Buletin Kedokteran & Kesehatan Prima
Vol.4 No.1 (2025)
DOI: 10.34012/bkkp.v4i1.6582

ORIGINAL ARTICLE

Factors contributing to weight gain among students during the COVID-19 pandemic

Jelentika Marpaung[1], Putri Marlinang[1], Masryna Siagian[2]*, Andreas Xaverio Bangun[3], Gilbert Lister[3], Frisca Gemmi Deseva[3], Andy William[3]

ABSTRACT

Weight gain among students during the COVID-19 pandemic was largely attributed to lifestyle changes, including diet, sleep patterns, decreased physical activity, and increased gadget use. This study aimed to identify the factors influencing weight gain in students at SMKN 10 Medan. A quantitative methodology was employed, utilizing a cross-sectional approach. The study population consisted of all students at SMKN 10 Medan, totaling 1,108 individuals. A sample of 294 students was selected using a random sampling technique. Data analysis was conducted using the chi-square test and logistic regression. The results indicated that all variables were significantly related to student weight gain during the COVID-19 pandemic, with p-values for physical activity (p=0.036), breakfast habits (p=0.042), snacking habits (p=0.001), sleep patterns (p=0.001), and gadget use (p=0.001). The most influential factors contributing to student weight gain were identified as snacking habits and sleep patterns, which exhibited the lowest significance values. It can be concluded that snacking habits and sleep patterns are the predominant factors associated with weight gain among students at SMKN 10 Medan during the COVID-19 pandemic.

Keywords: COVID-19, weight gain, students

Introduction

The COVID-19 pandemic has drastically altered people's lives, particularly for students who have had to adapt to online learning and strict social distancing measures.[1] Since the onset of the pandemic, the government has implemented Large-Scale Social Restrictions (PSBB) to curb the spread of the virus, which led to school closures and a shift to online learning methods.[2] This forced students to study from home, altering not only their academic routines but also impacting their physical activity and social interactions.[3]

Although online learning provides flexibility, it also poses several challenges for students. Previously, students engaged in physical activities at school, including walking between classes, participating in sports, and interacting with peers.[4,5] However, with online learning, many students spend hours in front of screens without breaks for movement. Limited space for movement at home and a lack of motivation contribute to their tendency to sit for extended periods.[6,7] Moreover, online learning has resulted in increased screen time. This excessive screen time may lead to eye strain and other health issues.[8–10] Time spent in front of screens often lacks balance with physical activity, contributing to a sedentary lifestyle. Increased sedentary behavior

Affiliation
[1]Undergraduate in Public Health Science, Universitas Prima Indonesia, Medan, Indonesia
[2]Department of Public Health, Universitas Prima Indonesia, Medan, Indonesia
[3]Faculty of Health Science, Universitas Adiwangsa Jambi, Jambi, Indonesia

***Korespondensi:**
rynasiagian@yahoo.co.id

can lead to numerous negative health consequences for students.[11] Research shows that lack of physical activity can result in weight gain, decreased fitness levels, and mental health issues such as anxiety and depression.[11–13] Furthermore, habits formed during the pandemic may be challenging to change once normal routines resume.[14]

Weight gain among students during the COVID-19 pandemic is a complex issue stemming from a combination of factors, including unhealthy dietary changes, stress from uncertainty, and reduced access to exercise facilities. Significant changes in students' diets have been primary drivers of weight gain. Students tended to eat more frequently during the pandemic, often accompanied by an increased consumption of fast food, which was readily available through delivery services.[15] Additionally, students often opted for processed foods and snacks high in calories, sugar, and fat, contributing to excess calorie intake and weight gain.[16] The uncertainty of the pandemic led to stress and anxiety for many students; these psychological factors can trigger unhealthy eating habits, such as overeating in response to negative emotions. The lack of a stable daily routine due to remote learning can exacerbate this issue.[17,18] Social distancing measures and the closure of sports facilities drastically reduced students' physical activity levels. More leisure time was spent at home engaging in sedentary activities like watching television or playing video games. This lack of physical activity significantly increased the risk of obesity.[19,20]

Weight gain in adolescents can have serious consequences for their health. Obesity during adolescence not only increases the risk of physical illnesses such as diabetes and hypertension but also negatively impacts mental health, leading to increased anxiety and depression. Therefore, understanding the causes of this weight gain is crucial for implementing preventive measures to maintain student health. This study aims to analyze the causes of weight gain among students at SMKN 10 Medan during the COVID-19 pandemic. By identifying the factors that influence these weight changes, it is hoped that recommendations can be provided to schools and parents to support healthy lifestyles for students. Additionally, this research is expected to offer insights for public health policies aimed at addressing obesity among adolescents.

