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The Association Between Chronotype and Physical Activity with Type of Obesity on Healthcare Students in Samarinda

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ABSTRACT

Obesity is a major global health problem, including in Indonesia, and is linked to increased risks of degenerative diseases and reduced quality of life. Based on the Asia-Pacific BMI classification from World Health Organization, Type I Obesity is defined as a BMI of 25 – 29.9 kg/m^2 , while Type II Obesity ($\geqslant$30 kg/m^2) poses higher risks of degenerative diseases. In Indonesia, adult obesity prevalence has risen from 14.8% in 2013 to 23.4% in 2023, with East Kalimantan (29%) and Samarinda (25.9%) exceeding national averages. University students are a vulnerable group due to lifestyle transitions involving irregular sleep, dietary changes, and low physical activity. Among them, health sciences students hold a critical role in obesity prevention, yet their credibility may be challenged if they themselves engage in unhealthy behaviors. This study aims to determine the correlation between chronotype and physical activity with the type of obesity on healthcare students in Samarinda city. The research method used is quantitative with a cross-sectional study design. The study population consisted of 7,728 students from six universities with healthcare faculties in Samarinda City, from which a sample of 105 respondents was selected using a purposive sampling technique. Data collection was conducted using MEQ-SA and IPAQ-SF questionnaires. Data were analyzed using the logistic regression test. This study found a statistically significant relationship between physical activity and obesity type among healthcare students in Samarinda ($p < 0.05$). In contrast, no significant associations were observed between chronotype and obesity type ($p > 0.05$) on healthcare students in Samarinda.

Key Messages:

- Light physical activity is significantly associated with an increased likelihood of Type II obesity among healthcare students, whereas chronotype does not demonstrate a statistically significant relationship with obesity classification in this population

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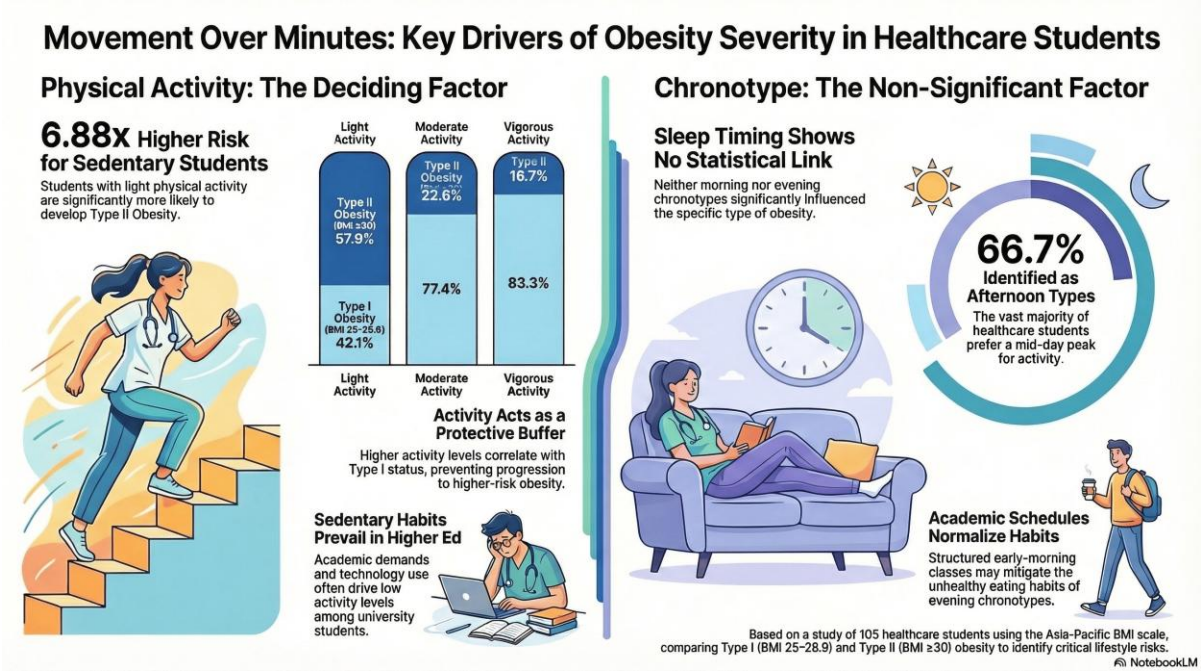
GRAPICHAL ABSTRACT



INTRODUCTION

Obesity is a major global health issue, including in Indonesia, and is characterized by excessive body fat accumulation that increases the risk of various disease (1) s. It is associated with cardiovascular disease, diabetes mellitus, hypertension, cancer, diminished quality of life, and psychological distress (2). According to the Asia-Pacific BMI classification, obesity is divided into Type I (BMI 25–29.9 kg/m^2) and Type II (BMI ≥30 kg/m^2), with Type II conferring higher risks of degenerative diseases such as diabetes and hypertension (3)

