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Lifestyle Alterations During the COVID-19 Pandemic and Its Impact on Obesity amongst Indonesian University Students

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Abstract

Covid-19 pandemic caused large-scale mobility restrictions, including for students. This condition might induce lifestyle changes which could impact metabolic conditions. This study aims to (1) investigate lifestyles pre and mid pandemic; (2) investigate the relative differences of the students' BMI early pandemic until recent; (3) estimate the relationship between lifestyle alterations and increased BMI during the pandemic. The research conduct using an online survey of 110 students spread across Indonesia in the first to ninth semesters. Analysis was performed using the Wilcoxon signed-rank test and Spearman's analysis. The results showed that there were lifestyle alterations; namely, 15% of respondents reduced their walking habits, duration, and the number of steps. 9% reduced exercise frequency, with more than 50% of respondents reducing their exercise duration. Nearly 20% increased sedentary frequency. 11% experience stress and take it out on food. As many as 93% of respondents maintain the habit of consuming sweet drinks. Moreover, 66% experienced increased BMI during the pandemic, with almost 30% changing nutritional status from normal to overweight or obese. The median BMI increased by 0.5 kg/m2 with a significant difference (p=0.001). Finally, of all lifestyle alterations during the pandemic, two lifestyles had a significant effect on the increase in BMI, namely changes in the frequency of exercise (p=0.03) and consumption habits of sugary drinks (p=0.05). In conclusion, lifestyle changes in students during the pandemic occurred and impacted the increase in BMI. Priority of intervention should be made in this population to prevent a further increase in obesity in Indonesia.

Keywords: BMI, Lifestyle Alteration, Obesity, Pandemic, University Student

1. Introduction

The COVID-19 pandemic has caused large-scale mobility restrictions. Under these regulations, it is mandatory for those in Indonesia to limit activities involving the public. Thus students are also required to attend university at home through online communication media. Given this unpleasant condition, students tend to spend more extended periods seated and perform sedentary activities more often than attending physical classes. Practising this style of living will have a toll on the students' physical and mental well being. Students may eventually develop metabolic alterations, e.g. risks of increased BMI to unhealthy extents in the long run. Other risks of an inactive lifestyle include exposure to health complications such as cardiovascular diseases and mental illnesses. Accustomed to this desk-bound routine may eventually deteriorate the life and health quality of the youths.

During these times, it is a responsibility to accentuate the health of our youths before they face the consequences that come within the practice of an unhealthy lifestyle that may worsen their well being as a whole. One of the consequences of living an unhealthy lifestyle is the likelihood of alteration towards the students' nutritional status to unhealthy levels. Unhealthy habits and sedentary activities such as not sleeping adequately, not exercising appropriately and not consuming a balanced diet may lead to unwanted illnesses and disabilities if this

way of life is practised in the long run.[1] However, health complications can be prevented by implementing healthy habits and disciplining themselves to adhere to living a healthy and active lifestyle. A healthy lifestyle or good health is described as being in a complete state of physical, mental and social well being.[2] In order to achieve a healthy life, the students shall devote themselves to the components that will contribute to their quality of life, such as eating a balanced diet and staying active.

Several studies have observed lifestyle changes during the pandemic. However, the ones available evaluated the lifestyle qualities before and during the pandemic distinctively. For instance, these papers assess lifestyle qualities by using indices such as Global Physical Activity Questionnaire (GPAQ), Pittsburgh Sleep Quality Index (PSQI) and Perceived Stress Scale (PSP).[3] Other papers also investigated lifestyle issues during the pandemic, but their targets were generally towards youth, i.e. not specifically for high school or undergraduate.[4] Furthermore, some of the papers studied more on physical activity-related lifestyles but rarely correlated with the BMI,[5–7], whereas one had researched the relationship between BMI and under-processed food consumption during the lockdown periods.[8] Other papers have also suggested paying attention to the treatment of those that experience obesity whilst adhering to the COVID-19 stay at home mandates.[9] Furthermore, a study observed changes in lifestyle and BMI before and during the pandemic amongst university students of any level in Malaysia and Indonesia. However, this paper catered to all university students, i.e. undergraduate and postgraduate, whereas our research specifically studied undergraduate students, especially students in the Indonesia region.[10]

Hence, our research would like to give coverage to issues that have not been proposed. According to the information obtained, there has not been any research devoted explicitly to assessing the alterations in lifestyle prior to the COVID-19 pandemic and during the pandemic towards university student groups and its effects on the body mass indices in Indonesia. Furthermore, studies observing the obesity rate during the pandemic amongst Indonesian university students were rarely carried out. This study is expected to provide policymakers with an overview of the increasing prevalence of obesity in Indonesia.

