational personnel counseling techniques and coping skills training courses, healthy lifestyle intervention and basic treatment for depression, would minimize the incidence of youth depression.

Limitations of the Study

This study was subject to a few limitations. First, the present study was a cross-sectional survey, so it was difficult to make statements about the cause and effect relationships between PSQ and depression. Second, these data apply only to those aged 14 to 19 years as the study subjects; therefore, they could not represent all the adolescents. Moreover, data collection might have excluded subjects absent from schools. Finally, all data were based on a self-report method.

CONCLUSION

The surveillance system of PSQ and depression should be conducted and along with a knowledge sharing program about associated factors of depression among adolescents with their parents and teachers. PSQ is recommended as one of surveillance factors to reduce depression among adolescents. School activities should comprise programs for managing stress and resolving problem skills. The health promoting school model of WHO[30] should be applied to develop effective school health programs to relieve these problems.

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Table 2: Univariable logistic regression analysis of factors associated with PSQ among senior high school students

Variable	Poor sleep quality/total	%	OR_c	95%CI	*p*-value
Age group (yr) (n=777)					
<16	59/123	47.97	1		
16-17	303/527	57.49	1.47	0.99 – 2.18	0.056
>17	75/127	59.06	1.57	0.95 – 2.58	0.079
Sex (n=777)					
Female	308/547	56.31	1		
Male	129/230	56.09	0.99	0.72 – 1.37	0.982
Education level (Grade) (n=777)					
10	131/247	53.04	1		
11	148/255	58.04	0.84	0.59 – 1.19	0.323
12	156/275	56.73	1.03	0.73 – 1.45	0.873
Parental marital status (n=774)					
Married	284/517	54.93	1		
Widowed, divorced, separated	151/257	58.75	0.86	0.62 – 1.17	0.351
Family members (n=629)					
Father and mother	271/346	78.32	1		
Father or mother only	166/283	58.66	1.16	0.87 – 1.56	0.319
Relative/Friend					
Monthly family income (THB) (n=647)					
≤10,000	171/289	59.17	1		
10,001 – 30,000	145/280	51.79	0.74	0.52 – 1.05	0.091
30,001 - 50,000	28/47	59.57	1.02	0.52 – 2.00	0.914
>50,000	18/31	58.06	0.96	0.43 – 2.16	0.942
Grade point average (n=715)					
≥3.50	76/128	59.38	1		
3.01-3.50	146/287	50.87	1.26	0.89 – 1.78	0.188
2.51-3.00	137/242	19.01	1.24	0.72 – 2.25	0.403
<2.50	33/58	50.00	1.41	0.93 – 2.15	0.109
Underlying diseases (n=777)					
No	370/668	55.39	1		
Yes	67/109	61.47	1.29	0.85 – 1.95	0.279
Smoking (n=774)					
No	430/764	56.28	1		
Yes	7/10	70.00	1.81	0.47 – 7.06	0.527
Alcohol consumption (n=777)					
No	368/663	55.51	1		
Yes	69/114	60.53	1.23	0.82 – 1.84	0.318
Illness history during last month (n=777)					
No					
Yes	283/537	52.70	1		
	154/240	64.17	1.61	1.18 – 2.20	<0.001
Social media (n=777)					
No	274/519	52.79	1		
Yes	163/258	63.18	1.53	1.13 – 2.08	0.006
Reading (n=777)					
No	428/751	56.99	1		
Yes	9/26	34.62	0.40	0.18 – 0.91	0.039

Coffee consumption (n=777)					
No	385/702	54.84	1		
Yes	52/75	69.33	1.86	1.12 – 3.10	0.022
Tea consumption (n=777)					
No	216/412	52.43	1		
Yes	221/365	60.55	1.39	1.05 – 1.85	0.027
Annoyance (n=777)					
No	352/658	53.49	1		
Yes	85/119	71.43	2.17	1.39 – 3.41	<0.001
Poor ventilation (n=777)					
No	393/719	54.66	1		
Yes	44/58	75.86	2.61	1.36 – 5.08	0.002
Stress (n=777)					
No	69/195	35.38	1		
Yes	368/582	63.23	3.14	2.24 – 4.41	<0.001
Depression (n=777)					
No	276/565	35.38	1		
Yes	161/212	63.23	3.31	2.32 – 4.72	<0.001
Sleep duration (hrs) (n=777)					
>7	54/254	21.26	1		
6-7	297/435	68.28	19.98	5.21-169.49	<0.001
<6	86/88	97.73	159.26	39.82-1354.78	<0.001

ORc= crude odds ratio, CI= confidence interval

Table 3: Multivariable logistic regression analysis of depression associated with PSQ among senior high school students

Variables	OR_c	95%CI	OR_{adj}	95%CI	p-value
Depression					
No	1		1		
Yes	3.31	2.32 – 4.72	2.48	1.70 – 3.63	< 0.001

OR_c = crude odds ratio, OR_{adj} = adjusted odds ratio for illness history during last month, social media, reading, coffee consumption, tea consumption, annoyance, poor ventilation and stress.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

ABBREVIATIONS

CES-D: The Center of Epidemiologic Studies Depression Scale; **CMB:** the China Medical Board; **DALYs:** Disability adjusted life years; **GPA:** Grade point average; **OR_{adj}:** Adjusted odds ratio; **OR_c:** Crude odds ratio; **PSQ:** Poor Sleep Quality; **PSQI:** Pittsburgh Sleep Quality Index; **WHO:** World Health Organization.

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