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Sleep Deprivation and Dehydration in Young Adults

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Abstract

Purpose: *Sleep deprivation is a significant issue among Indonesian young adults, with over 67% of them being affected. This lack of sleep can lead to various health problems, including dehydration, which affects 41.6% of the population. Despite the high prevalence of both sleep deprivation and dehydration, there has been no research in Indonesia on the relationship between sleep and dehydration. This study aimed to investigate this association among young adults.*

Methodology/approach: *The study involved 98 participants aged 17 to 22 years. Sleep duration was assessed using a sleep timing questionnaire (STQ), while the degree of dehydration was determined using a urine dipstick. The analysis, conducted using the Spearman correlation test.*

Results/findings: *The results revealed that the majority of participants slept for less than 6 hours per night (31.6%) and were minimally dehydrated (78.6%). Interestingly, a higher percentage of male participants (34.7%) slept for less than 6 hours compared to female participants (32.7%), yet the prevalence of minimal dehydration was higher in female participants (81.6%) than in male participants (75.5%). However, the bivariate analysis did not show any correlation between sleep duration and the degree of dehydration (p=0.418).*

Limitations: *The study solely captured participants' habitual sleep duration, failing to account for their sleep duration on the preceding night. Furthermore, the manual interpretation of the reagent strip in this study introduced interindividual variability. Therefore, a comprehensive approach to interpreting the findings necessitates a careful consideration of these aspects.*

Contribution: *The discoveries could contribute to the development of improved guidelines for both sleep and hydration.*

Keywords: *Sleep Duration, Sleep Deprivation, Dehydration, Degree of Dehydration, Medical Students, College Students*

1. Introduction

Young adults tend to sacrifice sleep to do their tasks and fulfill their responsibility in college and the workplace (Hershner, 2015; *Sleep Deprivation in Adolescents and Young Adults*, 2014). For them, sleep is a luxury, not a necessity (Hershner, 2015). Sleep deprivation is waking up for more than 16-18 hours per day (Kryger et al., 2011). Sleep deprivation is known to cause various acute and chronic health problems, but not many people know that sleep deprivation also causes dehydration (Colwell, 2010).

A survey by Honestdocs in 2019 found that 67% of Indonesians in the age range of 18 to 24 years were sleep-deprived (Safitri & Setiawan, 2019). Meanwhile, a study by The Indonesian Regional Hydration Study (THIRST) in Indonesia in 2008 found that 46,1% of Indonesians were minimally dehydrated (Briawan, 2008). Although the prevalence of sleep deprivation and dehydration in Indonesia is high, no Indonesian study has examined whether there is a relationship between sleep deprivation and dehydration. Even though dehydration is an important public

health issue that affects the quality of life and can cause long-term complications (El-Sharkawy et al., 2015; Liska et al., 2019).

Therefore, more study is needed to find the relationship between sleep deprivation and dehydration. The objective of this study is to determine the correlation between sleep duration and degree of dehydration using the Sleep Timing Questionnaire (STQ) and urine dipstick. In this study, we hypothesize that less sleep duration significantly correlates with a higher degree of dehydration.

2. Methodology

This was a cross-sectional study involving young adults ranging from 17 to 22 years old. This study was performed from October to November 2020 at the School of Medicine and Health Sciences, Atma Jaya Catholic University of Indonesia, Jakarta.

The study sample was taken by simple random sampling. A total of 98 participants signed the informed consent and were included in the study. The inclusion criteria were active preclinical students who agreed to become research subjects; had an underweight, normal, or pre-obese Body Mass Index; and drank ≥1,88 L of water/day (women) or ≥2 L of water/day (men). The exclusion criteria were participants who consumed >2 glasses/day or >400 mg of caffeinated drink/day; were highly active (Ptotal >300 minutes of moderate-intensity activity/week or >150 minutes of high-intensity activity/week); had a history of chronic diseases that could affect the degree of dehydration (e.g., kidney diseases, diabetes, and cystic fibrosis); consumed diuretics, anticholinergics, or sedative-hypnotics; and were pregnant.

The degree of dehydration was measured using urine specific gravity value in a urine dipstick. Participants were asked to collect a midstream morning urine sample and dip the urine dipstick (Strasinger & Di Lorenzo, 2014). Sleep duration was measured by Sleep Timing Questionnaire (STQ). After measuring their urine specific gravity, participants were asked to fill out the STQ by answering their good morning and good night-time on weekdays and weekends (Shahid et al., 2011).

