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# Risk factors for metabolic syndrome in medical faculty students of HKBP Nommensen University

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### ABSTRACT

Metabolic syndrome is a set of metabolic conditions associated with central obesity, increased blood pressure, decreased glucose tolerance, insulin resistance, increased triglycerides and LDL cholesterol. The World Health Organization states that cardiovascular diseases (stroke, coronary heart disease), which are manifestations of metabolic syndrome, are the number one cause of death in the world. Indonesia itself is experiencing an increasing prevalence of metabolic syndrome, especially in children and adolescents, which is caused by a poor lifestyle. This study aims to identify cardiometabolic risk factors in Faculty of Medicine, HKBP Nommensen University students. This study is descriptive with a cross-sectional design. Data were collected by interview, questionnaire, and anthropometric measurements. Data were analyzed by descriptive test. The results showed that the majority of the nutritional status of the students of the Faculty of Medicine of HKBP Nommensen University was obesity (38.3%), smoking habits (1.7%), lack of exercise (62.1%), the average duration of sleep of students at the Faculty of Medicine of HKBP Nommensen University was about 6.1 hours per day. The average screen time was about 7.3 hours for cell phones, one hour for tablets, 0.9 hours for laptops, and 2.75 hours for video games. A total of 66.7% of respondents had unhealthy food consumption habits, with an average frequency of consumption of 2 times per week. Further research is needed by examining biochemical profiles and looking at other metabolic risk factors.

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## INTRODUCTION

Metabolic syndrome (SM) is a complex metabolic disorder that results from increasing obesity. The main components of SM are obesity, insulin resistance, dyslipidemia, and hypertension (Braithwaite et al., 2014). Metabolic syndrome is a collection of risk factors for cardiovascular disease. Each of these conditions clustered together can synergistically increase the risk of cardiovascular disease. Metabolic syndrome is the leading cause of mortality worldwide.<sup>1</sup> The prevalence of obesity has increased dramatically in the United States, as well as in many countries around the world. It is well known that obesity is associated with vascular disease and metabolic syndrome. Epidemiologic data

suggest the global prevalence of SM is 20-25%. The results of the Framingham Offspring Study found that in respondents aged 26-82 years, 29.4% of men and 23.1% of women suffered from SM.<sup>4</sup> While research in France found the prevalence of SM was 23% in men and 21% in women.<sup>5</sup> Data from the Indonesian Obesity Study Association (HISOBI) showed the prevalence of SM was 13.13%.<sup>2</sup>

The prevalence of metabolic syndrome in adolescents in the United States varies between 2-9.4%, while in obese adolescents, the prevalence is higher, ranging from 12.4-44.2%, depending on the definition used. A study in Spain by de Armas et al found that the prevalence of metabolic syndrome in obese children and adolescents reached 19.6% using the International Diabetes Federation (IDF) criteria. In Indonesia, three studies have been conducted on the prevalence of metabolic syndrome in overweight and obese children. Two studies used the National Cholesterol Education Program-Adult Treatment Panel III (NCEP-ATP III) criteria, and one study used the IDF criteria.<sup>3</sup> The results of the Jakarta study showed that the prevalence of metabolic syndrome in obese adolescents aged 10-19 years reached 34%, while the study in Manado showed a lower prevalence of metabolic syndrome, namely 23% in overweight and obese adolescents aged 10-14 years. Another study in Jakarta found that the prevalence of metabolic syndrome in obese adolescents aged 12-15 years reached 19.6%.<sup>3</sup>