According to the World Obesity Federation's *World Obesity Atlas 2024*, the number of adults living with obesity is projected to increase significantly, building on the 2020 baseline of 0.81 billion (810 million) adults (18). The World Health Organization (WHO) also reports that in 2022 there were about 890 million adults living with obesity worldwide (19). In Indonesia, adult obesity prevalence has shown a steady increase over the past decade, from 14.8% in 2013 to 21.8% in 2018, and reaching 23.4% in 2023 (4). East Kalimantan exceeded the national prevalence at 29%, while Samarinda as its capital city recorded a total prevalence of 25.9%. University students represent a vulnerable group, as the transition from adolescence to adulthood often involves lifestyle changes such as irregular sleep, dietary shifts, and reduced physical activity (5). Healthcare tudents have a vital role in obesity prevention and health promotion, yet maintaining healthy personal habits is essential to strengthen their role as future health advocates (6). Evidence from Universitas Pembangunan Nasional "Veteran" Jakarta showed that 20.7% of health sciences students were obese, primarily associated with irregular sleep, poor dietary patterns, and sedentary behavior (7). An early study done by the author on December 2024 in Samarinda reported 28.6% obesity prevalence among 220 healthcare students, with 39 cases classified as Type II.

Because chronotype affects an individual's preferred time for sleep and activity, it can also influence participation in physical activity, which plays a crucial role in maintaining energy balance and preventing obesity. Sleep patterns and chronotype have been identified as key determinants of obesity risk. Chronotype reflects individual preference for activity timing and is classified as morning, afternoon, or evening (8). Evening chronotype is linked to unhealthy lifestyles and higher obesity risk (9). Studies confirm significant associations between evening chronotype and obesity among adults in Tehran (10) while 21% of nursing students in the United States were reported to have evening chronotype (11).

Low physical activity further contributes to obesity among students. Physical activity, defined as any skeletal muscle movement requiring energy expenditure, is a protective factor against obesity (1).

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However, sedentary lifestyles are increasingly common in higher education settings (12). Previous research showed that 47.8% of public health students at Universitas Muhammadiyah Prof. Dr. Hamka had low physical activity (13) and another study at Universitas Malahayati (14) identified a significant relationship between low physical activity and obesity among healthcare students (15). Research on obesity among Indonesian students has mostly looked at obesity in general, without separating it into specific types. This study fills that gap by using the Asia-Pacific BMI classification to distinguish between Obesity Type I and Type II which is more suitable for Asian populations. It also examines how chronotype and physical activity are related to these obesity types among healthcare students in Samarinda, a group that has not been studied before. The results are expected to give a better understanding of how daily habits and activity patterns relate to different types of obesity in young adults.

METHODS

This research is a quantitative study with a cross-sectional research design. This research took place in six universities at Samarinda City that has healthcare departements (Health Polytechnic of East Kalimantan, Samarinda Institute of Health Science, Wiyata Husada Institute of Health Technology, Mutiara Mahakam Institute of Health Science, East Kalimantan Muhammadiyah University, and Mulawarman University). The population in this study consisted of all healthcare students in Samarinda City, East Kalimantan, with 7.728 numbers in total. The sampling was determined by inclusion and exclusion criteria. The inclusion criteria were active health sciences students in Samarinda aged 19–24 years with BMI ≥25 kg/m^2 and sufficient communication ability to properly fill out the MEQ-SA and IPAQ-SF questionnaires. Moreover, the exclusion criteria included having a history of chronic disease, routine use of specific medications, record of bariatric surgery or other medical weight-loss treatments, and participation in a special dietary program. The sample size was calculated using the Lemeshow formula, which resulted in a total of 105 respondents. A purposive sampling technique was then applied to select participants who met the inclusion criteria.