The data were analyzed using the Spearman correlation test in the IBM-SPSS statistics program version 25. P-value was two-tailed and statistical significance was $p<0.05$.

The Ethical Research Committee of the School of Medicine and Health Sciences, Atma Jaya Catholic University of Indonesia, had approved this study on October 12th, 2020 under no. 04/10/KEP-FKIKUAJ/2020.

3. Results and discussion

Table 1 shows the characteristics of the study subjects. The number of male and female participants was the same. Most of the participants slept for <7 hours per night (62.2%) and were minimally dehydrated (78.6%). Table 2 shows that there was no significant correlation between sleep duration and degree of dehydration (p=0.418).

Table 1. Subject Characteristics

Characteristics	Gender				Total	
	Male		Female			
	n	%	n	%	n	%
Sleep Duration						
<6 hours	17	34.7	14	28.6	31	31.6
6 hours	16	32.7	14	28.6	30	30.6
7 hours	14	28.6	16	32.7	30	30.6
8 hours	2	4.1	5	10.2	7	7.1
≥9 hours	0	0	0	0	0	0
Total	49	100	49	100	98	100
Degree of Dehydration						
Well Hydrated	5	10.2	3	6.1	8	8.2

Minimal Dehydration	37	75.5	40	81.6	77	78.6
Significant Dehydration	7	14.3	6	12.2	13	13.3
Serious Dehydration	0	0	0	0	0	0
Total	49	100	49	100	98	100

Table 2. Bivariate Analysis of The Correlation between Sleep Duration and Degree of Dehydration

Sleep Duration	**Degree of Dehydration**								**p**
	Well Hydrated		**Minimal Dehydration**		**Significant Dehydration**		**Serious Dehydration**		
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	
<6 hours	0	0	26	83.9	5	16.1	0	0	
6 hours	6	20	19	63.3	5	16.7	0	0	
7 hours	2	6.7	27	90	1	3.3	0	0	0.418
8 hours	0	0	5	71.4	2	28.6	0	0	
≥9 hours	0	0	0	0	0	0	0	0	
Total	8	8.2	77	78.6	13	13.3	0	0	0.418

Our study result shows that most of the participants slept for <7 hours per night (62.2%) which is similar to the previous study by Michael Humianto (Humiantto, 2016). This may be because this study was performed when the course schedule was busy, the final exam was coming soon, and the inability to manage stress (Amin et al., 2016; Yu et al., 2017). On the contrary, this result is in contrast to the study conducted by Afriani et al., which showed that most of the medical students slept for 7-9 hours per night (Afriani et al., 2019).

This can be because that study only involved female students (Afriani et al., 2019). Females tend to sleep longer than males (Kabrita & Hajjar-Muça, 2016). Furthermore, sleep duration in that study was measured by Pittsburgh Sleep Quality Index (PSQI) which is considered not valid for measuring sleep duration (Afriani et al., 2019; Centre for Physiotherapy and Rehabilitation Sciences et al., 2015).

This study found that most of the participants were dehydrated (92%), as had been reported by Penggalih et al (Penggalih et al., 2014). This may be related to the high temperature and humidity in Jakarta, Bogor, Depok, Tangerang, and Bekasi; where participants were living (Gustam & Briawan, 2012). However, this result is in contrast to the study conducted by Anggraeni et al (Anggraeni & Fayasari, 2020). This can be because that study only involved male participants (Anggraeni & Fayasari, 2020). Males have higher total body water than females because they have a higher muscle mass percentage, so they are less prone to dehydration (Gustam & Briawan, 2012). Moreover, in that study, the degree of dehydration was determined by orthostatic dehydration indicator which is not sensitive, not reliable, and has uncertain normal value (Anggraeni & Fayasari, 2020; Johnson et al., 1995; Mott & Allen, 2016).

Our study result shows that most of the participants who slept for <7 hours were males (54.1%), which is similar to the previous study by Amin et al (Amin et al., 2016). Males tend to use mobile phones, laptops, and drink caffeine more than females (Giri et al., 2013). However, this result is in contrast to the study conducted by Hermoso et al. which showed that most of the college students who slept for <7 hours were females (Toscano-Hermoso et al., 2020). This may be because that study was dominated by female participants (Toscano-Hermoso et al., 2020). Furthermore, most of the female participants in that study tended to be sleep deprived because of having a history of gastrointestinal disease (*Sleep Deprivation*, 2008; "Sleep Deprivation And Deficiency," 2020; Toscano-Hermoso et al., 2020).