The criteria for establishing metabolic syndrome in adolescents have not been definitively established. A study in Indonesian adolescents in 2009 found that the prevalence of metabolic syndrome in obese adolescents was 31.6%, while there were no subjects with metabolic syndrome in the normal nutrition group. Over the past decade, cases of metabolic syndrome in adolescents have increased. Research by Dieny et al. showed that the increasing prevalence of obesity among Indonesian adolescents is the main factor causing the increase in the incidence of metabolic syndrome in adolescence.<sup>4</sup> In 2014, the Indonesian Pediatric Association (IDAI) published a consensus stating that the increasing prevalence of metabolic syndrome, especially in obese children and adolescents, became the background for the preparation of a consensus on metabolic syndrome in children and adolescents in Indonesia.<sup>3</sup> The increasing risk of metabolic syndrome starting from obesity cases is a serious concern in Indonesia. The incidence of obesity among the Indonesian population has been seen from an early age, even in adolescence. Data from the Basic Health Research (Riskesmas) showed that the prevalence of central obesity in adolescents aged  $\geq 15$  years increased from 2007 to 2013. In 2013, the prevalence of adolescent central obesity reached 26.6%, up from 18.8% in 2007. This increase needs special attention because obesity in adolescence can increase the risk of higher metabolic syndrome in adulthood.<sup>5</sup> In general, all of these studies examine the distribution of metabolic risk factors in children (elementary school age) and adolescents (junior high school age). Still, none have addressed metabolic risk factors in the 18-25-year-old age group.

This study will discuss the risk factors for metabolic syndrome in students of the Faculty of Medicine (FK) of HKBP Nommensen University during the ongoing COVID-19 pandemic. Since the students come from various regions, different habits, diets, and lifestyles can lead to different risk factors for metabolic syndrome in each student. As this population consists of adolescents with a similar age distribution, this study has interesting potential. The aim is to identify risk factors for metabolic syndrome in HKBP Nommensen University medical students, with the hope of preventing the development of metabolic syndrome in them in the future.

## RESEARCH METHOD

This study is a descriptive study using a cross-sectional design, and the sampling method used is consecutive sampling. This study was conducted on 240 students of the Faculty of Medicine, HKBP Nommensen University Medan. Data collection was conducted through questionnaires and interviews and involved anthropometric measurements, including weighing height, and waist circumference of the study subjects. In this study, the risk factors for metabolic/cardiometabolic syndrome studied included smoking behavior, time spent on screen time, sleep duration, fast food consumption patterns, and exercise activity. The nutritional status of the study subjects was

represented using the Body Weight/Height curve. Data processing was conducted using statistical applications, by conducting univariate tests to evaluate the distribution of nutritional status and other characteristics. The data results were presented in tabular form with percentages (n/%) and mean values along with standard deviations (SD).

## RESULTS AND DISCUSSIONS

Characteristics of Research Subjects based on age, gender, year of study, current medical history and family medical history.

Table 1. Characteristics of Research Subjects based on Age, Gender and Class of College Year, Current Medical History and Family Medical History

Characteristics	Total (n = 240)	Mean ± SD
Age		19 ± 1,3
Gender		
- Male	85 (35,4%)	
- Female	155 (64,6%)	
Class Year Lecture		
- 2020	66 (27,5%)	
- 2021	99 (41,25%)	
- 2022	75 (31,25%)	
Current Medical History		
Available		
- Asthma	3 (1,25)	
- Hypertension	10 (4,17)	
None	227 (94,58)	
Family History of Disease		
Yes		
- Hypertension	22 (9,2%)	
- Diabetes	20 (8,3%)	
- Heart	1 (0,4%)	
None	197 (82,1%)	

From table.1, in this study, a total of 240 students as research subjects who are students of the 2020-2022 lecture school year. The average age is 19 years where the youngest age is 18 years old and the oldest age is 22 years old. Almost all subjects have no history of current illness (94.58%) but there are 3 people who have asthma and 10 people have hypertension. A total of 22 (9.2%) and 21 (8.3%) subjects had a history of hypertension and diabetes in their family members.