Method

This research employed a quantitative approach with a cross-sectional design, conducted in January 2022. The population comprised all students from grades 10 to 12 at SMK Negeri 10 Medan during the 2021/2022 academic year, totaling 1,108 students. The research sample was determined using a simple random sampling technique, ensuring that each student had an equal chance of selection. Through a lottery technique, a sample of 294 students was obtained.

Primary data were collected directly by the researchers through interviews using questionnaires and observations of students at SMK Negeri 10 Medan. Secondary data, including school profiles, student numbers, class counts, and other relevant information, were obtained from SMK Negeri 10 Medan. This study examined five independent variables hypothesized to influence weight gain: physical activity, breakfast habits, snacking habits, gadget use, and rest patterns.

Physical Activity defined as bodily movement resulting from skeletal muscle contractions that lead to energy expenditure. Physical activity was measured using the International Physical Activity Questionnaire (IPAQ), with an interval scale. Measurement results were categorized into "Good" (below average) and "Poor" (above average). Breakfast habits defined as the consumption of food in the morning before daily activities, measured through interviews with an interval scale and categorized as "Good" (below average) and "Poor" (above average). Snacking habits defined as eating outside of main meal times, often accompanying other activities, measured through interviews with an interval scale and categorized as "Good" (below average) and "Poor" (above average).

Gadget use defined as an individual's ability to use gadgets to support daily activities, measured through interviews with an interval scale and categorized as "Good" (below average) and "Poor" (above average). Rest patterns defined as a system regulating a state of calm, relaxation, and freedom from emotional pressure and anxiety, measured through interviews with an interval scale and categorized as "Good" (below average) and "Poor" (above average). The dependent variable in this study was weight gain, defined as a change in body weight due to an increase in fat or muscle mass under the skin. Weight gain was measured through interviews with an interval scale and categorized as "Good" (below average) and "Poor" (above average).

Data analysis was conducted using SPSS software. Bivariate analysis employed the Chi-Square test to examine relationships between variables, while multivariate analysis used logistic regression to identify factors influencing the dependent variable.

Results

Table 1 presents the characteristics of a sample of 294 individuals, categorized by age, gender, grade level, weight, and various lifestyle habits. The majority of participants (62.9%, or 185 individuals) are aged 16-17 years. Younger individuals under 15 years old account for 24.2% of the sample (71 individuals), while those over 18 years represent the smallest group at 12.9% (38 individuals). The sample is predominantly female, comprising 87.8% (258 individuals), with males representing only 12.2% (36 individuals). In terms of grade level, the largest group consists of 12th graders, making up 49% of the sample (144 individuals). Tenth graders represent 31.6% (93 individuals), while 11th graders account for 19% (57 individuals). Weight is categorized into three groups: Most participants (79.6%, or 234 individuals) fall within the 41-60 kg range. Those weighing less than 40 kg make up 9.5% of the sample (28 individuals), while those weighing more than 61 kg represent 10.9% (32 individuals).

Table 1. Student characteristics (n= 294)

Characteristic	n	%
Age		
< 15 years	71	24.2
16 - 17 years	185	62.9
> 18 years	38	12.9
Gender		
Male	36	12.2
Female	258	87.8
Grade Level		
10th Grade	93	31.6
11th Grade	57	19
12th Grade	144	49
Weight		
< 40 kg	28	9.5
41 - 60 kg	234	79.6
> 61 kg	32	10.9
Physical Activity		
Good	118	40.1
Poor	176	59.9
Breakfast Habits		
Good	136	46.3
Poor	158	53.7
Snacking Habits		
Good	122	41.5
Poor	172	48.5
Sleep Patterns		
Good	130	44.2
Poor	164	55.8
Gadget Use		
Good	130	44.2
Poor	162	55.8

