Weight Behavioral Changed among College Student In Indonesia as Impact of Covid-19 Pandemic: A Structural Equation Model

Laras Sitoayu[1], Lintang Purwara Dewanti[2], Vitria Melani[2], Nurul Khairani[3]

[1]Dietitian Professional Education Study Program, Universitas Esa Unggul, Indonesia
[2]Nutrition Science Study Program, Universitas Esa Unggul, Indonesia
[3]STIKES Tri Mandiri Sakti, Bengkulu, Indonesia

Article info	Abstract
	Background: One of the community groups affected by the Covid-19 pandemic is college students. The pandemic has changed the learning system that requires college students to study from home. In addition, it changes college student life habits, including physical activity, diet, body composition, stress, changes in body weight, and others. **Objective**: Aim to model the impact of the pandemic on weight changes in college students in Indonesia. **Method**: this study was conducted on 1185 college students for 35 days with a cross-sectional design. The research design used a cross-sectional study design. Analysis of the data used is SEM with LISREL. **Result**: The results showed a causal relationship between the latent variables of significant lifestyle factors on consumption factors and important consumption factors on changes in body weight in a positive direction. Structural model of the determinants of weight change = 0.05 consumption + 1.03 lifestyle. Conclusion: Lifestyle and consumption factors affect changes in body weight during the Covid 19 Pandemic in college students. **Recommendation**: There needs to be more attention to public health after the Covid-19 Pandemic hit, especially regarding consumption patterns and stress. People must be able to adjust to new normal conditions so as not to vent their stress by consuming lots of snacks or foods high in fat and sugar. **Keywords:** Changes in body weight, the impact of the pandemic, college student

INTRODUCTION

World Health Organization (WHO) officially declared COVID-19 a pandemic in March 2020. In addition, the rapid transmission of the SARS Cov-2 virus requires physical restrictions on the movement of all people worldwide; work and learning are done online at home. So this leads to changes in active lifestyle habits to become more relaxed (1).

Likewise, for college students, restrictions on physical activity outside the home imposed by the government lead to changes in lifestyle, diet, and weight (2). Including nutritional factors that can affect changes in body weight. A sedentary lifestyle can increase appetite and ultimately change one's eating habits (3). Changes in eating habits tend to lead to overeating with choices of high-calorie foods, fried foods, and sweet foods (4).

Several studies show increased body weight and Body Mass Index for age (BMI/A) college students when doing home learning. Factors that increase weight at home or self-isolate during a pandemic are related to sedentary such as lack of sleep, snacking habits after dinner, increased appetite, changes in eating habits due to stress, and lack of physical activity (5).

Not only in terms of food consumption and sedentary behavior, but the COVID-19 pandemic has also indirectly forced people to adapt to new normal conditions, be active outside the home with proper health protocols or not leave the house to reduce the spread of the virus. For some people, this causes anxiety and even stress (6). The research results on college students stated that out of 160 respondents, 84% felt stressed during the COVID-19 pandemic. Students feel cooped up at home and cannot do anything but lie down, watch, and do the online (7). This stress factor triggers a person to eat more and behave passively, which affects body weight. Based on this background, researchers are interested in conducting survey research on Indonesian college students who are currently studying in Indonesia regarding the impact of the COVID-19 pandemic and other nutritional factors on changes in body weight.

The results of previous studies have found many determinants of changes in body weight but were analyzed by conventional regression (8–11). In addition, it is still rare to find research that analyzes the path of the COVID-19 pandemic in students throughout Indonesia with in-depth analysis using SEM.

OBJECTIVE

The study aims to examine the relationship between latent factors and indicators more precisely using the SEM approach.

METHOD
Design

This research is a quantitative analytical with a cross-sectional approach to analyze the impact of the COVID-19 pandemic and other nutritional factors on Indonesian college students' body weight changes.

Sample, sample size, & sampling technique

The population in this study were all Indonesian students studying in Indonesia. The sample in the study was taken using the Snowball Sampling technique. Three hundred eighty-two students were calculated using the proportion estimation formula for survey research.

The research method was carried out online on all Indonesian college students currently studying in Indonesia. The researcher conducted this study from April to November 2021. The population in this study was all Indonesian college students in Indonesia. Snowball Sampling is used to take the sample. The minimum sample size in this study was 382 students. The inclusion criteria in this study were Indonesian college students who were actively studying and willing to become respondents. The exclusion criteria were those who did not complete the survey.

