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Association between Excess Body Mass Index towards Excessive Daytime Sleepiness among Medical Students at the Atma Jaya Catholic University of Indonesia During the Post-COVID-19 Pandemic

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Abstract

Introduction: Social isolation during the COVID-19 pandemic brought several effects on one's daily activity, such as reduced physical activity, increased anxiety and stress towards their environment, and a sleep disorder called Excessive Daytime Sleepiness. EDS is often found in undergraduate students. Many factors could cause EDS, one of which is excessive fat consumption. This study was conducted because of the significant impact that COVID-19 brought on EDS and BMI. In addition, due to the high prevalence of excess BMI, the researcher wanted medical students aged 18 years or above as the target.

Methods: This study used observational analysis with a cross-sectional method. It used Epworth Sleepiness Scale (ESS) questionnaire distributed online from October to November 2022. The respondents were 108 (46 male, 62 female) pre-clinical students from the School of Medicine and Health Sciences, Atma Jaya Catholic University of Indonesia (FKIK UAJ), who met the inclusion and exclusion criteria. A bivariate analysis test was conducted with a chi-square statistical test with $p \leqslant 0{,}05$.

Results: Seventy respondents (64,9%) had Excess Body Mass Index (BMI), thirty-six of them (78,3%) were male, and the other thirty-four (54,8%) were female. Sixty-eight respondents (62,9%) experienced Excessive Daytime Sleepiness (EDS) post-COVID-19 pandemic; also, forty-two respondents (67,7%) were female, and the rest (56,5%) were male. A chi-square statistical test was used, and the results found that the p-value equals 0.002.

Conclusions: There is a significant association between excess Body Mass Index (BMI) towards Excessive Daytime Sleepiness (EDS) in medical students of the Atma Jaya Catholic University of Indonesia post-COVID-19 pandemic.

Keywords: Post COVID-19 - Excess Body Mass Index - Excessive Daytime Sleepiness – Medical Students – Pandemic

INTRODUCTION

Social isolation during the COVID-19 pandemic brought several effects on one's daily activity, such as reduced physical activity, reduced energy to study or work, and increased anxiety and stress. All this led to adverse effects such as sleep quality and onset. Research by Partinen et al. in 2021 found that social isolation significantly affected the increase of sleep disorders, including Excessive Daytime Sleepiness (EDS).[1] Excessive Daytime Sleepiness is one of the most common sleep disorders. According to the American Academy of Family Physicians (AAFP), around 20% of adults in the United States experience Excessive Daytime Sleepiness, which interferes with their activity.[2] EDS also occurs in college students. Hershner et al. 2014 did research that showed about 50.4% of college students experience EDS.[3] In a study conducted by Nadia in Indonesia in 2013, it was found that around 55% of medical students experienced excessive daytime sleepiness (EDS).[4] One of the reasons why EDS occurs in college students is that they tend to be sleep-deprived, caused by sleeping too late and waking up too early.

In 2011, Panossian et al. found an association between excessive fat accumulation and increased EDS. The prevalence of EDS in the obese group was around 30%.[5] This is caused by reduced physical activity and increased poor eating habits. Being overweight or obesity defined as excessive fat accumulation that may impair health. About 39% of adults, 18 years or older, were overweight, then 13% were obese.[6] Fitriani did research about the association between BMI towards EDS in the elderly; 26 out of 33 elderly with excess BMI experienced EDS.[7]

Although studies about EDS have been plenty enough carried out by others, it was only done by elderly and college students before the pandemic started. The author specifically wanted to study excess BMI because of the higher prevalence of 18 years or above. This study aims to determine the association between excess Body Mass Index (BMI) and Excessive Daytime Sleepiness (EDS) in medical students post-COVID-19 pandemic. The expectation in this study is that it can be helpful for people in society to be aware of their weight and to increase preventive action to reduce the incidence of EDS.

METHODS

Study Design

This study used observational analysis with a cross-sectional method and was carried out at the School of Medicine and Health Sciences, Atma Jaya Catholic University of Indonesia. The questionnaire used in this study was distributed from October until November 2022.

Subject and Sampling Method

All pre-clinical students from batch 2019 to 2022 (aged 18 – 24) School of Medicine and Health Sciences, Atma Jaya Catholic University of Indonesia, were invited to participate in this study. Sampling was done by stratified random sampling from 4 batches and calculated proportionally for each collection. Then, sampling is done according to the calculation. One hundred eight respondents (46 male, 62 female) met the inclusion criteria. The inclusion criteria for this study were active pre-clinical students at FKIK UAJ who were willing to sign informed consent, were 18 years or above, and not experiencing depression. The exclusion criteria were pre-clinical students who currently have medical conditions due to sleep disorders (e.g., Obstructive Sleep Apnea, Periodic Limb Movement Disorder, narcolepsy, hypersomnia, etc.), consuming drugs that induced drowsiness (e.g., antidepressants, flu & cold medications, sedative-hypnotic medications), having reduced sleep duration (less than 6 hours) or else poor sleep quality, and currently experiencing depression. Inclusion and exclusion criteria were obtained from questionnaire data made by the researcher.

