



Original Article

Sleep habits in adolescents of Saudi Arabia; distinct patterns and extreme sleep schedules



Roah A. Merdad ^a, Leena A. Merdad ^b, Rawan A. Nassif ^a, Douaa El-Derwi ^{b,c}, Siraj O. Wali ^{d,*}

^a Department of Family and Community Medicine, Faculty of Medicine, King Abdulaziz University, Jeddah, Saudi Arabia

^b Department of Preventive Dental Sciences, Faculty of Dentistry, King Abdulaziz University, Jeddah, Saudi Arabia

^c Faculty of Medicine, Cairo University, Cairo, Egypt

^d Department of Internal Medicine, Faculty of Medicine, King Abdulaziz University & Sleep Medicine and Research Center, King Abdulaziz University Hospital, Jeddah, Saudi Arabia

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ABSTRACT

Background and Study Objectives: There is a need for comprehensive studies on adolescents' sleep habits in the Middle Eastern region. The aim of this study was to investigate the sleep–wake patterns, prevalence of excessive daytime sleepiness (EDS), and disturbed sleep among adolescents in Saudi Arabia and to identify the associated factors.

Methods: The study was a cross-sectional survey done on a random sample of 1035 high school students, ages 14–23 years, in Jeddah, Saudi Arabia. The response rate was 91%. Students filled a self-reported questionnaire that included sleep–wake questions, Pittsburgh Sleep Quality Index, Epworth Sleepiness Scale, Perceived Stress Scale, academic performance, and personal data.

Results: Students slept an average of 7.0 hours on school nights, with an average delay of 2.8 and 6.0 hours in weekend sleep and rise times, respectively. Around 1 in 10 students stayed up all night and slept after returning from school (exhibiting a reversed sleep cycle) on weeknights. This pattern was more prevalent among boys and students with lower grade point averages. The prevalence of sleep disturbance was 65%, and EDS was found in 37% of the students. Predictors of EDS were school type, stress, napping and caffeine use, while gender was a predictor of disturbed sleep.

Conclusions: Adolescents in Saudi Arabia showed a high percentage of poor sleep quality. Compared with adolescents from other countries, they had a larger delay in weekend sleep and rise times. An alarming reversed sleep cycle on weekdays is present and highlights the need for further assessment.

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1. Introduction

Sleep problems are growing internationally among the youth, as evidenced by studies from different parts of the world [1–3]. Research investigating the prevalence, causes, and consequences of adolescents' sleep problems has mainly focused on three aspects of sleep: sleep duration, sleep quality, and daytime sleepiness [4–6]. Adolescent sleeping patterns are affected by social, psychological, physiological, and environmental factors [4]. Adolescents experience a biological sleep phase delay [7], in addition to rigid early school start times [8,9], elevated academic and social demands, and increased exposure to electronic media [10], all of which contribute to shortened and disturbed sleep [4]. The excessive use of

electronic media has been associated with delayed bedtimes and shorter sleep [11], and the late night use of technology (after 9 pm) has been associated with shorter sleep [12].

The consequences of adolescent sleep problems are well documented in the literature. However, there is no sufficient high-level evidence supporting the recommendations for optimal hours of sleep in children and teenagers [13]. Nonetheless, shorter hours of sleep in adolescents, mainly below 8–9 hours, have been linked to a variety of negative outcomes, including obesity [14], impaired insulin resistance [15], poor mental health [16], and substance use/abuse [17], as well as poor academic performance [1,18]. Disturbed sleep has also been associated with an increase in the expression of markers of cardiovascular risk [19], high frequency of depression [20] and anxiety [21], poor mental health [16], poor school performance [6], and an increase in risky behavior [22]. In addition, excessive daytime sleepiness has been linked to poor school achievement [6] and risky behavior in adolescents [23].

The first aim of this study was to investigate the sleep–wake patterns and prevalence of poor sleep quality and excessive daytime sleepiness among adolescents in Saudi Arabia. Studies on the

* Corresponding author at: College of Medicine, King Abdulaziz University, Consultant in Pulmonary & Sleep Medicine, Sleep Medicine and Research Center, King Abdulaziz University Hospital, Jeddah 21589, POBOX 80215, Saudi Arabia. Tel.: +966 12 6408258; fax: +966 12 6408315.

E-mail address: sowali@kau.edu.sa (S.O. Wali).

prevalence of sleep problems have shown that these problems are common among adolescents. Sleep surveys have consistently shown that adolescents get insufficient sleep and have delayed sleep–wake patterns. A meta-analysis of data from 41 countries highlighted the global trends in adolescent sleep patterns and confirmed that a worldwide delayed sleep–wake behavior pattern exists [5]. Adolescents reported later bedtimes (due to developmental delays in sleep patterns), thereby leading to shorter school night sleep time, which was compensated by longer weekend sleep time. Disturbed sleep is also common; a study on 95,680 Japanese junior and high school students found that 42% rated their sleep as being “poor” [24]. Not surprisingly, daytime sleepiness, which may reflect insufficient and poor sleep, is also common among adolescents, with the percentage of adolescents with excessive sleepiness being reported to be high in many countries [1,25–27]. Adolescents in the Middle East exhibit the same global trends in sleep problems. Studies in Palestine, Israel, and Iran indicated that the school night sleep duration was 6.4, < 7.5, and 7.7 hours, respectively [10,28,29]. A study on Kuwaiti secondary school students found high rates of insomnia, with approximately one-third of the students complaining of early morning awakening [30].