Data collection process

Research variables include respondent characteristics (gender, age, education level, education sector, and area of residence), latent variables consist of 1) Changes in Body Weight (Perception of Weight Changes & Weighing Habits), 2) Consumption Factors (Breakfast Habits, Changes in Eating Patterns, Consumption of Supplements), and 3) Lifestyle Factors (Stress, Sedentary Behavior & Exercise Habits). The instrument used in this research is online using Google Forms, which consists of 60 questions.

The research team collected the data, assisted by several college student enumerators at the time of data collection.

Data analysis

Data processing and analysis were carried out with the help of a computer using the software LISREL Data analysis using Structural Equation Modelling (SEM). Before analyzing with the SEM method, several assumptions need to clarify, including 1). The ratio of the chi-square value to the model's degrees of freedom, 2). Comparative Fit Index (CFI) value is more than 0.9, 3). Root Mean Square Error of Approximation (RMSEA) value <0.05, 4). The Goodness of Fit Index (GFI) value is close to 1 and 5) if the variable has to construct reliability >0.6 and variance extracted> 0.05.

Ethical consideration

RESULTS

The research was conducted online on all Indonesian college students. From the data collection results, which took about 35 days, there were 1185 college student respondents. This study has three latent variables and their indicators (Table 1), including changes in body weight, consumption, and lifestyle factors. The results found that most of the respondents experienced changes in body weight during the Covid-19 pandemic, namely 67.1%, and had a habit of weighing as much as 57.4%.

Table 1 Distribution of Research Variables

Latent Variables	Amount (n)	%
Body Weight Changes		
1. Perception of Weight Changes		
Changing	795	67.1
Not changing	390	32.9
2. Habit of Weighing		
Not Routine	680	57.4
Routine	505	42.6
Consumption		
1. Breakfast Habit		
Not Routine	616	52
Routine	569	48
2. Dietary Changes		
Changing	562	47.4
Not changing	623	52.6
3. Supplement		
Changing	532	47.4
Not changing	653	52.6
Lifestyle		
1. Stress		
Severe	110	9.3
Moderate	914	77.1
Mild	161	13.6
2. Sedentary Behavior		
Not Good	751	63.4
Good	434	36.6
3. Exercise		
Not Good	430	36.3
Good	755	63.7
Total	1185	100

Based on the results of the analysis of consumption factors for breakfast habits, some respondents who did not usually eat breakfast, namely 52%, experienced changes in eating patterns with almost the same proportions as those who were "not changing" (47.4%) and "changing" (52.6%). In contrast, for indicators of supplement consumption, there was no difference. The proportion of changes in diet, where most of the respondents had taken supplements well during the pandemic, was 52.6%. The lifestyle factors of the respondents mainly experienced moderate stress, which was 77.1%, with bad sedentary behavior at 63.4% and good exercise habits at 63.7%, especially sports that were popular again, such as bicycles.

Results of the SEM model (Figure 1) show the direction and relationship between latent variables and indicators and exogenous and endogenous variables. The model that has been formed must be tested several times so that it can be declared feasible, valid, and significant so that the meaning can be interpreted. The model's feasibility test must meet several indicators (Table 2)

Based on the results of the feasibility test (Table 2), it can be seen that only the chi-square results indicate no fit. However, the results of other indicators state fit so that the model is considered feasible, and the next step in data analysis is the Measurement Model Test.

Table 2 Feasibility Test

Indicator	Result	Cut-off Value	Description
Chi-square	0.000	≥ 0.05	Not Fit
RMSEA	0.043	≤ 0.08	Fit
GFI	0.99	≥ 0.90	Fit
AGFI	0.98	≥ 0.80	Fit
RMR	0.032	≤ 0.05	Fit

Analysis between variables was carried out with structural model tests, both direct and indirect. The direct one is the consumption factor variable to the weight change variable. In contrast, the indirect one is the lifestyle variable to the consumption factor and then the consumption factor to the weight change (Table 3).

Table 3 Structural Model Test

No.	Direction of effect	Standardized coefficient value	t-*Value*	Description
Direct				
	Konsumsi → UbahBB	0.05	9.13	Significant
Indirect				
	Lifestyl → konsumsi	1.03	7.16	Significant
	Konsumsi → ubahBB	0.05	2.79	Significant
	Total	0.0515		Significant

Based on the results of the structural model test, the results show that direct and indirect variables have a significant effect on weight change. The causal relationship between the latent variable consumption factor and weight change is significantly positive, with a P-value of 9.13. The path coefficient value for the consumption factor variable is 0.05, meaning that the lower the consumption factor, the weight change will decrease by 0.05. Indicators that build consumption factor variables include dietary changes and supplement consumption. These two indicators have a positive coefficient value on weight change with values of 0.38 and 0.26, respectively. This means that the more significant the

difference in a person's diet, the higher the change in body weight.

