

Obese School Children Assessment During COVID-19 Pandemic

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ABSTRACT

School closure policies in all countries during COVID-19 pandemic can increase the incidence of obesity in obese school children. The aim of this research was to assess the nutritional status, eating habits, and physical activity of obese school children during the pandemic. This is a cross-sectional study at the two elementary schools with the highest prevalence of obesity in South Jakarta. Anthropometric data were collected at respondents' homes while food consumption and daily activity were collected online. The 24-hours-recall and food consumption analysis were used. Statistical analysis data used SPSS, ($p = 0.05$). Of 52 students, 33 were classified as obese, and 19 students were classified as overweight. The proportion of obesity incidence and waist circumference for height was significantly higher ($p < 0.05$) in boys than girls. There was a significant difference ($p < 0.05$) in energy and carbohydrate intake between overweight and obese students. The average energy intake and carbohydrate of overweight students were 74.42% RDA (Recommended Dietary Allowance) and 64.23% RDA, respectively, while obese students were 87.00% RDA and 86.33% RDA, respectively. The average physical activity a day was around 9-12 minutes, and secondary activities such as watching TV, playing games, and surfing the internet are more than 3 hours per day. This can conclude that during the pandemic, the proportion of obese and centrally obese children was higher than overweight children. They habitually consume high-calorie density foods, while the intake of fiber such as vegetables and fruit was very low. The physical activity of all students was low.



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1. INTRODUCTION

Coronavirus Disease 2019 (COVID-19) is an infectious disease with common signs and symptoms of acute respiratory disorders such as fever as well as cough with shortness of breath. The cause of the disease is SARS coronavirus 2 (SARS-CoV-2). This disease initially spread rapidly from Wuhan Hubei City, Province of China in December 2019, to the rest of the world [1]. Since March 2020, The World Health Organization (WHO) had set the COVID-19 outbreak as a global pandemic. At the same time, Indonesia had been declared

as one of the countries exposed by this virus [2]. Transmission of this disease is very fast and short. Moreover, the mortality rate is remarkably high [3]. For example, in early July 2020, WHO reported 11,858,226 confirmed cases with 545,481 deaths worldwide (Case Fatality Rate/CFR 4.6%). Meanwhile, in Indonesia there were 70,736 confirmed cases of COVID-19 with 3,417 deaths (CFR 4.8%) [4]. In order to break the chain of transmission, WHO suggests to temporarily stop activities that potentially cause crowds in various ways such as social distancing, self-isolation and school closures [5]. Most governments around the world, including Indonesia, have followed this suggestion particularly in closing educational institutions to prevent the spread of the COVID-19 pandemic. Indonesian Ministry of Education and Culture released instruction number 1 of 2020, to conduct distance learning as well as advised students from elementary school to university to study from their homes, until further information [6]. In addition, this school closure influenced obesity control programs in school age children both in the world and in Indonesia. Several reports from developed countries showed that 2-month school closure and a decrease in physical activity by more than 10% in summer season significantly increased the prevalence of obesity by 0.64% [7].