This study aims to (1) investigate lifestyles pre and mid pandemic; (2) investigate the relative differences of the students' BMI early pandemic until recent; (3) estimate the relationship between lifestyle alterations and increased BMI during the pandemic.

2. Method

In order to carry out this research, an online survey using Google Form was distributed to university students in Indonesia. The questionnaire's content consists of the respondents' consent, a guarantee against any form of privacy breaching, enquiries regarding respondents' sociodemographic and questions regarding the lifestyles and nutritional status of each participant before and during the pandemic.

Questions related to lifestyle were assessed by enquiring about the respondents' weights and heights before and during the pandemic. It also followed by queries regarding walking frequency and duration, step count, exercise frequency and duration, sedentary frequency and duration, stress frequency, stress eating, habits of junk food and sweet beverages consumption, healthy sleeping cycle and respondent's self-report on whether the lifestyle before or during pandemic seems to be healthier.

The validation of this questionnaire was tested by firstly publishing the online survey to 50 respondents, and the questions were subsequently improved. The finalized total number of respondents for the questionnaire was 110 participants, of which 3 participants were excluded since they did not fulfil the questions completely.

The data analysis was done descriptively for the respondents' sociodemographic. The median and proportion were identified during the process. A normality test was carried out to evaluate data distribution. Data that are not normally distributed are presented in the median. Data distribution was used to clearly describe the lifestyle proportion and BMI before and mid pandemic. The lifestyles of each individual were also analyzed and grouped into three categories, including decrease, no change and increase during the pandemic. Subsequently, the lifestyle alteration data was analyzed, and correlations with the BMI changes were investigated using Spearman's analysis. Correlation (r) is indicated as positive if $r>0$ and negative if $r<0$. Significant changes were presented when ($p<0.05$). Data were analyzed using the Stata 13 (Stata Corp) software.

3. Results

The demographic characteristics of the respondents were described by age distribution, university subject (field of study), semester and sex. The age distribution had a median of 19 years old respondents and an interquartile range (IQR) of 19-20. The distribution for the respondents at tertiary education level was almost equal between public and private universities, where 41.3% of students were respondents from public universities whereas 58.7% were those studying in private universities. The distribution for the subjects was almost equivalent to each other, where 59% of respondents were in natural science courses and 41% from social science courses. Moreover, most of the respondents were those in the 1st to 5th semester, with a prevalence of 91.9%. Finally, the prevalence of female respondents was 82%, being the majority sex compared to males (Table 1).

Table 1. Demographic Characteristic of University Students

Demographic Characteristic	n	%
Age, year Median (IQR)	110	20 (19,20)
University		
Public	45	41.3%
Private	64	58.7%
Subject		
Natural Science*	64	59%
Social Science**	46	41%
Semester		
1st semester	9	8.2%
2nd semester	8	7.3%
3rd semester	28	25.5%
4th semester	14	12.7%
5th semester	42	38.2%
6th semester	3	2.7%
7th semester	2	1.8%
8th semester	3	2.7%
9th semester	1	0.9%
Sex		
Male	21	18%
Female	89	82%

*Natural science including Technical, engineering, architecture, biology, chemistry, biochemistry, pharmacy, psychology, statistics, medicine, dentistry, nursing, physics, mathematics. (Science, technology, engineering, mathematics) STEM

**Social science including Literature & art, business & economy, accounting, politics, education, Islamic courses

When observing the prevalence (Table 2), the most noticeable lifestyle changes were (1) the prevalence of those that reduced their walking frequency is 39%, (2) the recommended walking duration, 30 minutes per day experienced a reduction (3) 54% reduced step count to less than 1000 steps per day, (4) exercise frequency is

reduced from 24% to 18% for the ideal exercise frequency (3 times a week), (5) prevalence of those exercising only once a week increased from 29% to 45%.