A total of 40.1% (118 individuals) are classified as having "good" physical activity habits, while the majority, at 59.9% (176 individuals), are classified as having "poor" habits. Breakfast habits show a similar pattern: 46.3% (136 individuals) report "good" breakfast habits, whereas 53.7% (158 individuals) report

"poor" habits. Snacking habits are almost evenly split, with 41.5% (122 individuals) reporting "good" habits and 58.5% (172 individuals) reporting "poor" habits. Sleep patterns are predominantly classified as "poor," with 55.8% (164 individuals) falling into this category; the remaining 44.2% (130 individuals) report "good" rest patterns. Regarding gadget use, 44.2% (130 individuals) are classified as having "good" habits, while the remaining 55.8% (162 individuals) are classified as having "poor" habits.

Table 2 presents data on the relationship between lifestyle factors and weight gain during the COVID-19 pandemic. Of those with good physical activity, 58.5% (69 people) experienced weight gain, while 41.5% (49 people) did not. In contrast, in the group with poor physical activity, the percentage who experienced weight gain was higher, namely 71.0% (125 people), and only 29.0% (51 people) did not. This shows that there is a correlation between poor physical activity and weight gain during the pandemic. In good breakfast habits, 59.6% (81 people) experienced weight gain and 40.4% (55 people) did not. Meanwhile, in poor breakfast habits, 71.5% (113 people) experienced weight gain and only 28.5% (45 people) did not. Just like physical activity, poor breakfast habits also seem to contribute to weight gain.

Table 2. Association between lifestyle factors and weight gain during the COVID-19 pandemic

Variable	Weight gain during COVID-19 (n(%))		p-value
	Experienced	Not experienced	
Physical activity			
Good	69 (58.5)	49 (41.5)	118 (100.0)
Poor	125 (71.0)	51 (29.0)	176 (100.0)
Breakfast habits			
Good	81 (59.6)	55 (40.4)	136 (100.0)
Poor	113 (71.5)	45 (28.5)	158 (100.0)
Snacking habits			
Good	58 (47.5)	64 (52.5)	122 (100.0)
Poor	136 (79.1)	36 (20.9)	172 (100.0)
Sleep patterns			
Good	64 (49.2)	66 (50.8)	130 (100.0)
Poor	130 (79.3)	34 (20.7)	164 (100.0)
Gadget use			
Good	67 (51.5)	63 (48.5)	130 (100.0)
Poor	127 (77.4)	37 (22.6)	164 (100.0)

A significant difference is seen in snacking habits. In the group with good snacking habits, only 47.5% (58 people) experienced weight gain, and 52.5% (64 people) did not. However, in the group with poor snacking habits, the percentage who experienced weight gain soared to 79.1% (136 people), with only 20.9% (36 people) not experiencing it. This data clearly shows that poor snacking habits are strongly associated with weight gain during the pandemic. Good sleep patterns showed balanced results, with 49.2% (64 people) experiencing weight gain and 50.8% (66 people) not. However, in poor sleep patterns, 79.3% (130 people) experienced weight gain, and only 20.7% (34 people) did not. Poor sleep patterns also contribute to weight gain.

In good gadget use, 51.5% (67 people) experienced weight gain and 48.5% (63 people) did not. Whereas in poor gadget use, 77.4% (127 people) experienced weight gain and only 22.6% (37 people) did not. Poor gadget use also seems to be correlated with weight gain. Overall, the analysis results show that poor snacking habits, poor sleep patterns, poor gadget use, lack of physical activity, and poor breakfast habits all contribute to weight gain during the COVID-19 pandemic. Poor snacking habits show the strongest correlation with weight gain.

Table 3. Multiple logistic regression

Variable	Significance Level	S.E.	B	95% C.I.for EXP(B)	
				Lower	Upper
Physical activity	0,194	0,281	0,694	0,400	1,204
Breakfast habits	0,984	0,288	1,006	0,572	1,769
Snacking habits	0,001*	0,285	0,299	0,171	0,523
Sleep patterns	0,001*	0,288	0,310	0,176	0,546
Gadget use	0,075	0,293	0,593	0,334	1,053

The multiple logistic regression results indicate that snacking habits and sleep patterns of students are dominant factors that significantly affect students' weight gain during the COVID-19 pandemic (p = 0.001).