### Subject Characteristics based on Subject Behavior

Table 2. Characteristics based on Subject Behavior

Characteristics	Total (n = 240)	Mean ± SD
Smoking Habit		
- Yes	4 (1,7%)	
- No	236 (98,3%)	
Number of cigarettes per day (cigarettes)		
- 0	236 (98,3%)	
- 1-3	0	
- ≥ 4	4 (1,7%)	
Mobile phone use per day (hours)		7,3 ± 2,5
Tablet use per day (hours)		0,9 ± 2,05

Laptop/computer use per day (hours)		2,75 ± 1,69
Habit of playing video games/etc.		
- Yes	96 (40%)	
- No	144 (60%)	
Number of video games played (hours / day)		0,98 ± 1,6
Sleep time (hours/day)		6,1 ± 1,3
Consumption of junk food		
- Yes	160 (66,7%)	
- No	80 (31,3 %)	
Consumption of junk food (times/week)		2,36 ± 2,5
Exercise habit		
- Yes	91 (37,9 %)	
- No	149 (62,1%)	
Duration of exercise (minutes/time)		14,6 ± 26,8
Number of exercise (times/week)		1,03 ± 1,48

From table 2. a total of 1.7% of subjects have a smoking habit, with the number of cigarettes  $\geq 4$  cigarettes per day. The average subject uses a cellphone for seven hours per day, uses a tablet 0.9 hours per day, and a laptop/computer 2.75 hours per day. There were 96 subjects (40%) who had the habit of playing video games. The average sleeping time of the subjects was 6.1 hours per day. A total of 160 subjects (66.7%) had the habit of consuming junkfood, with an average number of 2.3 times per week. A total of 91 subjects (37.9%) subjects did not have the habit of exercising with a mean duration of 14.6 minutes per exercise, with a total of one time per week.

### Subject Characteristics based on Blood Pressure and Anthropometry

Table 3. Distribution of Blood Pressure and Anthropometric Measurements

Characteristics	N (%)	Mean ± SD
Systolic blood pressure (mmHg)		122.2 ± 13, 3
Diastolic blood pressure (mmHg)		79,5 ± 9,7
Hypertension		
- Yes	66 (27,5%)	
- No	174 (72,5%)	
Body weight (kg)		63, 8 ± 15,4
Height (cm)		161,5 ± 8,3
Body Mass Index Category		
- Underweight	10 (4,2%)	
- Normal weight	96 (40%)	
- Overweight	42 (17,5%)	
- Obesity	92 (38,3%)	
Waist Circumference (cm)		75,1 ± 11,6
Waist Circumference Category		
Male		
- Normal	68 (80%)	
- Central obesity	17 (20%)	
Female		
- Normal	29 (18,7%)	
- Central obesity	126 (81,3%)	

From table 3. based on the results of blood pressure measurements, the average systolic blood pressure of the subjects was 122.2 mmHg and diastolic 79.5 mmHg. The number of subjects who are hypertensive is 66 people (27.5%). The subjects of this study had an average body weight of 63.8 kg, the average height (TB) of the subjects was 161.5 cm. Based on BB / TB mapping, 42 subjects had overweight criteria (17.5%) and 92 subjects had obesity criteria (38.3%). The mean waist

circumference of the subjects was  $87.5 \pm 11.9$  cm. Most subjects (68 people or 80%) of men had a normal waist circumference and the majority of women (126 people or 81.3%) had central obesity.

### Discussion

From table. 1, in this study, a total of 240 students as research subjects who are students of the 2020 - 2022 lecture school year. The average age is 19 years where the youngest age is 18 years old and the oldest age is 22 years old. Almost all subjects have no history of current illness (94.58%) but there are 3 people who have asthma and 10 people have hypertension. A total of 22 (9.2%) and 21 (8.3%) subjects had a history of hypertension and diabetes in their family members.