Table 2. The lifestyle proportion of undergraduate students prior and during the pandemic

Lifestyle	Before Pandemic		During Pandemic	
	n	%	n	%
Walking Frequency				
Never	2	2%	0	0%
Seldom	50	45%	54	49%
Often	46	42%	43	39%
Always	12	11%	13	12%
Walking Duration				
<10 mins	44	40%	46	42%
10-30 mins	47	43%	46	42%
30-60 mins	16	15%	12	11%
>60 mins	3	3%	6	5%
Step count (n=67)				
<1000	31	46%	36	54%
1000-2000	13	19%	11	16%
2000-3000	9	13%	8	12%
3000-4000	4	6%	3	4%
4000-5000	5	7%	7	10%
5000-6000	2	3%	1	1%
6000-7000	1	1%	0	0%
7000-8000	0	0%	0	0%
8000-9000	0	0%	0	0%
9000-10000	2	3%	1	1%
Exercise frequency (per week)				
No exercise	15	14%	0	0%
Once	32	29%	50	45%
Twice	25	23%	27	25%
Three times	26	24%	20	18%
Four times	5	5%	6	5%
Five times	1	1%	2	2%
Six times	3	3%	3	3%
> six times	3	3%	2	2%
Exercise duration				
No exercise	14	13%	17	15%
<30 mins	46	42%	76	69%
30-60 mins	46	42%	16	15%
>60 mins	4	4%	1	1%
Sedentary Frequency				
Never	2	2%	0	0%
Seldom	26	24%	18	16%
Often	71	65%	78	71%
Always	11	10%	14	13%
Sedentary Duration				
1-3 hours	44	40%	38	35%
3-6 hours	64	29%	24	31%
>6 hours	102	31%	38	35%
Stress frequency				
Never	4	4%	2	2%
Seldom	55	50%	51	46%
Often	44	40%	52	47%
Always	7	6%	5	5%
Stress food				
Never	22	20%	20	18%
Seldom	46	42%	41	37%
Often	33	30%	40	36%
Always	9	8%	9	8%
Eating junk food habit				
Never	2	2%	1	1%
Seldom	53	48%	53	48%
Often	49	45%	51	46%
Always	6	5%	5	5%
Sweet drink habit				
Never	15	14%	14	13%
Seldom	66	60%	66	60%
Often	25	23%	27	25%
Always	4	4%	3	3%
Enough sleep				
Never	4	4%	2	2%
Seldom	41	37%	47	43%
Often	52	47%	50	45%
Always	13	12%	11	10%
Sleep before midnight				
Yes	66	60%	65	59%
No	44	40%	45	41%
Healthier life				
Yes	56	51%	32	29%
No	54	49%	78	71%

However, there was a positive alteration that was done towards the exercise frequency during the pandemic. All of the respondents exercised at least once a week, compared to pre-pandemic days where the prevalence of those who did not exercise was 14%, whilst reduced to 0% during the pandemic. It was also shown that those that exercised ideally (3 times a week) reduced whilst those that exercised less than the recommended frequency increased.

Moreover, the prevalence of frequent sedentary lifestyle increased for often and always categories, the former increased from 65% to 71% whilst the latter from 10% to 13%.

The occurrence of practising sedentary duration also increased. Respondents that spent more than 3 hours sedentary increased to 31%, whilst 35% spent more than 6 hours sedentary. The proportion of those who encountered stress often also increased from 40% to 47% during the pandemic, which simultaneously increased the prevalence of those who stress eat.

In the meantime, the habits of junk food and sweet drinks consumption did not experience drastic alterations when compared to pre-pandemic and during the pandemic. However, respondents that did not practice ideal sleeping durations were already high since before the pandemic. It was reported that during the pandemic, 43% seldom slept adequately. Moreover, the prevalence of sleep before midnight experienced an elevation. As much as 41% of the respondents reported sleeping after midnight during the pandemic. Overall, only half of the respondents agreed that their lifestyle before the COVID-19 pandemic was healthier when compared during the pandemic.