Sleep can be viewed as occurring in the context of both intrinsic (psychological, biological, maturational) and extrinsic (environmental and cultural) factors [31]. The second aim of the study was to identify factors associated with insufficient sleep, poor sleep quality, and excessive daytime sleepiness. Such factors identified in previous studies on adolescents include age [5], gender [28], stress [1], and caffeine consumption [32]. Identifying such associations can facilitate the understanding of the factors regulating sleep–wake patterns in adolescents [31], and can help generate hypothesis for future studies. Moreover, identifying factors associated with poor sleep will allow healthcare workers, school counselors, teachers and parents identify adolescents at risk, and can inform policy makers investing in educational programs for adolescents.

Compared with Western societies, Saudi Arabia in particular, and Arab societies in general, have a culture associated with a lifestyle that does not promote sufficient hours of sleep each night. Studies assessing sleep habits in a sample of 1012 elementary school children from Saudi Arabia reported that around 40% of children nap during the daytime [33], and that the mean weekday bedtime was 21:20 ($\pm 01:48$) in this young age group [34]. Moreover, in his report “Sleep medicine in Saudi Arabia: Current problems and future challenges,” Bahammam addressed the fact that the majority of the general public are unaware of the health risks and negative consequences associated with sleep deprivation and disturbances of biological rhythms [35]. The physiological delay in adolescents biological clock, coupled with early school start times in Saudi Arabia (between 7:00 and 7:30 am for both private and governmental high schools and an end time at around 01:30 pm for governmental schools and between 2:00 and 3:00 pm for private schools), in addition to documented napping and delayed bedtimes among elementary school students, suggests adolescents might be at a high risk of sleep deprivation, disturbed sleep patterns, and their potential negative consequences.

Sleep behavior studies in adolescents from Saudi Arabia are limited to two studies by Al-Hazzaa et al. that evaluated the relationship between sleep hours and obesity and between sleep hours and lifestyle factors in adolescents in Saudi Arabia [36,37]. In both studies, the same survey was used and the average total hours of sleep among adolescents in Saudi Arabia was documented; however, no further information on sleep variables was collected. Thus, in this exploratory study, we aimed to: (1) investigate the sleep–wake patterns and prevalence of poor sleep quality and excessive daytime sleepiness among adolescents in Saudi Arabia; and (2) to identify factors associated with insufficient sleep, poor sleep quality, and excessive daytime sleepiness. This study is the first

comprehensive study that investigates adolescents' sleep habits in Saudi Arabia.

2. Methods

2.1. Sampling procedure

This cross-sectional study was conducted in Saudi Arabia's second largest city, Jeddah. The sample size needed for $\pm 5\%$ precision with a power level of 85% was determined to be 800. The sample size was increased to 1035 to account for non-responders. A multi-stage random sample was used to select the sample population from students enrolled in high schools in Jeddah. First, a stratified random sample of schools was selected. Using Jeddah schools' list, we stratified the schools according to the funding source (private or governmental) and geographic location (north, central, southeast, and southwest). In Saudi Arabia, schools are generally segregated by gender. One school was randomly selected from each stratum, thereby giving a total of 8 girls' schools and 7 boys' schools (a north male public school was not included because the school administration could not be reached). Second, in each selected school, one classroom was randomly selected from each grade, i.e., 10th, 11th, and 12th. All students in the selected classrooms were included. The Ministry of Education does not impose age restrictions for completing high school in Saudi Arabia, and no exclusions based on age were made. Nine hundred and forty seven students returned their questionnaires, thereby giving a response rate of approximately 91%. Because of the uniform protocol for survey approvals from the Ministry of Education and the absence of need for parental consent in all schools, response rates were high and did not fall below 90% across the different school funding sources (private and governmental) and grade levels, or for both genders.

2.2. Questionnaire

2.2.1. Predictors and outcome variables collected

The self-administered questionnaire collected data on the following: (1) sleep–wake patterns and sleep disturbance, using the Pittsburgh Sleep Quality Index (PSQI); (2) excessive daytime sleepiness (EDS), using the Epworth Sleepiness Scale (ESS); (3) demographic and lifestyle factors, including self-reported school performance, daily caffeine intake, and napping habits; (4) psychological distress using the Perceived Stress Scale (PSS).

The PSQI is a standardized, reliable, and valid scale developed by Buysse et al. to differentiate poor from good sleepers and evaluate the sleep quality in the past month [38]. The PSQI includes 19 self-rated questions that were included in our questionnaire. They are generally used in the adult population but easily understood by high school students. The scale begins with four questions asking about the usual sleep and wake-up time, sleep latency, and sleep duration. Fifteen multiple-choice questions follow, which inquire about sleep disturbance frequency and subjective quality of sleep. Students have to indicate how frequently they had difficulty falling asleep, insomnia, waking up during the night or too early in the morning, use of hypnotic medications, etc. For each component, they had to respond by choosing one of the following categories: not during the past month, less than once a week, once or twice a week, or three or more times a week.

Two questions about weekend sleep and rise times were added, but they were not included in the PSQI calculations, and hence, the final score was not affected. From these questions, the sleep–wake patterns, including school night sleep time and rise time, weekend sleep time and rise time, and sleep latency were measured. A global PSQI score was calculated for each student by using the PSQI scoring database. A global score ranges from 0 to 21, with higher scores indicating higher levels of sleep disturbance, and a score of > 5 was used

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