Research in Verona, Italy reported that children and adolescents who were experiencing a stay at home for 3 weeks did not have any change in vegetable consumption, however, there was an increase in the consumption of fruits, chips, red meat, and sweet drinks [8]. Physical activities were only carried out less than 150 minutes per week, sleeping time increased by 0.65 hours/day; time spending on watching television became 4.85 hours/day [9]. It can be concluded that global pandemic has forced students to study at home and increased several unhealthy activities such as sitting, watching TV, playing games, reading, while consuming fast food and drinking sweet. The condition became worse since some outdoor play areas were closed which reinforced an obesogenic environment that is conducive to physical inactivity and sedentary lifestyle. Obesity of school age children in Indonesia as well as in developed countries had increased rapidly. Recently, the prevalence of obesity in Indonesia has increased every decade. From 16% in 2001, 20.2% in 2010, 21.8% in 2013 to 23.4% in 2018 respectively. DKI Jakarta is one of the provinces in Indonesia that has the highest prevalence of obesity. Currently the prevalence of obesity has risen to 29.8%, above the national average [10]. Studies in Japan show that 32% of obese boys and 41% of obese women become obese as adults. Moreover, overweight and obesity in childhood and adolescence have adverse consequences on premature mortality and physical morbidity such as cardiovascular disease, diabetes mellitus as well as development disorder [11]. Therefore, since the end of 2019 until 2020, along with overcoming stunting or malnutrition problem, DKI Jakarta, capital Province, started an obesity control program, with an initial program of health screening school age children and mapping schools which have high obesity prevalence. Unfortunately, due to COVID-19 pandemic, the implementation of this program has been postponed. High priority was given in controlling COVID 19 because of the significant increase in positive infected patients. (on January 16, 2021, positive confirmed cases were 223,970 [12].

This study aims to evaluate the physical activity, nutritional status, eating habits and types of food consumed by obese and overweight school age children during pandemic. Hopefully, the results of the study will provide evidences that obesity in school age children needs to be addressed immediately along with controlling COVID-19 disease since obesity also contributes to higher mortality risk in COVID-19 patients including 14 years old children or older [13].

2. Methods

Ethical approval of the study was obtained from Health Polytechnic Jakarta II No LB.02.01/I/KE/31/418/2020, September 21, 2020. The research was a cross sectional study in two public elementary schools in urban area at South Jakarta, Indonesia, selected from the list schools based on the highest prevalence of overweight and obese according to the screening assessment by Health Department in

South Jakarta in February 2020. Population of the study was elementary school children from two schools who nutritional status was overweight and obese. Sample was selected using inclusion and exclusion criteria. The inclusion criteria of sample were overweight or obese children and from grade 4, 5 or 6. Informed consent was obtained from mothers of children who were willing to take part after the study procedure was explained. The exclusion criteria were children and family who was sick or in self-isolation due to COVID-19 infection. Anthropometric data including body weight, height, waist circumference of sample were collected at respondents' home by enumerators and applied health protocol for COVID-19 infection. Enumerator, children and parents using plastic glove, mask, face shield, hand sanitizer. Enumerator would explain the parents how to measure the anthropometric data for self-assessment. The anthropometric measurement kit was sprayed by disinfectant regularly before used. Body weight of children were measured using weighing scale with 0.01kilograms' precision. Height of respondents was measured using microtoise with precision of 0.1cm. Then, nutritional status of children was calculated using WHO anthropometric plus and classified overweight if BMI-for-age greater than 1 standard deviation above the WHO growth reference median, and obesity if greater than 2 standard deviations above the WHO growth reference median. Waist circumference was measured circumference of waist at 2 fingers from navel without cloth using microtoise tape with unit precision of 0.1 cm. Waist circumference to height ratio used to determine central obesity. Ratio $\geq 0,5$ classified as central obesities.

Data of food intake and activity of children were collected online using hand phone and whatsapp application to children and their parents. The questionnaire used to collect characteristics of parents and children include education and employment status of the parents. Food intake data provided using one day of 24 hours' dietary recall. We used the Nutrisurvey software for analyse the nutrient contents of food. Mean energy and nutrient intake of the children were evaluated according to the recommended dietary allowances (RDAs) for Indonesia. Data of daily activity include length time for study, watching TV, play games, outdoor activity, household activity, sport and exercise and length of sleeping time collected using google form.

Statistics: Analysis the data used the computer statistic program. Percentage, frequency, number (n), mean, standard deviation (SD) were given as descriptive statistics. Chi-square test, t test and other were used as analytic statistic. Significance level was p-value < 0.05.