This study found that the prevalence of dehydration was higher in females than males (51.1% vs 48.9%). This finding is similar to the previous study by Gustam (Gustam & Briawan, 2012). Females have less total body water than males because they have a lower muscle mass percentage, so they are more prone to dehydration (Gustam & Briawan, 2012). Moreover, in the luteal phase, females tend to lose more fluid because of the elevation of plasma progesterone that inhibits sodium reabsorption in the kidney (Rehrer et al., 2017). However, this result is in contrast to the study conducted by Francescato et al. which showed that male athletes experienced a higher degree of dehydration than female athletes. (Francescato et al., 2019) This may be because the degree of dehydration assessment in that study was done right after participants had finished doing physical activity (Francescato et al., 2019). After doing physical activity, males sweat more than females (Francescato et al., 2019).

This study found no significant correlation between sleep duration and the degree of dehydration (p=0.418). This result is in contrast to the study conducted by Rosinger et al about the association between short sleep duration and inadequate hydration in the US and Chinese adults from 2007 to 2012 (Rosinger et al., 2019). That study found a significant association between short sleep duration and inadequate hydration (Rosinger et al., 2019). This can be due to the differences in the characteristic of study subjects, study method, and environment.

Firstly, the characteristic of this study subjects is different from that study. This study was dominated by participants who had low physical activity and were inactive because it was performed during the COVID-19 pandemic (participants spent most of their time at home) (Sitohang & Ghani, 2021). This caused sleep-deprived participants weren't dehydrated. Furthermore, the number of participants in that study far exceeded the number of participants in this study (Rosinger et al., 2019).

Secondly, this study method is different from that study. The dependent variable in this study is the degree of dehydration, while in the study by Rosinger et al. is inadequate hydration (Rosinger et al., 2019). This study matched the reagent strip photo and urine specific gravity read by each of the participants to determine the degree of dehydration, while that study interpreted the reagent strip using a urine analyzer (Rosinger et al., 2019). Urine analyzer helped to avoid interindividual variability when reading reagent strips (Oyaert & Delanghe, 2019). Sleep duration in this study was measured by STQ; meanwhile, that study only asked participants' sleep duration on weekends and weekdays without using a questionnaire (Rosinger et al., 2019). This might have caused a bias in the number of sleep-deprived participants.

Finally, this study environment is different from that study. This study was performed in November when the temperature and humidity were higher than usual ("BMKG Ungkap Pemicu Panas Terik Di Indonesia Akhir-Akhir Ini," 2020). High temperature and humidity were the confounding factors of this study because participants tended to be dehydrated even though they had consumed enough water (Gustam & Briawan, 2012). Therefore, even though these study results show that sleep-deprived participants were dehydrated, there was no significant correlation between sleep duration and degree of dehydration.

This study has some limitations. Firstly, this study only measured participants' usual sleep duration and not the sleep duration on the night before measuring the urine specific gravity; otherwise, it would have been more accurate (Rosinger et al., 2019). Secondly, interpretation of the reagent strip in this study was done manually, so that participants' urine specific gravity has been affected by interindividual variability (Oyaert & Delanghe, 2019). Therefore, several considerations have to be taken when interpreting the findings.

4. Conclusion

4.1. Conclusion

This study shows that there was no significant correlation between sleep duration and the degree of dehydration. This study found that most of the preclinical students slept for <6 hours per night and were minimally

dehydrated. Furthermore, this study also found that most of the male participants slept for <6 hours per night and were minimally dehydrated. Meanwhile, most of the female participants slept for 7 hours per night and were also minimally dehydrated, but the number of female participants who were minimally dehydrated exceeded male participants.

4.2. Limitation

This study has some limitations. Firstly, this study only measured participants' usual sleep duration and not the sleep duration on the night before measuring the urine specific gravity; otherwise, it would have been more accurate (Rosinger et al., 2019). Secondly, interpretation of the reagent strip in this study was done manually, so that participants' urine specific gravity has been affected by interindividual variability (Oyaert & Delanghe, 2019). Therefore, several considerations have to be taken when interpreting the findings.

4.3. Suggestion

In order to improve the accuracy of our measurements, it is crucial to not only record participants' typical sleep duration, but also their sleep duration on the night prior to the urine-specific gravity measurement. This approach will help to account for short-term fluctuations in hydration status resulting from recent sleep patterns. Additionally, to minimize variability between individuals, we may want to consider utilizing automated readers for the reagent strips. Doing so can mitigate human error and promote reliable, consistent results.

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