Similar to the consumption factor, the variable relationship between lifestyle factors and consumption factors is significant at 7.16 with a positive direction and has a path coefficient value of 1.03, meaning that the higher the lifestyle factor, the consumption factor will increase by 1.03. The indicators that build lifestyle variables include stress levels, exercise habits, and sedentary behavior.

In the analysis phase, the structural model test is carried out in two stages, either directly or indirectly. The direct variable is the consumption factor for the weight change variable. At the same time, the indirect is the lifestyle variable for the consumption factor, then the consumption factor for the weight change.
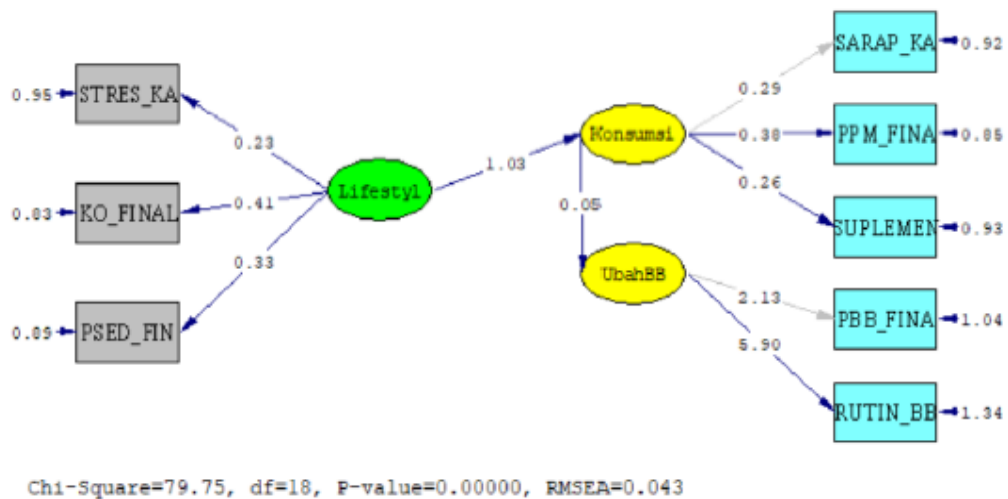

Chi-Square=79.75, df=18, P-value=0.00000, RMSEA=0.043

Figure 1. Body Weight Change Model

The results of the structural model test state that the direct and indirect variables significantly affect the changing weight. The significance can be seen from the value of the t-Value. The causal relationship between the latent variable of consumption factors and changes in body weight has a significant positive value with a P-value of 2.79. Furthermore, the path coefficient value for the consumption factor variable is 0.05, meaning that the lower the consumption factor, the change in body weight will decrease by 0.05.

DISCUSSION

Changes in body weight during the pandemic due to increased consumption of snacks and diet can increase degenerative diseases (12). Changes in consumption patterns during the Covid-19 pandemic for college students consisted of increasing meal portions, frequency of cooking at home, frequency of snacks, and frequency of vegetables and fruit (13).

Research conducted by Bolang et al. stated that the covid-19 pandemic caused changes in the nutritional status of college students (14). His study found that male students had a higher average body weight during the Covid-19 pandemic than women, as well as their nutritional status. In addition, many late teens and young adults experienced changed body weight and nutritional status during the pandemic compared to before the pandemic (15)

Indicators that build consumption factor variables include diet changes and supplement consumption. Of these two indicators, the coefficient values are positive for changes in body weight, with values of 0.38 and 0.26, respectively. The mean showed a higher score in a person's diet, the higher the change in body weight. This statement aligns with the research

results, stating that the Covid-19 pandemic has significantly affected college students' eating and buying habits. Students buy many snacks to accompany activities at home, even at night. In addition, some college students consume more healthy food prepared at home and reduce snacks but eat more often than usual (16). Based on the study results, college students in Indonesia tend to experience many changes in their diet, especially foods high in fat and sugar purchased online. Only some students experience changes by constantly consuming processed foods at home. Most experienced a change in consuming staple foods and snacks, more vegetables and fruit, and animal and vegetable side dishes.

