Sleep Medicine 35 (2017) 62–66

Contents lists available at ScienceDirect

Sleep Medicine

journal homepage: www.elsevier.com/locate/sleep

Original Article

Association between sleep duration and menstrual cycle irregularity in Korean female adolescents

Ga Eun Nam [a], Kyungdo Han [b], Gyungjoo Lee [c, *]

[a] Department of Family Medicine, Sahmyook Medical Center, 82, Mangu-ro, Dongdaemun-gu, 02500 Seoul, Republic of Korea
[b] Biostatistics, College of Medicine, The Catholic University of Korea, 222 Banpo-daero, Seochogu, 65091 Seoul, Republic of Korea
[c] College of Nursing, The Catholic University of Korea, 222 Banpo-daero, Seochogu, 65091 Seoul, Republic of Korea

ARTICLE INFO

Article history:
Received 23 November 2016
Received in revised form
17 March 2017
Accepted 18 April 2017
Available online 8 May 2017

Keywords:
Adolescents
Menstrual cycle irregularity
Sleep duration

ABSTRACT

Objective: The association between sleep and the menstrual cycle in the adolescent population has been scarcely studied. This study aimed to investigate the association between sleep duration and menstrual cycle irregularity among female adolescents using nationwide representative data from the South Korean population.

Methods: This population-based, cross-sectional study used the data collected from Korea National Health and Nutrition Examination Survey 2010–2012, and the data from 801 female adolescents were analyzed. Hierarchical multivariable logistic regression analysis was performed to assess the risk of menstrual cycle irregularity in relation to sleep duration.

Results: Subjects with menstrual cycle irregularity accounted for 15% ($N = 120$). The mean sleep duration in subjects with menstrual cycle irregularity was significantly shorter than that in those without ($p = 0.003$). Menstrual cycle irregularity prevalence tended to decrease as sleep duration increased (p for trend $= 0.004$), which was significantly different based on sleep duration and presence of depressive mood ($p = 0.011$). Sleep duration $\leq$5 h per day was significantly associated with increased risk of menstrual cycle irregularity compared with that in the subjects whose sleep duration is $\geq$8 h per day even after adjusting for confounding variables. The odds ratios of menstrual cycle irregularity tended to increase for shorter sleep duration in all adjusted models.

Conclusion: This study found a significant inverse association between sleep duration and menstrual cycle irregularity among Korean female adolescents. Increasing sleep duration is required to improve the reproductive health of female adolescents.

1. Introduction

Women commonly experience irregular menstrual cycles during their reproductively fertile years, and menstrual cycle irregularity aggravates the frequency and degree of menstrual symptoms [1]. Moreover, irregular menstrual cycles have been shown to have implications for women's health. Menstrual cycle irregularity has been reported to be associated with serious health outcomes such as breast cancer, type 2 diabetes, cardiovascular disease, osteoporosis, and infertility [2–6]. In addition, evidence supporting the association between this condition and mental health problems has been increasing [7–12]. In particular, menstrual cycle abnormalities were reported to be associated with symptoms of depressive disorders in high school girls [7], that seem to affect the female adolescents' quality of life and disturb active participation in academic performance and psychosocial functioning [13,14].

Although the objective definition of menstrual cycle irregularity has not been established, the prevalence of this condition has been reported to be high among adolescents [15–17]. In addition, the American Academy of Pediatrics recommended that menstrual cycle should be assessed with other vital signs, emphasizing the critical role of menstrual patterns in reflecting the overall health status of female adolescents [18]. Therefore, specific efforts should be made to identify associated factors to prevent menstrual cycle irregularity in the adolescent age group.

Menstrual cycle regularity has been reported to be influenced by a variety of physical and mental conditions and health-related lifestyles [18]. Age at menarche, excessive exercise or rapid gain

* Corresponding author. Fax: +82 02 2258 7779.
E-mail address: kjdooly@catholic.ac.kr (G. Lee).

http://dx.doi.org/10.1016/j.sleep.2017.04.009
1389-9457/

or loss of body weight has been explored as risk factors of menstrual cycle irregularity [19]. It is also caused by many medical conditions, such as pregnancy, endocrine disorders, and other chronic diseases [18]. In addition, mental health problems including depressive mood and psychological stress were also suggested as risk factors of menstrual cycle irregularity [9,13,19–21]. Recently, sleep has been gaining attention as an associated factor in menstrual cycle irregularity in adults. Romans et al. [22] concluded in their review that some studies showed significant associations between poorer sleep quality and premenstrual and menstrual phases. In general, women are well known to have higher prevalence of sleep disturbance than men [22], which suggests that sleep may be correlated with reproductive function in women. Also, puberty disrupts sleep onset, which can cause delayed bedtimes and low sleep quality [23].

