

# Mean Blood Pressure Difference among Adolescents Based on Dyssomnia Types

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## Abstract

**Citation:** Sembiring K, Ramayani OR, Lubis M. Mean Blood Pressure Difference among Adolescents Based on Dyssomnia Types. Open Access Maced J Med Sci. 2018 Feb 15; 6(2):293-296. <https://doi.org/10.3889/oamjms.2018.068>

**Keywords:** Blood pressure; Dyssomnia; Adolescent; Hypertension

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**Received:** 25-Aug-2017; **Revised:** 01-Dec-2017; **Accepted:** 02-Dec-2017; **Online first:** 04-Feb-2018

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**Funding:** This research did not receive any financial support

**Competing Interests:** The authors have declared that no competing interests exist

**BACKGROUND:** Dyssomnia is the most frequent sleep disturbance and associated with increased blood pressure. There has been no study determining the difference in mean blood pressure based on dyssomnia types among adolescents.

**OBJECTIVE:** To determine the difference in mean blood pressure among adolescents based on dyssomnia types.

**METHODS:** Cross-sectional study was conducted in SMP Negeri 1 Muara Batang Gadis in April 2016. Samples were students having sleep disturbance based on Sleep Disturbance Scale for Children (SDSC) questionnaire. Stature and blood pressure data were collected along with demographic data and sleep disorder questionnaire. Analyses were done with Kruskal-Wallis test and logistic regression. P - value < 0.05 was considered significant.

**RESULTS:** Seventy-six samples were obtained with mean age 13.9 (SD 1.14) years - old. Dyssomnia proportion and hypertension were 72/76 and 20/76 respectively. Mean systolic (SBP) and diastolic blood pressure (DBP) was 111.1 (SD 16.46) mmHg and 70.3 (SD 11.98) mmHg respectively. Mean SDSC score was 49.7 (SD 8.96), and the most frequent dyssomnia type was disorders of initiating and maintaining sleep. Age and sex were not the risk factors of hypertension in dyssomnia. There was a significant difference in mean SBP (P = 0.006) and DBP (P = 0.022) based on dyssomnia types. Combination dyssomnia type had the highest mean blood pressure among dyssomnia types.

**CONCLUSION:** There is a significant difference in mean blood pressure among adolescents based on dyssomnia types.

## Introduction

Adolescent phase is an important phase in human's growth and development and associated with alteration in cognitive, behaviour, social, and emotional functions. Along with the alteration, adolescents frequently experience sleep disturbances such as dramatically changing in duration, pattern, and amount of sleep [1][2].

Sleep disturbance in adolescents is a neglected health condition. On the other hand, sleep disturbance has a massive negative impact on adolescents later in their life [3][4]. There are three types of sleep disturbance in adolescents: dyssomnia, parasomnia, and secondary sleep disturbance. The classification is described further by Bruni et al. in

Sleep Disturbance Scale for Children (SDSC) questionnaire [4][5].

Sleep disturbance affects adolescent's daily life and health status. The impacts on health are disruptions in growth, cardiovascular, cognitive functions, and daily behaviour [6][7]. Several studies have shown that sleep disturbance might cause elevation of blood pressure in adult, but a study in adolescent population is still scarce. Recent studies in adolescent population also showed controversies in the relationship between sleep disturbance and blood pressure [8][9].

Even there are still controversies, the relationship between sleep disturbance and blood pressure in adolescents is more frequently reported. But there has been no study determining the difference in blood pressure based on sleep

disturbance classification, especially dyssomnia which is the most frequent sleep disturbance in adolescents. It is important to know which type of dyssomnia that mostly affects blood pressure so that clinicians can be more aggressive in managing the sleep disturbance. This will minimise the impact of dyssomnia in the future.

## Methods

### Study Design

A cross-sectional study was conducted to determine the difference in mean blood pressure among adolescents based on dyssomnia types in SMP Negeri 1 Muara Batang Gadis on April 2016. Samples were students having sleep disturbance based on SDSC questionnaire. The exclusion criteria were students with secondary diseases and medications affecting blood pressure. Samples were obtained by total sampling method. Stature and blood pressure data were collected along with demographic and sleep disturbance data. Data analysis was done with statistical software, and the result will be presented in tables. This study was approved by the Health Research Ethical Committee, Medical School, University of Sumatera Utara.