There was an increment in the median of the BMI before the pandemic and during the pandemic. The median pre-pandemic was 20.35 (18.5-22.2), whilst during the pandemic, the median was 20.93 (19.0-23.2). Hence, the median BMI has increased 0.5 kg/m2 with a significant difference (p=0.001). Simultaneously, the prevalence of underweight decreased by 8%, and overnutrition increased by 7% (Table 3).

Table 3. The students' BMI before and during pandemic

Nutritional Status	Before Pandemic		During Pandemic	
	n	%	n	%
BMI, kg/m² (median, IQR)*	110	20.35 (18.5-22.2)	110	20.93 (19.0-23.2)*
Underweight	27	25%	18	17%
Normal	58	54%	60	55%
Overweight	12	11%	19	17%
Obese I	10	9%	10	9%
Obese II	1	1%	2	2%

*The median BMI increased by 0.5 kg/m2 with a significant difference (p=0.001).

In table 4, the results showed that there were lifestyle alterations; namely, 15% of respondents reduced their walking habits, duration, and the number of steps. 9% reduced exercise frequency, with more than 50% of respondents reducing their exercise duration. Nearly 20% increased sedentary frequency. 11% experience stress and take it out on food. As many as 93% of respondents maintain the habit of consuming sweet drinks.

Moreover, 66% of the respondents experienced increased BMI, with almost 30% of the respondents changing nutritional status into higher levels towards overnutrition. Finally, of all lifestyle alterations during the pandemic, two lifestyles had a significant effect on the increase in BMI, namely changes in the frequency of exercise (p=0.03) and consumption habits of sugary drinks (p=0.05).

Table 4. Individual lifestyle, perception of health

Alteration	Decrease		N
	n	%	n
Walking frequency	15	14%	7
Walking duration	14	13%	8
Step count (n=67)	11	16%	5
Exercise frequency (per week)	10	9%	8
Exercise duration	56	51%	5
Sedentary frequency	6	5%	8
Sedentary duration	4	4%	9
Stress frequency	6	5%	9
Stress eating	3	3%	9
Eating junk food habit	4	4%	1(
Sweet drink habit	4	4%	1(
Enough sleep	9	8%	9
Sleep before midnight	6	5%	9
Perception of heathier life	28	25%	7
BMI (n=107)	31	28%	5
Nutritional status (n=107)	13	12%	6

4. Discussion

This research can showcase those lifestyle alterations that affect the nutritional status of university students. This paper is also able to demonstrate the quality of life of the students. It was proven that practicing unhealthy habits like walking and exercising inadequately, regular sedentary lifestyle, frequent stress, regular junk food consumption, and lack of sleep contributed to the decreased life quality.[11] This is further accentuated by the fact that only one third (⅓) reported that their current lifestyle is healthy after the pandemic. Last but not least, this study can also prove the impact of the COVID-19 pandemic on the lifestyle of these students. During the pandemic, activities involving the public and close contact were advised to be avoided to curb the spread of the virus. Under this mandate, many people were required to stay home and study at home online. This caused students to spend more extended periods seated since they usually study in one place, which happened to be their study area. Therefore, the students have a low chance of being physically active as frequently as they were studying on site. This lifestyle shift can lead to unhealthy nutritional status and unhealthy lifestyle practices resulting in health complications.

The demographic characteristics of respondents showed that the distribution of public and private universities and fields of study was almost equivalent. This finding indicated that these results were a fair representation of the student population coming from various universities and fields of study. However, careful consideration must be considered while generalizing this study result as the vast majority of the respondents were women.