Discussion

This study aims to analyze the factors contributing to weight gain among students at SMKN 10 Medan during the pandemic period. The factors investigated include physical activity, breakfast habits, snacking habits, sleep patterns, and gadget use. Regular physical activity typically contributes to weight control; however, some students at SMKN 10 Medan experienced weight gain despite being physically active. This phenomenon may be linked to increased snacking habits after exercise or activity. An increased appetite following physical activity can lead to excessive snack consumption, ultimately contributing to weight gain.

Conversely, weight gain in physically active students may also be attributed to increased muscle mass. Regular physical activity stimulates muscle growth, which has a higher density than fat. Therefore, weight gain does not always indicate an increase in body fat; it can also reflect an increase in muscle mass. This study aligns with several previous studies that highlight the relationship between physical activity and body mass index (BMI). Research by Wahyuningsih and Pratiwi[21] indicated that adolescents with moderate physical activity tend to be overweight or obese. Similarly, studies found that insufficient or poor physical activity was associated with an increased risk of obesity.[22,23]

Good breakfast habits are crucial for maintaining a healthy weight. Nevertheless, some students at SMKN 10 Medan who did not have good breakfast habits did not experience weight gain during the pandemic. This phenomenon may relate to other factors such as higher levels of physical activity, reduced snacking habits, or stress due to restrictions on outdoor activities. The study by Glinkowska and Glinkowski (2018) demonstrated that inactive adolescents have twice the risk of obesity. Studies by Ng et al.[24] and Kurdaningsih et al.[25] also found a significant relationship between breakfast habits and excess weight in adolescents. Additionally, systematic review and meta nalysis by Ma et al.[26] found that skipping breakfast was associated with increased risk of obesity.

Uncontrolled snacking habits can significantly increase the risk of weight gain. However, some students at SMKN 10 Medan with poor snacking habits did not experience weight gain, likely compensating with regular or more intense physical activity than usual. Research consistently shows that uncontrolled snacking habits significantly increase the risk of weight gain and obesity. A prospective study found that self-reported between-meal snacking was associated with a 69% higher risk of becoming obese.[27] Similarly, adolescents consuming more than 20% of their daily calories from snacks had a higher risk of overweight/obesity. Evening snacking was particularly problematic, with a 3.12 times higher risk of overweight/obesity.[27] A cross-sectional study revealed a direct association between snacking and weight gain in middle-aged individuals.[28] Importantly, habit strength was found to be the most crucial predictor of unhealthy snacking behavior, outperforming conscious intentions and environmental food cues.[29]

Irregular or poor sleep patterns are suspected contributors to weight gain; however, some students at SMKN 10 Medan with poor sleep patterns did not experience weight gain, possibly due to increased physical activity or lack of excessive snacking habits. Multiple studies have found associations between short sleep duration and increased risk of obesity, particularly in children.[30] Poor sleep quality and irregular sleep patterns may also play a role in weight gain.[31] The mechanisms underlying this relationship include hormonal changes affecting appetite regulation, increased food intake, and enhanced hedonic processing of food stimuli in the brain.[31,32] Short sleep duration has been linked to preferential increases in abdominal adiposity, possibly due to hyperactivation of the hypothalamo-pituitary-adrenal axis.[31] While most evidence supports the sleep-obesity link, findings in adolescents are inconsistent, and more research is needed on sleep timing patterns and chronotype.[30] Encouraging adequate sleep may be a valuable addition to weight management strategies.[31]

Excessive gadget use can negatively impact health, including the risk of weight gain. However, some students at SMKN 10 Medan who used gadgets excessively did not experience weight gain, likely because they remained physically active or reduced snacking habits due to their engagement with gadgets. Extended screen time is associated with sedentary behavior, which can contribute to weight gain. Studies indicate that children and adolescents who spend more than two hours daily on electronic devices are at a higher risk of obesity due to reduced physical activity levels and increased calorie intake from snacking while using

gadgets. The American Academy of Pediatrics recommends limiting screen time to mitigate these risks, yet many youths exceed this guideline significantly.[33]