Respondents in this study regularly took supplements. Even in a day, some took more than one kind of supplement. The behavior is made because of the fear of pandemics. It is also a way to increase the body's immunity. The supplements consumed mainly by Indonesian college students are multivitamins, vitamins C and D. Since the Covid-19 pandemic, there have been many recommendations for taking supplements or vitamins to increase endurance. In addition, although not entirely true, vitamin c and multivitamins can prevent coronavirus transmission (17)

Another factor that causes weight gain in college students is changes in breakfast habits during the pandemic. The shift in breakfast time occurred in 64 students who were observed before the pandemic. Students who had breakfast before 9 o'clock were 62.51%. Still, during the pandemic, most students started eating in the morning after 9 o'clock, which was 57.81%. While studying at home does not require students to get up early to go to campus, students also tend to wake up later and skip breakfast 9. As with the consumption factor, the variable relationship between lifestyle factors and consumption factors has a significant value in a positive direction and has a path coefficient value of 1.03, meaning that the higher the lifestyle factor, the consumption factor will increase by 1.03. The indicators that build lifestyle variables include stress levels, exercise habits, and sedentary behavior.

Online learning was initially responded to positively by students, but over time students experienced several difficulties, including unsupportive signals, lack of quotas, many distractions when studying at home, lack of focus, difficulty understanding the material, and more assignments with short deadlines time. This situation causes stress to students (18). Therefore, college students have a high risk of stress and are exposed to various stressors. The stress experienced by students that occur in higher education is called academic stress (19)

The conclusion found that Indonesian college students were stressed because they were bored with routines that required them to stay home during the pandemic. They could not meet friends and spent much time completing assignments online, which in turn caused the desire to eat more snacks and food at home. Based on the study's results, the stress level in adolescents can increase appetite. Therefore, food reduces stress levels (20)

A structural model was obtained based on the data analysis and explanation results. The following is the result of the equation: Changes in body weight = 0.05 consumption + 1.03 lifestyle. Therefore, changes in body weight that occur in college students due to the COVID-19 pandemic are due to changes in the new normal lifestyle that students must carry out (21)

As part of Indonesian society, college students have received much information about COVID-19. The attitude of college students and the community is quite good, one of which is by implementing Health protocols in daily life, regularly sunbathing, and taking supplements/vitamins. Some consumed vitamins can increase endurance, make the body more prime, and increase appetite. The low level of physical activity supported by increased appetite may trigger changes in body weight (22-23)

The limitation of this study is that it did not measure the research variables before the pandemic, so the results obtained could only analyze the changes felt by the respondents. The weight variable in this study was calculated based on estimated physical changes confirmed through a questionnaire.

CONCLUSION

The results showed that lifestyle and consumption factors influenced changes in body weight during the pandemic. The structural model of the determinants of weight

change is weight change = 0.05 consumption + 1.03 lifestyle. Therefore, the public, especially college students, must have sufficient knowledge and attitudes to maintain unwanted weight changes during the pandemic.

Furthermore, educational institutions must pay attention to this because changes in body weight, either less or more in the long term, can increase the risk of degenerative diseases.