Throughout the pandemic, there has been a change in the expected lifestyle. Walking frequency is expected to be often or always. Almost half of the respondents seldom walked. However, the prevalence of those that never walked decreased by 2% during the pandemic. It is known that the practice of adequate walking will have health benefits such as reducing the risks of developing heart disease and stroke, building stronger bones and improving balance, and contributing to overall mental well being.[12] The results also showed that more than 80% of the respondents invested less than 30 minutes each day for a walking duration, and the prevalence of those who walked less than 30 minutes per day decreased 4% more compared to pre-pandemic days. Walking 30 minutes per day with an ideal frequency shares similar benefits that cater to better physical and mental well being.[12]

Moving on to the ideal step count, the recommended count is in the range of 6000-10.000 steps per day. Cultivating this in one's daily routine is shown to reduce the risks of encountering problems in walking, standing, or climbing up the stairs. It is also mentioned that those that add 1000 steps each day may reduce the risk of facing mobility complications by 16% to 18%.[13] Half of the respondents who own a smartwatch report fewer than 1000 steps per day. The

prevalence of those walking minimum steps less than 1000 steps per day increased to 8% during a pandemic.

Exercise at least 150 minutes a week of moderate-intensity activity, equivalent to exercising at least three times a week. Most of the respondents exercised less than what had been recommended. During the pandemic, those who invested time for exercise reduced to 6% whilst exercising only once a week increased to 16%. However, when comparing exercise frequency before and during the pandemic, there is a positive change so that there are no respondents who do not exercise at all in a week. Exercise duration is expected to be done at least 30 minutes each day since this is the recommended duration to obtain health benefits such as improved cognitive functions and reduce risks of depression and anxiety.[12] However, the exercise duration experienced the most significant change in lifestyle alterations. 51% of respondents reported that their exercise duration was drastically reduced when compared to before pandemic days. Long-term practice of this unhealthy habit may jeopardise the quality of life of the youths in Indonesia.

Moreover, the sedentary period is expected to be reduced. Ever since before the pandemic, 75% have had high sedentary frequency. It is more worrying that those who often and always practice a sedentary lifestyle increased to 9% during the pandemic. Sedentary activity is determined as performing inactivity more than (>6) hours per day.[14] It is proven that sedentary duration negatively affects lifestyles and BMI.[15] During the pandemic, those that practice sedentary duration more than (>6) hours increased by 6%.

We also anticipate that stress faced by the respondents shall reduce to a minimum frequency. This is because stress is usually associated with obesity, and this occurs because stress tends to involve food or the practice of comfort eating as a coping mechanism to relieve stress.[11] However, almost 50% of the respondents have experienced stress before the pandemic, but the Covid-19 pandemic further exacerbated it. This was proven when the respondents reported that 7% endured stress more often than pre-pandemic days, whereas 6% reported stress eating. Half of the respondents used to consume junk food both before and during the pandemic, and a quarter of respondents often consumed sweet beverages.

The ideal sleeping hours for an adult is 7-9 hours per night. However, the vast majority of the respondents admitted to sleeping less than recommended. The 40% prevalence marked this. Even worse, during the pandemic, those that slept less than seven hours per night increased to 9%. Furthermore, those that slept later than midnight have been dominant since before the pandemic.

Those that reported life quality during pre-pandemic days were healthier was only half of the respondents. However, this value further decreased to one-third of the early percentage when compared to the pandemic era. Living a healthy life is crucial as a measure to strengthen immunity. Individuals are advised to maintain healthy lifestyle practices like eating a healthy diet, improving physical activity, and cultivating a healthy sleeping cycle. These are influential to the efficiency and physiological functions of the immune system.[16] Therefore a healthy immune system is essential during these times since a strong immunity will better compensate for immune responses towards COVID-19 infections and reduce the severity of the disease.[17]

The pandemic has affected the lifestyles which were observed at the individual level. Some individuals experienced a shift in lifestyle, either decreasing or increasing. However, the vast majority of the

respondents experienced unhealthier lifestyle alterations, including step counts, optimum exercise duration, increment in frequent sedentary lifestyle and duration, enduring stress and stress eating, and less adequate sleeping habits. As much as 25% of the individual respondents perceived that the pandemic had reduced overall lifestyle conditions. Less than 5% deemed lifestyle during the pandemic was healthier. However, some respondents also have lifestyle changes to a healthier direction, including walking duration, walking frequency and exercise frequency.