Conclusion

This study presents a comprehensive overview of the factors contributing to weight gain among students at SMKN 10 Medan during the COVID-19 pandemic. Physical activity, breakfast habits, snacking behaviors, sleep patterns, and gadget usage all significantly influence weight regulation. However, it is essential to consider the interactions among these factors. The findings of this study emphasize the necessity of a holistic approach to weight management in adolescents. In addition to promoting regular physical activity and healthy eating habits, it is crucial to pay attention to adequate sleep patterns and responsible gadget usage.

References

1. Karasmanaki E, Tsantopoulos G. Impacts of social distancing during COVID-19 pandemic on the daily life of forestry students. Child Youth Serv Rev. 2021 Jan;120:105781.
2. Yuliyanto R, Yamin RD. The Impact of Learning Loss During a Pandemic Among Students. J Adv Soc Sci Policy. 2022;2(2).
3. Beserra V, Nussbaum M, Navarrete M, Garrido N. Online physically active academic lessons in COVID-19 times: A pilot study. Teach Teach Educ. 2022 Aug;116:103750.
4. Diciano J, Mateo W, Junior RJ, Versoza JI, Tindowen DJ. Students' experiences in learning physical education in an online environment. Edu Sport Indones J Phys Educ. 2021 Nov 14;2(3):140–54.
5. Tjandra C, Selvianita D. The Impact of Face-Face Learning after the Pandemic on the Attention and Independence of Elementary School Students. Edunesia J Ilm Pendidik. 2023 May 19;4(2):920–37.
6. Coman C, Țîru LG, Meseșan-Schmitz L, Stanciu C, Bularca MC. Online Teaching and Learning in Higher Education during the Coronavirus Pandemic: Students' Perspective. Sustainability. 2020 Dec 11;12(24):10367.
7. Yates A, Starkey L, Egerton B, Flueggen F. High school students' experience of online learning during Covid-19: the influence of technology and pedagogy. Technol Pedagog Educ. 2021 Jan 1;30(1):59–73.
8. Gupta R, Chauhan L, Varshney A. Impact of E-Schooling on Digital Eye Strain in Coronavirus Disease Era. J Curr Ophthalmol. 2021 Apr;33(2):158–64.
9. Abou Hashish EA, Baatiah NY, Bashaweeh AH, Kattan AM. The online learning experience and reported headaches associated with screen exposure time among Saudi health sciences students during the COVID-19 pandemic. BMC Med Educ. 2022 Dec 1;22(1):226.
10. Elsaid A, Abdelwahab A. The impact of increased screen time on students during covid-19 school closures. J Pediatr Neonatal Care. 2024 Oct 14;14(3):175–9.
11. Hanifah L, Nasrulloh N, Sufyan DL. Sedentary Behavior and Lack of Physical Activity among Children in Indonesia. Children. 2023 Jul 26;10(8):1283.
12. Ellingson LD, Meyer JD, Shook RP, Dixon PM, Hand GA, Wirth MD, et al. Changes in sedentary time are associated with changes in mental wellbeing over 1 year in young adults. Prev Med Reports. 2018 Sep;11:274–81.
13. Wang CH, Peiper N. Association Between Physical Activity and Sedentary Behavior With Depressive Symptoms Among US High School Students, 2019. Prev Chronic Dis. 2022 Nov 17;19:220003.
14. Charonitis M, Requier F, Guillemin C, Reyt M, Folville A, Geurten M, et al. The Influence of Changes in Daily Life Habits and Well-Being on Fatigue Level During COVID-19 Pandemic. Psychol Belg. 2024 Jul 18;64(1).
15. Palmer K, Bschaden A, Stroebele-Benschop N. Changes in lifestyle, diet, and body weight during the first COVID 19 'lockdown' in a student sample. Appetite. 2021 Dec;167:105638.
16. Kanberger ED, Leon Köbrich A, Schobin J. COVID-19 and shifting food preferences: A panel study among Chilean students. Appetite. 2025 Jan;204:107721.
17. Shehata WM, Abdeldaim DE. Emotional eating in relation to psychological stress during COVID-19 pandemic: a cross-sectional study in faculty of medicine, Tanta University, Egypt. BMC Public Health. 2023 Feb 7;23(1):277.
18. Cummings JR, Ackerman JM, Wolfson JA, Gearhardt AN. COVID-19 stress and eating and drinking behaviors in the United States during the early stages of the pandemic. Appetite. 2021 Jul;162:105163.
19. Berggren S, Almquist-Tangen G, Wolfbrandt O, Roswall J. Effects of the COVID-19 pandemic on the physical activity and screen time habits of children aged 11–13 years in Sweden. Front Public Heal. 2023 Aug 9;11.
20. Dunton GF, Do B, Wang SD. Early effects of the COVID-19 pandemic on physical activity and sedentary behavior in children living in the U.S. BMC Public Health. 2020 Dec 4;20(1):1351.
21. Wahyuningsih R, Pratiwi IG. Hubungan aktifitas fisik dengan kejadian kegemukan pada remaja di Jurusan Gizi Politeknik Kesehatan Mataram. AcTion Aceh Nutr J. 2019 Dec 19;4(2):163.
22. Devi KS, Nilupher, Gupta U, Dhall M, Kapoor S. Incidence of obesity, adiposity and physical activity pattern as risk factor in adults of Delhi, India. Clin Epidemiol Glob Heal. 2020 Mar;8(1):8–12.
23. Ahmadi MN, Inan-Eroglu E, Mishra GD, Salis A, Stamatakis E. Associations of changes in physical activity and diet with incident obesity and changes in adiposity: Longitudinal findings from the UK Biobank. Prev Med (Baltim). 2023 Mar;168:107435.
24. Ng M, Fleming T, Robinson M, Thomson B, Graetz N, Margono C, et al. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the Global Burden of Disease Study 2013. Lancet. 2014 Aug;384(9945):766–81.