Data collection was carried out by distributing questionnaires, including *Morning Eveningness Questionaire Self Assesment* (MEQ-SA) and *International Physical Activity Questionnaire Short Form* (IPAQ-SF). *The Morningness–Eveningness Questionnaire Self-Assessment* (MEQ-SA), consisting of 19 validated and reliable items in Indonesian, was used to determine respondents' chronotype over the past month with classifications of evening (score <42), afternoon (score 42–58), and morning (score >58), while the *International Physical Activity Questionnaire Short Form* (IPAQ-SF), consisting of 7 validated and reliable questions in Indonesia language, was applied to assess physical activity levels during the past week. Based on the IPAQ scoring protocol, participants' physical activity levels were categorized as light (<600 MET-min/week), moderate (600–2999 MET-min/week), or vigorous (≥3000 MET-min/week). In addition to filling out the questionnaire, nutritional status measurements also carried out. The type of obesity was assessed using a microtoise to measure height and a digital scale to measure body weight, followed by the calculation of Body Mass Index (BMI) values. The type of obesity was classified according to the Asia-Pacific criteria, where Type I Obesity is defined as a BMI of 25.0–29.9 kg/m^2, and Type II Obesity as a BMI of ≥30.0 kg/m^2. Data collection was conducted over a period of one month. To minimize potential recall bias when completing the questionnaires, the author clarified any uncertain or inconsistent responses by directly confirming them with the respondents during data collection. This ensured that participants' answers reflected their actual habits and conditions as accurately as possible. The collected data were then analyzed using a logistic regression test.

This study obtained ethical clearance from the Health Research Ethics Committee of the Faculty of Medicine, Universitas Sebelas Maret (Approval No. 53/UN27.06.11/KEP/2025). Prior to data collection, all participants were informed about the research objectives, benefits, procedures, potential risks, and their rights, including the right to withdraw at any stage without penalty. Written informed consent was then obtained using a standardized consent form, which participants signed voluntarily after confirming their understanding. To ensure confidentiality and anonymity, respondents' names were replaced with coded identifiers (e.g., R1, R2) and all data were securely stored with access restricted to the researcher.

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RESULTS

Table 1 presents the general characteristics of the respondents, including age, sex, BMI classification, chronotype category, and physical activity level.

Table 1. Subject Characteristics

Characteristics	n = 105	%
Gender		
Male	17	(16.2)
Female	88	(83.8)
Age (years)		
19-20	60	(57.1)
21-22	39	(37.1)
23-24	6	(5.7)
Institution		
Health Polytechnic of East Kalimantan	16	(15.2)
Samarinda Institute of Health Science	12	(11.4)
Wiyata Husada Institute of Health Technology	24	(22.9)
Mutiara Mahakam Institute of Health Science	5	(4.8)
East Kalimantan Muhammadiyah University	23	(21.9)
Mulawarman University	25	(23.8)
Type of Obesity		
Type I	76	(72.4)
Type II	29	(27.6)
Chronotype		
Morning	24	(22.9)
Afternoon	70	(66.7)
Evening	11	(10.5)
Physical Activity		
Light	19	(18.1)
Moderate	62	(59.0)
Vigorous	24	(22.9)

The results of the descriptive analysis showed that this study involved 105 respondents who agreed to participate in the research activities. The respondents consisted of 88 females (83.8%) and 17 males (16.2%), all of whom were categorized as adults aged 19–24 years (100%). All respondents were classified as obese, with 76 individuals categorized as Type I Obesity (72.4%) and 29 individuals as Type II Obesity (27,6%) The majority of respondents had afternoon chronotype (66.7%), while the rest were classified as morning type (22.9%) and evening type (10.5%). In terms of physical activity, 59% of respondents were categorized as having moderate activity, 22.9% as vigorous activity, and 18.1% as light activity.

Table 2. Respondent Characteristics Based on Type of Obesity

Category	Type of Obesity			
	Type I		Type II	
	n=76	(%)	n=29	(%)
Genders				
Male	16	(94.1)	1	(5.9)
Female	60	(68.2)	28	(31.8)
Chronotype				
Morning	19	(79.2)	5	(20.8)
Afternoon	50	(71.4)	20	(28.6)
Evening	7	(63.6)	4	(36.4)
Physical Activity				
Light	8	(42.1)	11	(57.9)
Moderate	48	(77.4)	14	(22.6)
Vigorous	20	(83.3)	4	(16.7)

Among the 105 students, 76 (72.4%) were classified as Type I Obesity and 29 (27.6%) as Type II. Female respondents had a higher proportion of Type II obesity (31.8%) compared to males (5.9%),

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whereas most males were classified as Type I (94.1%). Chronotype distribution indicated that Type I obesity was more prevalent among afternoon chronotypes (71.4%), while Type II obesity appeared relatively more common among evening chronotypes (36.4%) than among morning (20.8%) or afternoon types (28.6%). In terms of physical activity, Type II obesity was predominantly associated with light activity (57.9%), while Type I obesity was more frequent among those reporting moderate (77.4%) and vigorous activity (83.3%) (Table 2).

Table 3. Bivariate Test of Chronotype and Type of Obesity

Chronotype	OR	95% CI	P-Value
Morning	1.43	0.38 – 5.42	0.600
Evening	0.66	0.22 – 2.03	0.461

The logistic regression analysis indicated that chronotype was not significantly associated with obesity type. Compared with the afternoon chronotype as the reference category, the morning chronotype showed no significant association with obesity type (p = 0.600), and the evening chronotype also showed no significant association (p = 0.461) (Table 3).