3. Results

3.1 Characteristic

Table 1, showed that the respondents characteristic in this study which were dominated by boys (59.6%), aged 11-12 years (65.4%), and sitting in class 6 (42.3%). The last education history of the respondent's parents was dominated by high school graduates, namely father (55.8%) and mother (51.9%). Meanwhile, for the father's job, it is dominated by private employees (51.9%) and mother's job is housewives (78.8%).

Table 1. Characteristic Data

Characteristic	N	%
Gender		
Boy	31	59.6
Girl	21	40.4
Age		
9-10 Years	18	34.6
11-12 Years	34	65.4

Class		
4 th Grade	12	23.1
5 th Grade	18	34.6
6 th Grade	22	42.3
Father's Last Education		
Elementary School	2	3.8
Junior High School	8	15.4
Senior High School	29	55.8
College	13	25.0
Mother's Last Education		
Elementary School	5	9.6
Junior High School	9	17.3
Senior High School	27	51.9
College	11	21.2
Father's Occupation		
Government Employee	0	0.0
Private Employee	27	51.9
Entrepreneur	11	21.2
Labour	7	13.5
Not Work	7	13.5
Mother's Occupation		
Government Employee	0	0.0
Private Employee	6	11.5
Entrepreneur	5	9.6
Housewife	41	78.8

3.2 Nutritional Status Indicators

Nutritional status indicators in this study were visualized based on the z-score BMI/age and waist circumference ratio according to age. In table 2 it can be seen that the average waist circumference of other boy is 83.29cm with a minimum of 71cm and a maximum of 121cm. Whereas for girl the average waist circumference is 76.04cm with a minimum value of 59cm and a maximum of 89cm. After the t-test was carried out, it was found that there was a significant difference in waist circumference between boy and girl students ($p < 0.05$).

The average z-score based on BMI / U in the boy group was 2.61 with a minimum value of 0.21 and a maximum value of 5.11. Whereas in the group of girls, it was known that the average z-score was 1.83 with a minimum value of -0.95 and a maximum value of 3.55. After the t-test was carried out, it was found that there was a significant difference in z-scores between the two groups ($p < 0.5$).

Table 2. Distribution of Nutritional Status Indicators (n=52)

Nutritional Status Indicator	Boy			Girl			P-value
	Mean \pm SD	Min	Max	Mean \pm SD	Min	Max	
Waist Circumference	83,29 \pm 10,93	71,0	121,0	76,04 \pm 9,62	59,0	89,0	0,039*

(cm)

Z-Score (BMI/Age) 2,61±0,99 0,21 5,11 1,83±1,14 -0,95 3,55 0,018*

*) Significant p<0,05

In Table 3 below, based on the nutritional status indicator z-score (BMI/age), 76.7% of the boy group had obese nutritional status and 54.5% of the girl group had over nutritional status. Meanwhile, based on the waist circumference to height ratio, 83.3% of the boy group and 72.7% of the girl group had a ratio of > 0.5, which means that they are at risk of having central obesity.

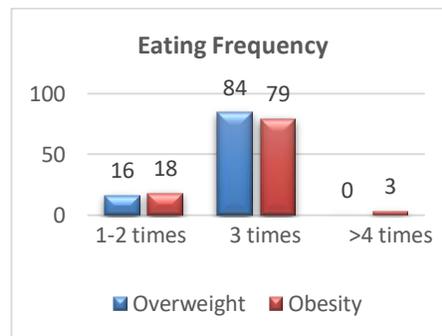
Table 3. Distribution of Waist Sircumference to Height Ratio (n=52)

Nutritional Status Indicator	Gender				p-value
	Boy		Girl		
	n	%	n	%	
Z-Score (BMI/age)					
>+1 (Overweight)	7	23,2	12	54,5	0,365
>+2 (Obese)	23	76,7	10	45,5	
Rasio WC/Height					
<0,5	5	16,7	6	27,3	0,021*
>0,5	25	83,3	16	72,7	

*)Significant p<0,05

3.3 Eating Habbits During Study at Home

During a pandemic, students are required to study at home. An illustration of student's eating frequency can be seen in Figure 1. It is known that 84% of students with nutritional status are overweight and 79% of obese students eat 3-4 times a day.