Nevertheless, the most crucial impact on lifestyle was proven through the prevalence of those that reduced exercise frequency to 51%. Research on the impact of the COVID-19 pandemic towards lifestyle held by the South Korean government reported similar experiences in which the quality of life and mental health gradually decreased in times of the pandemic. This was a clear indication that this issue is a global issue that can happen to various ethnicities.

This research demonstrated that the prevalence of the BMI increment during the pandemic was 0.61 kg/m2. Indonesia was not solely the country that experienced this crisis. Other research suggested that the elevation of BMI during the pandemic was also found globally. Even worse, countries and populations that experience unhealthy BMI are prone to developing metabolic diseases.[18] Other research also proved an increment in BMI median 0.05 to 0.1 kg/m2.

Lifestyle alterations were seen to give rise to nutritional status changes significantly. The relationship between lifestyle changes and nutritional status was shown through the difference manifested dominantly by the exercise frequency. The exercise frequency negatively correlated to the BMI ($p=0.035$, $r=-0.2$), which indicated that the BMI should be relatively lower when someone exercises more often. A similar occurrence was also propounded during research conducted amongst youths in China that studied changes in activity patterns and their correlation to obesity. The results presented that the youths experienced modifications in their lifestyles before and during the pandemic. The prevalence of those that experienced an increment in BMI, namely overweight and obese, was presented by ($p<0.001$) due to lifestyle modifications.[4]

Furthermore, a significant change was also seen in those consuming sweet drinks ($p<0.05$). However, the consumption of sugary beverages correlated negatively with the BMI ($r=-0.1$) indicating that sugary drinks did contribute to the reduction of BMI rather than increment. This finding is contrary to research on the relationship between sugar-sweetened beverages intake and weight gain. This study suggested that sugary beverages that were consumed per day increased BMI significantly, indicating the exposure towards consumption of sugary drinks catered to a significant outcome.[19] In further analysis, we found a positive correlation between sweet drink consumption and the frequency and duration of exercise. This may lead to an indirect effect resulting in a negative correlation between sweet consumption and BMI. Moreover, the results we obtained might result from some limitations during the data collection, e.g. did not specifically assess how much they drank (mL). It is necessary to research with a more detailed cohort or clinical trial design to see the effect of sweet consumption on BMI, especially in the university student population in Indonesia.

In some lifestyle changes, although there is no significant correlation, we can observe its effect on changes in BMI. Lifestyles that have the potential to be negatively correlated with an increase in

BMI include more step count, more exercise duration, reduced frequentation and duration of sedentary lifestyle practices, reduced stress eating, reduced junk food consumption, healthy sleep cycle and sleeping before midnight. Other research also found that the association between lifestyle alterations and body weight amongst Chilean citizens also suggested that food habits and physical activity patterns induce BMI increment. The study found that long hours of sedentary time (>6 hours per day) had an impact on increased BMI.[20]

This study has several strengths, including 1) This study showcased a fair representation of students from different universities and various fields of study in Indonesia, so education providers can also participate in intervention strategies; 2) This study explored the lifestyle habits of the youths in Indonesia, i.e. undergraduate students, before and during the COVID-19 pandemic; 3) This study successfully demonstrated the correlation between lifestyle alterations and BMI, specifically the impact on the obesity rate amongst Indonesian university students. 4) Data was analysed proportionally and on an individual basis, which made the impact of the lifestyle alterations during the pandemic towards the BMI of each respondent more noticeable. It would have been less distinguishable if only the prevalence differences were observed. The limitations of this study include 1) Study was using a cross-sectional approach, which meant we could not identify and relate the root cause with the impacts; 2) Data on lifestyle was self-reported, which meant there was a tendency for responses to bias towards the current lifestyle whilst answering queries regarding pre-pandemic lifestyle. Research on lifestyle changes requires a further qualitative approach through in-depth interviews to obtain information on the underlying causes of lifestyle changes. More in-depth data is also needed regarding the extent to which lifestyle changes occur to provide more specific recommendations for improvement.

5. Conclusion

Lifestyle changes in students during the pandemic occurred and impacted the increase in BMI. It was proven that lifestyles namely exercise duration and sweet drink consumption contributed to the BMI increment. Priority of intervention should be made in order to prevent a further increase in obesity in Indonesia.

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