This paragraph clarifies the category that has been used in this study. Students with BMI more than equal to 23 were considered to have excess BMI. As for EDS, students with a total ESS score of more than similar to 11 were considered to experience EDS.

Data Collection

This study measured the incidence of excessive daytime sleepiness (EDS) using the Epworth Sleepiness Scale (ESS) questionnaire.[8] The Epworth Sleepiness Scale (ESS) questionnaire contains eight statements that could measure the average sleep tendency in daily life, with 4 point scale. The ESS questionnaire classified EDS into several categories. If the total score is between 0 and 10, it is classified as normal daytime sleepiness. Furthermore, students were considered to have EDS if the total ESS score is more than 10, which is organized into mild EDS (11 – 12), moderate EDS (13 – 15), and severe EDS (16 – 24).[8] In this study, the ESS questionnaire has been translated into Indonesian. It has been tested for its validity by Raissa, a Master's degree student in Occupational Medicine at FKUI in 2018, with the value of Cronbach's alpha between 0.645 and 0.654.[9] This questionnaire was distributed along with informed consent, weight and height data for BMI measurement, and filtered the respondents themselves did questions. The weight and height data from this study were obtained based on self-reported by respondents. The ethical committee has approved this study with the number of ethics permits 08/01/KEP-FKIKUAJ/2023.

Statistical Analysis

Data were analyzed by SPSS v22 software using two types of tests. Univariate analysis was used to obtain the distribution of each variable. On the other hand, bivariate analysis was carried out with a Chi-square statistical. The Chi-square test was used to determine the relationship between excess Body Mass Index (BMI) and Excessive Daytime Sleepiness (EDS), with a p-value ≤ 0.05 considered significant.

RESULTS

Out of 108 respondents, 46 were male (42.6%), and 62 were female (57.4%). The majority of respondents were 18 years old (28.7%), in the excess BMI category (64.9%), and experienced EDS (62,9%). (Table 1)

Table 1. Respondents' demographic characteristics (n=108)

Variables	n	%
Gender		
Male	46	42.6
Female	62	57.4
Age		
18-21	103	95.4
22-24	5	4.6
Body Mass Index		
Underweight	9	8.3
Normal	29	26.9
Overweight	33	30.6
Obese I	29	26.9
Obese II	8	7.4
Excessive Daytime Sleepiness (EDS)		
Normal	40	37.0
Mild	28	25.9
Moderate	27	25.0
Severe	13	12.0

Other than that, based on gender using logistic regression test, there is a significant association between gender towards excess Body Mass Index with a p-value of 0.013 (BMI), and males tend to have excess BMI (78,3%). However, there is no significant association between gender towards Excessive Daytime Sleepiness (EDS), and females tend to experience EDS (67.7%). (Table 2)

Table 2. Association between Excess Body Mass Index (BMI) and Excessive Daytime Sleepiness (EDS) toward gender

Variables	Gender				P-value
	Male		Female		
	n	%	n	%	
Excess BMI (≥23)					
Yes	36	78.3	34	54.8	0.013*
No**	10	21.7	28	45.2	
EDS (≥ 11)					
Yes***	26	56.5	42	67.7	0.234
No	20	43.5	20	32.3	

The results of the Chi-square test found that there was a significant relationship between excess Body Mass Index (BMI) and Excessive Daytime Sleepiness (EDS) in medical students post-COVID-19 pandemic with a p-value of 0.002. (Table 3)

Table 3. Association between Excess Body Mass Index (BMI) towards Excessive Daytime Sleepiness (EDS)

Variables	Excessive Daytime Sleepiness (EDS)								P-value
	Normal		Mild		Moderate		Severe		
	n	%	n	%	n	%	n	%	
Excess Body Mass Index (BMI)									
Yes	17	24.3	22	31.4	22	31.4	9	12.9	0.002*
No**	23	60.5	6	15.8	5	13.2	4	10.5	

DISCUSSION

This study showed a significant association between gender toward excess BMI (p=0.012) and males with excess BMI. It may occur because males tend not to care about their weight. Other than that, hormones could also play a role in this finding. Research by Taylor et al. in 2010 found that during the growth period from adolescence to young adulthood, males tend to experience excess fat accumulation compared to females. It observed between adolescent and young adult males and found a fat collection of at least 2 kilograms. So, most likely, males tend to experience visceral adiposity compared to females.[10] Although male androgens, one of which is testosterone, are beneficial for maintaining healthy body composition and muscle mass, it also plays a vital role in fat deposition.[11] In 2011, research by Xuan et al. in Malaysia showed that males tend to not care about their weight (77%) compared to females (47.7%).[12]