25. Kurdaningsih S, Sudargo T, Lusmilasari L. Physical activity and sedentary lifestyle towards teenagers' overweight/obesity status. Int J Community Med Public Heal. 2016;3(3):630–5.
26. Ma X, Chen Q, Pu Y, Guo M, Jiang Z, Huang W, et al. Skipping breakfast is associated with overweight and obesity: A systematic review and meta-analysis. Obes Res Clin Pract. 2020 Jan;14(1):1–8.
27. Bes-Rastrollo M, Sanchez-Villegas A, Basterra-Gortari FJ, Nunez-Cordoba JM, Toledo E, Serrano-Martinez M. Prospective study of self-reported usual snacking and weight gain in a Mediterranean cohort: The SUN project. Clin Nutr. 2010 Jun;29(3):323–30.
28. Sánchez-Villegas A, Martínez-González MÁ, Toledo E, Irala-Estévez J de, Alfredo Martínez J. Influencia del sedentarismo y el hábito de comer entre horas sobre la ganancia de peso. Med Clin (Barc). 2002 Jan;119(2):46–52.
29. Verhoeven AAC, Adriaanse MA, Evers C, de Ridder DTD. The power of habits: Unhealthy snacking behaviour is primarily predicted by habit strength. Br J Health Psychol. 2012 Nov 5;17(4):758–70.
30. Miller AL, Lumeng JC, LeBourgeois MK. Sleep patterns and obesity in childhood. Curr Opin Endocrinol Diabetes Obes. 2015 Feb;22(1):41–7.
31. Chaput JP, Tremblay A. Insufficient Sleep as a Contributor to Weight Gain: An Update. Curr Obes Rep. 2012 Dec 16;1(4):245–56.
32. Beccuti G, Pannain S. Sleep and obesity. Curr Opin Clin Nutr Metab Care. 2011 Jul;14(4):402–12.
33. Tsang SMH, Cheing GLY, Lam AKC, Siu AMH, Pang PCK, Yip KC, et al. Excessive use of electronic devices among children and adolescents is associated with musculoskeletal symptoms, visual symptoms, psychosocial health, and quality of life: a cross-sectional study. Front Public Heal. 2023 Jun 29;11.