REFERENCES

1. CDC. New CDC data finds adult obesity is increasing. 2020.
2. Pecanha T, Goessler KF, Roschel H GB. Social isolation during the COVID-19 pandemic can increase physical inactivity and the global burden of cardiovascular disease. Am J Physiol - Hear Circ Physiol. 2020;318(6):H1441-6.
3. Ammar, Achraf; Brach, Michael; Trabelsi, Khaled; Chtourou, Hamdi; Boukhris, Omar; Masmoudi, Liwa; Mouaziz, Bassem; Bentlage, Allen; Hammouda, Omar; Paineiras-Domingos, Laisa Liane; Braakman-Jansen, Annemarie; Wrede, Christian; Bastoni, Sofia; Pernambuco, C A. Effects of COVID-19 Home Confinement on Eating Behaviour and Physical Activity: Results of the ECLB-COVID19 International Online Survey. Nutrients. 2020;12(1583):1–13.
4. Ruiz-Roso MB, Padilha P de C, Mantilla-Escalante DC, Ulloa N, Brun P, Acevedo-Correa D, et al. Covid-19 confinement and changes of adolescent's dietary trends in Italy, Spain, Chile, Colombia, and Brazil. Nutrients. 2020;12(6):1–18.
5. Zachary Z, Brianna F, Brianna L, et al. Selfquarantine and weight gain related risk factors during the COVID-19 pandemic. Obes Res Clin Pr. 2020;14(3):210–6.
6. Ros Maria GA, Raharjo ST. Adaptasi Kelompok Usia Produktif Saat Pandemi Covid-19 Menggunakan Metode Reality Therapy. J Kolaborasi Resolusi Konflik. 2020;2(2):142.
7. Gimon N et al. Gambaran Stres Dan Body Image Pada Mahasiswa Semester VI Fakultas Kesehatan Masyarakat Universitas SAM Ratulangi Selama Masa Pandemi Covid-19. J KESMAS. 2020;Vol. 9(No. 6):Hlm. 17-26.
8. Long E, Patterson S, Maxwell K, Blake C, Pérez RB, Lewis R, et al. Covid-19 pandemic and its impact on social relationships and health. J Epidemiol Community Heal. 2022;76:128–32.
9. Fitriadi F, Jiuhardi J, Busari A, Ulfah Y, Hakim YP, A EK, et al. Using Correlation to Explore the Impact of Corona Virus Disease on Socioeconomics. Emerg Sci J. 2022;6(Special Issue):165–80.
10. Grondal, Maria; Ask, Karl; Luke, Timothy J.; Winblad S. Self-reported impact of the COVID-19 pandemic, affective responding, and subjective well-being: A Swedish survey. PLoS One. 2021;Oktober(15):1–15.
11. Maghyereh A, Abdoh H, Wątorek M. The impact of the COVID-19 pandemic on the dynamic correlations between gold and U.S. equities; evidence from multifractal cross-correlation analysis. Qual Quant [Internet]. 2022; June. Available from: https://doi.org/10.1007/s11135-022-01404-x
12. Lin AL, Vittinghoff E, Olgin JE, Pletcher MJ, Marcus GM. Body Weight Changes During Pandemic-Related Shelter-in-Place in a Longitudinal Cohort Study. 2021;4(3):17–20.
13. Noviasty R, Susanti R, Sari IW. Karakteristik Nutrisi Korban dan Pelaku Bullying Pada Anak Usia Sekolah Dasar. Public Heal Sci J [Internet]. 2017; Available from: http://103.55.216.56/index.php/Al-Sihah/article/view/3761
14. Bolang CR, Kawengian SES, Mayulu N, Bolang ASL. Status Gizi Mahasiswa Sebelum dan Di Saat Pandemi COVID-19. 2021;13(28):76–83.
15. Huber BC, Steffen J, Schlichtiger J, Brunner S. Altered nutrition behavior during COVID - 19 pandemic lockdown in young adults. Eur J Nutr [Internet]. 2021;60(5):2593–602. Available from: https://doi.org/10.1007/s00394-020-

02435-6

16. Yılmaz HÖ, Aslan R, Unal C. Effect of the COVID-19 Pandemic on Eating Habits and Food Purchasing Behaviors of University Students. Kesmas Natl Public Heal J. 2020;15(3):154–9.

17. Lidia K, Levina E, Setianingrum S, Folamauk C, Riwu M, Lidesna A, et al. Peningkatan Kesehatan dengan Suplemen dan Gizi Seimbang di Era Pandemi Covid-19. J Pengabdi Kpd Masy Undana. 2020;14(2):63–8.

18. Andiarna F, Kusumawati E. Pengaruh Pembelajaran Daring terhadap Stres Akademik Mahasiswa Selama Pandemi Covid-19. J Psikol. 2020;16(2):139.

19. Barseli, M., & Ifdil I. Konsep Stres Akademik Siswa. J Konseling dan Pendidik. 2017;5:143.

20. Aminatyas, Ismi; Sitoayu, Laras; Angkasa, Dudung; Gifari, Nazhif; Wahyuni Y. Hubungan Konsumsi Makanan Cepat Saji, Tingkat Stres dan Kualitas Tidur terhadap Status Gizi pada Remaja Putra SMA DKI Jakarta. Indones J Hum Nutr. 2021;8(1):55–64.

21. Cao, W., Cao, W., Cao, W., Fang, Z., Hou, G., Han, M., Xu, X., Dong, J., Zheng J. The Psychological Impact of The Covid-19 Epidemic on College Students in China. Psychiatry Res. 2020;

22. Atmadja TFA, Yunianto AE, Yuliantini E, Haya M, Faridi A, Suryana S. Gambaran sikap dan gaya hidup sehat masyarakat Indonesia selama pandemi Covid-19. AcTion Aceh Nutr J. 2020;5(2):195.

23 Pamungkas RA, Chamroonsawasdi K. Home-based interventions to treat and prevent chilhood obesity: a systematic review and meta-analysis. Behavioral Sciences. 2019; 9(4): 38