On the other hand, females tend to experience weight dissatisfaction which has increased over time in modern society. That condition can occur due to the perception of being underweight as a body ideal for females. Vijayalakshmi et al.'s research in 2017 found that about 81.6% of females were unsatisfied with their bodies.[13] Another study by Zhang et al. in 2018 found that underweight females still want thinner bodies than their current ones. The same study found that underweight females carried out weight-control behavior to get a thinner body, such as physical activity and dieting, to extreme behaviors, such as strict diets and taking laxatives.[14]

Furthermore, this study found no significant association between gender and EDS, but females tend to experience Excessive Daytime Sleepiness (EDS). Similar research by Fatani et al. in 2015 also found that more females experience EDS, but there was also no significant association between gender towards EDS. Although EDS is more common in women, this absence of a significant association may occur due to the many male-related EDS trigger factors such as smoking and snoring.[15] Related to females who tend to experience EDS, it may appear to be caused by the tendency of females to do less physical

activity. Moreover, medical conditions such as depression and anxiety commonly happen to females. In Russia, Putilov et al. in 2021 showed that females tend to experience sleep deprivation which causes a lower ability to be awake compared to males.[16]

Perceived stress caused by environmental changes will eventually impact gastrointestinal syndrome, fatigue, and sleep problems. The ecological changes referred to in this study are several exams respondents face when collecting the data. Although there is no significant relationship between gender and EDS, the finding here in this study about females who tend to experience EDS may occur because the majority of respondents in this study are females. It also cannot be denied that females tend to be more emotionally sensitive as human beings than males, so environmental changes such as exams are more easily a stressor in females. Lang et al. in 2022 found that stress and fatigue were related to EDS.[17] In 2013, Lee et al. also found that females tend to be more emotionally sensitive to environmental changes than males.[18] Although this sensitivity makes females better at expressing their emotions, females are more susceptible to psychiatric illnesses such as stress and depression.[18] Fatigue also tends to occur in females monthly, impacting EDS. Due to the tendency of fatigue, that can inhibit the central nervous system. If this cycle occurs continuously, a protective mechanism, namely sleep deprivation, a common cause of EDS, will be activated.[17] Theorell-Haglöw et al. 2015 was done a longitudinal study regarding the risk factors for EDS in females, which found that apart from insomnia and depression as significant risk factors for EDS, other factors such as somatic diseases (diabetes, asthma, cardiac diseases, hypertension), physical inactivity, snoring, and smoking were also related to EDS.[19]

A significant association between excess BMI and EDS in this study may happen because of the pandemic, which changed one's life, such as reduced physical activity and tended to feel depression or stress that may induce obesity and reduced sleep quality in someone.[3] Hayley et al., in 2014, showed that the increase in EDS comes with a rise in BMI (with OR 1.5 – 1.6x in females and 1.5x in males).[20] The same research by Mokhber et al. in 2014 found that drowsiness tends to appear significantly along with increased BMI.[21] Regarding its relation to the COVID-19 pandemic, research by Partinen et al. in 2021 showed that excessive sleepiness worsened during the pandemic (16,2%) in 14 countries.[3]

Pro-inflammatory cytokines also mediate the association between excess BMI towards EDS.[22] Vgontzas et al., in 2006, specifically stated that interleukin-6 (IL-6) and Tumor Necrosis Factor-α (TNF-α) were correlated with obesity. These cytokines are released by

fat cells, which become mediators of EDS.[22] There was also a correlation between the HPA axis-cytokines towards the increased prevalence of EDS. Due to the hypoactivity of the HPA axis and hypercytokinemia, this activity exacerbates most EDS.[22]

During this research, there are several limitations. First, the risk of recall bias may occur caused by using Epworth Sleepiness Scale (ESS), a self-reported questionnaire. Other than that, weight and height data could also increase the risk of recall bias caused by a self-reported system that the researcher used in this study. Also, gender characteristics were not homogenous, where females dominated. In the following research, sampling can use a simple random sample to balance the number of male and female respondents. Measurements of depression in this study are only based on a history of taking antidepressants, not on clinical assessment by a professional.

CONCLUSION

There is a significant association between gender towards excess Body Mass Index (BMI) but not with Excessive Daytime Sleepiness (EDS). There is also a significant association between excess Body Mass Index (BMI) towards Excessive Daytime Sleepiness in medical students of the Atma Jaya Catholic University of Indonesia post-COVID-19 pandemic. Due to our several limitations, future research should avoid self-reported questionnaires, which can cause recall bias and obtain more objective results. Also, future researchers should consider getting weight and height data from respondents simultaneously to avoid recall bias and do another measurement, such as Waist-to-Height Ratio (WHtR), to measure central adiposity.

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CONFLICT OF INTEREST

The author declares that there was no conflict of interest.

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