Figure 1. Distribution Eating Frequency in a Day Based on Nutritional Status (n=52)

Based on Figure 2, showed that students who have overweight nutritional status always have breakfast (89.5%) in the morning and really like to eat snacks (84.2%). Similar to students who have obesity nutritional status, students always have breakfast (90.9%) and really like the consumption of snacks (81.8%) such as candy, cookies, and chocolate.



Figure 2. Frequency Distribution of Breakfast and Snack Habit Categories Based on Nutritional Status (n=52)

Based on Table 4 in the overweight group, it showed that the average energy consumption is 1,448.61kcal with 74.42% of the RDA, protein 54.92grams with 105.74% RDA, fat 55.02grams with 103.37% RDA, carbohydrates 182.39 grams with 64.23% RDA and 5.78 grams fiber with 28.41% RDA. Whereas in the obese group the average energy intake was 1,794.57kcal with 87% RDA, 64.57grams of protein with 122.48% RDA, 64.51grams of fat with 96.33% RDA, 252.90grams of carbohydrates with 86.33% RDA and 8.31grams of fiber with 29.13% RDA.

After the independent sample t-test was carried out, it was found that there were significant differences in energy and carbohydrate intake between the overweight and obese groups ($p < 0.05$). In the percent adequacy of RDA, there was a significant difference in the percent adequacy of carbohydrates between the two groups ($p < 0.05$).

Table 4. Distribution of Average Macro Nutrient Intake of Nutritional Status during the COVID-19 Pandemic

Intake	Nutritional Status			
	Overweight		Obese	
	Mean \pm SD	%RDA	Mean \pm SD	%RDA
Energy (kcal)	1448,61 \pm 260,81	74,42	1794,57 \pm 477,54*	87,00
Protein (gr)	54,92 \pm 15,45	105,74	64,57 \pm 23,44	122,48
Fat (gr)	55,02 \pm 20,46	103,37	64,51 \pm 21,22	96,33
Carbohydrate (gr)	182,39 \pm 38,96	64,23	252,90 \pm 115,82*	86,33*
Fiber (gr)	5,78 \pm 3,55	28,41	8,31 \pm 5,85	29,13

*)Significant $p < 0,05$, independent sample t –test

3.4 Activity Patterns During at Home

In Table 5 it can be seen that the overweight group had an average physical activity of 9.474 minutes/day with the least students not doing it and the longest being 45 minutes/day. Playing games and watching TV activities is carried out for 3.15 hours/day with at least 1 hour and a maximum of 6 hours. The sleep duration pattern during the pandemic was 7.89 hours/day with a minimum of 5 hours and a maximum of 10 hours.

Meanwhile, the obese group did the physical activity for an average of 12.15 minutes/day with at least not doing and a maximum of 30 minutes. Playing games and watching TV an average of 3.30 hours/day with at

least 1 hour and a maximum of 6 hours. The sleep duration pattern during the pandemic was 8.39 hours/day with a minimum of 5 hours and a maximum of 11 hours. After conducting an independent sample t-test, it was found that there was no difference in activity patterns during the pandemic between the overweight and obese groups ($p < 0.05$).