From table. 2 a total of 1.7% of subjects have a smoking habit, with the number of cigarettes  $\geq 4$  cigarettes every day. This study shows the number of smokers is less than the results of the National Statistics Agency which states that the average percentage of smoking in the population at the age of  $\geq 15$  years in 2022 is 25.2%.<sup>6</sup> Cigarettes can trigger metabolic syndrome through impaired function of small blood vessels (endothelial capillaries) and increased blood clotting, as well as increased cortisol production which contributes to increased appetite and the development of obesity. In addition, cigarettes also have an antagonistic effect on insulin, increase heart rate, and stimulate the release of vasopressin, which can ultimately lead to hypertension.<sup>7</sup> On average, subjects used mobile phones for seven hours per day, tablets for 0.9 hours per day, and laptops/computers for 2.75 hours per day. The use of cell phones, gadgets, laptops/computers screen time as a whole is associated with sedentary time, which increases the risk of metabolic syndrome.<sup>8</sup> There were 96 people (40%) subjects who had the habit of playing video games. The average sleep time of the subjects was 6.1 hours per day. The recommended length of sleep is 7-9 hours. Sleep deprivation can lead to an increase in excessive food intake, triggering obesity, impaired blood pressure lowering, and decreased insulin sensitivity. This situation can eventually lead to the emergence of metabolic syndrome in the future.<sup>9,10</sup> A total of 160 subjects (66.7%) had junkfood consumption habits, with an average number of 2.3 times per week. This is significantly higher than the prevalence noted in a study that reported that only 15% of the young adult population in Indonesia frequently consumed unhealthy foods. Other studies have shown that consumption of unhealthy foods is significantly associated with the risk of high blood pressure, both in systolic and diastolic pressure, due to their sodium content, and may increase the risk of overweight due to high energy and fat intake. In addition, consumption of unhealthy foods can also reduce satiety mechanisms, which in turn increases the risk of being overweight. All of these can increase the risk of metabolic syndrome.<sup>11,12</sup> A total of 91 subjects (37.9%) did not have a habit of exercising with a mean duration of 14.6 minutes per exercise, with a total of one time per week. In a previous study, only 28.7% of medical students regularly jogged. Aerobic exercise activity has a significant correlation with total cholesterol level, systolic blood pressure, and increased energy expenditure, which contributes to the reduction of body weight (amount of body fat) and body mass index.

From table.3, based on the results of blood pressure measurements, the average systolic blood pressure of the subjects was 122.2 mmHg and diastolic 79.5 mmHg. The number of subjects who are hypertensive is 66 people (27.5%). The subjects of this study had an average body weight of 63.8 kg, the average height (TB) of the subjects was 161.5 cm. Based on BB / TB mapping, 42 subjects had overweight criteria (17.5%) and 92 subjects had obesity criteria (38.3%). The mean waist circumference of the subjects was  $87.5 \pm 11.9$  cm. Most subjects (68 people or 80%) of men had normal waist circumference and the majority of women (126 people or 81.3%) had central obesity. Previous studies noted that the prevalence of hypertension increases with an increase in body mass index in all age groups and gender of adolescents. An increase in body mass index also has an impact on blood sugar levels because it triggers insulin resistance, and increases blood cholesterol through an increase in blood triglycerides.<sup>14,15,16</sup> Individuals who are centrally obese show a higher daily calorie intake compared to those with a normal waist circumference. Fat in the central region releases large amounts of free fatty acids from intra-abdominal fat to the liver via the portal system, inhibiting

hepatic insulin clearance, thus increasing the risk of metabolic syndrome. Hypertension is the most common comorbidity in the overweight adolescent population. In adolescents and young adults, hypertension can lead to increased left ventricular mass and worsen cardiovascular prognosis, increasing the risk of cardiovascular morbidity and mortality such as heart attack, stroke and heart failure. Therefore, controlling hypertension from a young age is very important.

## CONCLUSION

This study identified risk factors for metabolic syndrome in HKBP Nommensen University Faculty of Medicine students, including obesity (38.3%), smoking (1.7%), physical inactivity (62.1%), and an average sleep duration of about 6.1 hours per day. High screen time was also noted, with an average of 7.3 hours for cell phones, one hour for tablets, 0.9 hours for laptops, and 2.75 hours for video games. More than half of the respondents (66.7%) had unhealthy food consumption habits, with an average frequency of twice a week. Suggestions for future research development include measuring biochemical profiles, stimulating longitudinal studies, implementing lifestyle change interventions, conducting comparative studies with other populations, exploring the health impact of technology use, analyzing cultural and regional variability, and expanding the sample size using qualitative research methods. The integration of these suggestions is expected to provide a more comprehensive insight into the factors that influence the risk of metabolic syndrome in the medical student population.

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