Table 4. Bivariate Test Of Physical Activity and Type of Obesity

Physical Activity	OR	95% CI	P-Value
Light	6.88	1.68 – 28.10	0.007*
Moderate	1.46	0.43 – 4.98	0.547

The logistic regression analysis revealed that respondents with light physical activity was significantly associated with obesity type (p=0.007). Meanwhile, moderate physical activity was not significantly associated with obesity type (p = 0.547).

DISCUSSION

This study demonstrated that the majority of respondents were classified as Type I obesity (72.4%), while Type II obesity was identified in 27.6%. These proportions are consistent with the increasing prevalence of obesity among young adults in Indonesia (16). Although most respondents exhibited a afternoon chronotype (66.7%), logistic regression analysis revealed no significant association between chronotype and type of obesity. This finding diverges from previous evidence reported in Tehran, where evening chronotype was significantly associated with higher obesity risk (10), and in the United States, where evening chronotype was correlated with obesity among college students (11). Several factors may explain the lack of association between chronotype and the type of obesity in healthcare students. First, cultural and lifestyle variations could influence the sleeping patterns and eating behaviors. In the present setting, healthcare students may have more structured daily routines and earlier academic schedules, reducing the tendency toward late night eating commonly observed in evening chronotypes (21,22). Second, environmental and dietary factors, such as differences in meal timing, composition, and local food culture could modulate the relationship between chronotype and obesity across populations (23,24).

In contrast, physical activity showed a significant relationship with the type of obesity. Respondents with light physical activity were 6.88 times more likely to present with Type II obesity compared to Type I. This result corroborates findings from Malahayati University, which reported significant associations between low physical activity and obesity among healthcare students (14). Similarly, Avrialdo and Elon (12) observed that overweight and obese students with lower physical activity had a tendency toward obesity. Physiologically, insufficient physical activity reduces total energy expenditure, resulting in an energy imbalance that promotes excessive adipose tissue accumulation leading into the manifestation of obesity (1). Meanwhile, vigorous physical activity showed no significant relationship with the type of obesity (p=0.547). A cohort study using device-measured physical activity among African-origin adults found that although individuals with higher levels of moderate-to-vigorous activity (including vigorous intensity) tended to have lower body weight at baseline, this activity level was not significantly related to changes in body weight during an eight-year follow-up. This suggests that vigorous physical activity alone may not be sufficient to prevent long-term weight gain in daily life conditions (17).

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The present findings highlight the protective role of physical activity against Type II Obesity, even among healthcare students who are presumed to demonstrate a higher level of awareness regarding healthy lifestyle practices. These observations align with Gormley and Melby (6), who emphasized that knowledge alone does not necessarily translate into healthy practices. Environmental factors, academic demands, and sedentary behaviors related to technology use may substantially influence physical activity levels among university students(13).

The lack of association between chronotype and type of obesity in this study should be analyzed further in future wider research. Previous research suggests that evening chronotype may predispose individuals to late-night eating, increased caloric intake, and difficulty adhering to structured weight-loss programs (9).

This study also has some potential limitations. Referring the cross-sectional design employed in the present study, causal direction for both chronotype or physical activity with the type of obesity cannot be established. The wide confidence interval suggests limited precision, likely resulting from the small sample size. In addition, using self-reported instruments such as the MEQ-SA and IPAQ-SF may lead to bias, as participants might not always report their sleep habits or physical activity levels accurately.

Overall, these findings underscore the need for targeted interventions promoting physical activity among healthcare students. Such efforts are not only relevant for obesity prevention but also valuable for cultivating early health promoting habits that align with their future responsibilities as health professionals. Practical implications of the study suggest that higher education institutions, particularly health-related faculties, should prioritize strategies to promote physical activity, such as improving sports facilities, developing schedules supportive of active lifestyles, and integrating health behavior promotion into the curriculum. Future research is recommended to employ longitudinal designs with larger sample sizes to better elucidate the causal mechanisms linking chronotype, physical activity, and obesity progression.

CONCLUSION

In conclusion, this study identifies a significant association between light physical activity and the prevalence of Type II obesity among healthcare students in Samarinda. Specifically, individuals engaging in light physical activity exhibit a substantially higher likelihood of being classified with Type II obesity compared to Type I. In contrast, chronotype does not demonstrate a statistically significant relationship with obesity classification within this specific population. These findings underscore the critical role of physical activity as a primary protective factor against the progression of obesity. Consequently, higher education institutions, particularly health-related faculties, should implement targeted strategies to promote active lifestyles, thereby mitigating obesity risks and fostering healthy behavioral habits among future healthcare professionals.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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