### Sample Recruitment

All students who fulfilled the inclusion criteria were enrolled in this study. SDSC questionnaires were distributed to each of them and collected in the following day. The questionnaire was filled by student's parents. SDSC score was then calculated, and dyssomnia types were determined. We interviewed each student to obtain demographic data. Student's stature was measured using microtome. Blood pressure was measured using mercury sphygmomanometer three times with interval 15 minutes. Students were allowed to rest for 10 minutes before measurement. Mean blood pressure was categorised into hypertension and non - hypertension.

### Statistical Analysis

The relationship between demographic factors and blood pressure in dyssomnia students was analysed using logistic regression test. Kruskal - Wallis test was used to determine the difference in mean blood pressure based on dyssomnia types. Statistical calculation was done at 95% confidence interval and P - value < 0.05 was considered significant.

## Results

Of 205 students in the school where the study was conducted, 76 fulfilled the inclusion criteria. Table 1 shows the baseline characteristics of students, including mean age, sex, and school grade. We found that mean students stature was 146.3 (SD 7.2) cm with mean systolic and diastolic blood pressure was 111.1 (SD 16.3) mmHg and 70.3 (SD 11.8) mmHg respectively. Mean SDSC score was 49.4 (SD 8.8).

**Table 1: Baseline characteristics of students**

Characteristics	n = 76
Mean age, years (SD)	13.9 (1.1)
Sex, n (%)	
Male	26 (34)
Female	50 (66)
School grade, n (%)	
Grade 7	34 (45)
Grade 8	29 (38)
Grade 9	13 (17)

Table 2 shows students distribution based on sleep disturbance types. The most frequent sleep disturbance type was disorders of initiating and maintaining sleep (37%) while the rarest was disorders of arousal/nightmares. Students were divided based on their sleep disorder type into dyssomnia and non - dyssomnia. There were 11 students with a combination of two sleep disturbance types, but both of the types were classified as dyssomnia type. Therefore all of them were grouped into dyssomnia type. Based on the information, it was known that the proportion of dyssomnia among all sleep disturbance types was 95%. Students were also divided into hypertension and non - hypertension based on mean blood pressure according to their age, sex, and stature. We found that the proportion of hypertension in this study was 26%.

**Table 2: Distribution of students based on sleep disturbance types**

Sleep disturbance type	Percentage
Disorders of initiating and maintaining sleep	37
Sleep breathing disorders	8
Disorders of arousal/nightmares	1
Sleep-wake transition disorders	25
Disorders of excessive somnolence	10
Sleep hyperhidrosis	4
Combination	14

Logistic regression test was conducted to determine the relationship between demographic factors and hypertension in students with dyssomnia (Table 3). According to the test's result, demographic factors such as age and sex were not the risk factors for hypertension in dyssomnia students.

**Table 3: Risk factors for hypertension in student with dyssomnia**

	Constant	Wald	P*
Age	0.003	0.000	0.991
Sex	-1.387	3.636	0.057

\* Logistic regression test

Normality test was done using Kolmogorov-Smirnov test toward systolic and diastolic blood pressure. The result showed that systolic and diastolic blood pressure were not normally distributed (Table 4).

**Table 4: Normality test for mean systolic and diastolic blood pressure**

	Z	P*
Mean systolic blood pressure	0.178	0.0001
Mean diastolic blood pressure	0.167	0.0001

\* Kolmogorov - Smirnov test.

Statistical analysis was then continued to Kruskal - Wallis test. There was the statistically significant difference in mean systolic based on dyssomnia types ( $P = 0.006$ ) (Table 5). Combination dyssomnia type had the highest mean systolic blood pressure (126.0, SD 13.2 mmHg).

**Table 5: Mean systolic blood pressure difference based on dyssomnia types**

	Mean (mmHg)	SD (mmHg)	P*
Disorders of initiating and maintaining sleep	108.6	15.5	0.006
Sleep breathing disorders	116.3	9.6	
Sleep-wake transition disorders	107.0	17.2	
Disorders of excessive somnolence	104.7	13.2	
Combination	126.0	14.9	

\* Kruskal-Wallis test.

The test also showed a difference in mean diastolic blood pressure based on dyssomnia types ( $P = 0.022$ ) and the highest mean diastolic pressure was found in students with combination dyssomnia type (80.1, SD 11.3 mmHg).