Sleep is essential in the effective performance of various daily tasks in adolescents. Sleep patterns and quality contribute to successful academic achievement and holistic quality of life [24]. Inadequate sleep causes daytime malfunctioning, psychological and behavioral problems, and physical diseases including obesity [25]. Baker and Driver [26] issued that circadian disruption such as sleep–awake disorders may be associated with disturbance in the menstrual cycle [26]. Approximately a third of adolescents experience sleep disturbances [27], and only one in 10 adolescents is estimated to sleep more than 8 h, as recommended by the National Sleep Foundation [27]. The poor sleep pattern of adolescents seems to be associated with exposure to screen light including television watching and computer gaming, as well as after-school work and academic stress [28]. This may disturb the circadian rhythm, which affects the menstrual cycle of female adolescents. However, the association between sleep duration and menstrual cycle regularity has been scarcely studied in the adolescent population.

Thus, this study aimed to identify the association between sleep duration and menstrual cycle irregularity among female adolescents using the nationwide representative data of the South Korean population.

2. Methods

2.1. Data source and study subjects

This population-based, cross-sectional study used the data collected from the Korea National Health and Nutrition Examination Survey (KNHANES) 2010–2012. KNHANES has been conducting nationwide surveys annually since 1998, by the Division of Chronic Disease Surveillance under the Korea Centers for Disease Control and Prevention (KCDC) and the Korean Ministry of Health and Welfare. The survey aimed to assess the health and nutritional status of the non-institutionalized civilians of South Korea. The survey is composed of three parts: health interview, health examination, and nutritional surveys, and each part was conducted by trained investigators. The sampling units were defined based on the 2005 population and housing census in South Korea, which includes information regarding sex, age, and geographical area. A stratified, multi-staged, and clustered probability design with a rolling survey sampling model was used to select a representative sample of the non-institutionalized South Korean population.

Of the 25534 individuals who participated in the KNHANES during 2010–2012, we excluded males ($N = 11616$), those aged <12 or >18 years ($N = 12911$), those who were diagnosed with epilepsy or attention deficit hyperactivity disease or were treated for these diseases ($N = 8$), those before menarche ($N = 79$), those who were pregnant or breastfeeding ($N = 0$), and those with missing data ($N = 119$). Finally, the data of 801 female adolescents were analyzed. Parental written informed consents were signed before participation in the survey for all study participants because they were minors. The institutional review board of the KCDC reviewed and approved the survey protocol. The data are accessible on the following website (http://knhanes.cdc.go.kr).

2.2. Assessment of sleep duration and menstrual cycle

Sleep duration was self-reported from the following question: “How many hours do you sleep on average?” Sleep duration was classified into three categories: ≤5, 6–7, and ≥8 h. Subjects were asked to describe menstrual cycle regularity through the following question: “Do you have a regular menstrual cycle?” Subjects who responded “yes” were defined as having a regular menstrual cycle, whereas those who responded “no” were defined as having a menstrual cycle irregularity.

2.3. Covariates

Sociodemographic and lifestyle characteristics of subjects were obtained by trained interviewers or by self-reported questionnaire. Monthly household income was divided into quartiles, and the lowest quartile of the total subjects was defined as a low income level. Subjects who had consumed one alcohol drink or more for at least one day during the month before the survey were defined as ever-drinkers, and those who had not, were defined as non-drinkers. For smoking status, based on the responses to the self-reported questionnaire, subjects who had smoked cigarettes at least one day during the month before the survey were defined as ever-smokers, and those who had not, were defined as non-smokers. Physical activity was assessed using the Korean version of the International Physical Activity Questionnaire [29]. Subjects who exercised moderately for at least 30 min per session, more than five times per week, or those who exercised strenuously for at least 20 min per session more than three times per week were defined as regular exercisers. Subjects were asked to respond to the following question to assess their history of weight control attempts: “Have you ever attempted weight control?” In addition, information regarding the subjects' age at menarche was also collected.

Psychological problems were investigated by providing questions regarding psychological stress and depressive mood. Psychological stress was assessed from the responses to the following question: “How much stress do you feel in your daily life?” Subsequently, subjects were asked to report the stress level as rare, mild, much, or severe. Based on the responses, subjects were classified into the low-stress group if they reported feeling stress rarely or mildly, and the high-stress group if they responded as feeling stress much or severely. Subjects were considered to have depressive mood when they answered “yes” to the following question: “Has your daily life been burdened by feelings of sadness or hopelessness for two continuous weeks or more during the previous year?”

Trained staffs performed anthropometric measurements for all participants. Height and body weight were measured to the nearest 0.1 cm and 0.1 kg, respectively, with light clothing and without shoes, and body mass index (BMI) was calculated as body weight (kg)/height^2 (m^2). Waist circumference (WC) was measured to the nearest 0.1 cm at the midpoint between the lowest margin of the rib cage and iliac crest at the end of expiration.

Blood samples were obtained after fasting for 8 h or more and were immediately processed and refrigerated. They were transported in cold storage to the Central Testing Institute in Seoul, Korea and then analyzed within 24 h. The blood hemoglobin level was measured using XE-2100D (Sysmex, Tokyo, Japan).