**Table 6: Mean diastolic blood pressure difference based on dyssomnia types**

	Mean (mmHg)	SD (mmHg)	P*
Disorders of initiating and maintaining sleep	69.5	11.8	0.022
Sleep breathing disorders	74.6	7.2	
Sleep-wake transition disorders	66.4	12.7	
Disorders of excessive somnolence	65.6	6.4	
Combination	80.1	11.3	

\* Kruskal-Wallis test.

## Discussion

Sleep disturbance is a neglected health condition mainly in children and adolescent population. Sleep disturbance is a group of disorders associated with alteration in amount, quality, and duration of sleep [5]. The prevalence of sleep disturbance is increasing in the recent decades [3][10]. Sleep disturbance is classified into dyssomnia, parasomnia, and secondary sleep disturbance. Dyssomnia correlates with problems in the amount of sleep, initiating sleep, and maintaining sleep and is the most frequent sleep disorder in children [3][4][6][11][12]. Bruni et al. divided dyssomnia in their

Sleep Disturbance Scale for Children questionnaire into disorders of initiating and maintaining sleep, sleep breathing disorders, disorders of arousal/nightmares, and disorders of excessive somnolence [3].

The prevalence of sleep disorder based on Sleep Disturbance Scale Disorders questionnaire in this study is 37.1%. The most frequent sleep disorder type is disorders of initiating and maintaining sleep (37%). Overall, the proportion of dyssomnia among all sleep disturbance types is 95%. These results are by the study by Ohida, et al. in Japan, which reported a range of sleep disturbance prevalence from 15.3% to 39.2% [10]. Liu et al. did a study in Beijing and reported a prevalence of 21.1%, a value that is close to the prevalence in this study [3]. A study in Jakarta showed a higher prevalence than this study (62.9%) [13]. Among all of the studies, Bruni, et al. reported the highest prevalence of sleep disturbance (73.4%) [10]. Disorders of initiating and maintaining sleep were known as the most frequent sleep disorder type in the study held by Chevrin, et al. The prevalence ranged from 10% to 20%. Another multicenter study in France, Great Britain, Germany, and Italy showed that 25% of sleep disorders in adolescents was insomnia, which is also a part of dyssomnia [3]. The number from the last study is not very different with the result in this study.

The incidence of hypertension in adolescents is increasing significantly, changing the opinion that hypertension is found exclusively in the adult population. This tendency may be caused by changes in lifestyle including dietary pattern, sedentary life, and mentally or physically exhaustion [14][15]. This study shows that the prevalence of hypertension in dyssomnia students is 26%. This is relevant to the result of a study conducted by Kuchiene et al. where the prevalence of hypertension in adolescents with sleep disturbance is 22.5% [16].

According to Ewald, et al. there were several risk factors for hypertension in adolescents including age, sex, race, medical condition, dietary intake, and lifestyle [17]. On the other hand, Tavasoli et al. reported a contrary result. They reported that body mass index, age, sex, and family predisposition were not related to hypertension in adolescents [8]. In our study, we found that that age and sex are not risked factors for hypertension in adolescents with dyssomnia.

Dyssomnia will increase vasoactive hormone secretion that causes vessel constriction. It also activates the renin-angiotensin aldosterone system followed by raising in intravascular volume. Cortisol secretion and sympathetic nervous system are stimulated, resulting in increasing cardiac contractility. The combination of those mechanisms will elevate the blood pressure [6][8]. Au et al. reported that there was a relationship between sleep disturbance and blood pressure [9]. Narang et al. confirmed that finding in

the study, they conducted [18]. In contrast, Tavasoli et al. found no relationship between sleep disturbance and blood pressure. Additionally, they found no difference in blood pressure between normal children and children with sleep disturbance. None of the studies has determined the difference in blood pressure based on dyssomnia types. The result of this study shows that there is a difference in blood pressure among adolescents based on dyssomnia types. Combination dyssomnia type has the highest mean blood pressure, suggesting that addition of dyssomnia types will increase blood pressure in adolescents.

This is a pilot study. Therefore further investigation is mandatory to determine risk factors for hypertension in adolescents with dyssomnia including socioeconomic status, salt consumption, and sedentary life which are not analysed in this study. A larger study involving more samples and better method is needed to confirm the result of this study.

This study shows that there is a statistically significant difference in blood pressure among adolescents based on dyssomnia types. Combination dyssomnia type has the highest mean blood pressure compared to the other dyssomnia types. Age and sex are not the risk factors for hypertension in adolescents with dyssomnia.

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