Table 5. Activity Ratios based on Nutritional Status

Duration	Nutritional Status						p-Value
	Overweight			Obese			
	Mean \pm SD	Min	Max	Mean \pm SD	Min	Max	
Physical Activities (minute)	9.474 \pm 5,43	0	45	12.15 \pm 9,36	0	30	0.699
Playing game & watching TV (hour)	3.15 \pm 1,47	1	6	3.30 \pm 1,18	1	6	0.333
Sleep (hour)	7.89 \pm 1,44	5	10	8.39 \pm 1,16	5	11	0.180

4. Discussion

This research was conducted during the COVID-19 pandemic, precisely after 5 months of school closure. The aim of this study was to assess the nutritional status, eating habits and physical activity of obese children during the pandemic. Nutritional status was determined by WHO growth reference for school-aged children and adolescent [14]. This study showed that of the 52 obese school children aged 9-12 years, 36.54% had overweight, and 63.46% were obese. Measurement of obesity based on waist circumference to height Ratio (WtHR), there were 78.85% central obesity categories and 21.15% normal. Boy has a higher incidence proportion than girl. Interestingly, this study indicated that the prevalence of obesity is increased and the prevalence of cardiovascular risk factors is higher when compared with the results of BMI per age and sex. It should be considered that before the pandemic, the increase in obesity was already remarkably alarming, for example in 2013, 5-12 years old children experienced an overweight problem of 18.8% consisting of 10.8% fat and 8.8% obesity. In 2018, the percentage increased to 23.4% [10]. This condition also occurred in several countries such as Nigeria that identified the prevalence of overweight, and obesity, among children aged 5 to 18 years were 11.4%, and 2.8%, respectively [15]. Research in seven European countries, such as Italy, Germany, the Netherlands, Romania, Bulgaria, Lithuania, and Turkey showed that out of 5,206 school children aged 6–11 years 15.6% were overweight and 4.9% obese [16]. Furthermore, the National Child Measurement Program (NCMP, 2015) measures the height and weight of about one million school age children in the UK each year, with the aim of providing a detailed picture of the prevalence of obesity in children. Recent data shows that the prevalence of obesity in children aged 10-11 years is greater than overweight, which were 21% obesity and 17.0% for overweight [17].

Roepeng (2020) predicted that this pandemic will increase the incidence of obesity, especially among school age children about 2.4%. if the schools are closed until December 2020. When it is associated with the incidence of obesity with the results of this study, it appears that there is a similarity in the results, namely the prevalence of obesity is higher than overweight men have a faster chance of becoming obese including central obesity. Therefore, it needs serious discussion with policy makers to take immediate action [18]. Otherwise, it will have implications for an increase in the incidence of hypertension in children, which in the long term will develop chronic conditions of metabolic disorders and cardiovascular disease including adult-onset diabetes mellitus, coronary heart disease, orthopaedic disorders and respiratory diseases [19]. It is also proven by, that overweight and obesity in childhood and adolescence have adverse consequences on premature mortality and physical morbidity in adulthood [20]. There is a significant difference in the energy and carbohydrate intake between obese and obese children while other macro nutrients such as protein and

fat and fibre are not different. Foods frequently consumed are staple foods, animal side dishes, vegetables and oils, while fruit and vegetable protein are very rare. Unfortunately, this study has weakness since it examines the obese group only, the normal ones are not evaluated. The consumption data were collected only on the fat ones, meanwhile, there is a tendency that the obese tends to report little amount of consumption. On the contrary, the thin group tends to report higher. Physical activity and adequate nutrition are crucial keys to health [21]. These results indicate that the activities of all obese and overweight children are low, ranging from only 9-12minutes per day, whereas ideally it should accumulate 60minutes of at least moderate intensity activity a day. Physical activity will have an effect on health if done using the concept of F.I.T.T; Frequency (how often), Intensity (how hard), Time (how long), and type of exercise [22].

Another result of this study showed that mostly, students spent more than 3 hours for watching TV, playing games and surfing internet per day, which was longer than the recommendation. If this condition continues, it will increase body weight. According to the Canadian Paediatric Society and the American Academy of Paediatrics, children should not spend more than two hours a day using electronic media for entertainment (i.e. computer games, TV, Internet), particularly during daylight hours.

The limitations of this study can be classified as follows: (1) This study is a cross-sectional survey, without studying the previous data. (2) Collecting eating habits and physical activity is done using a short questionnaire via whatsApp and if it is unclear it is done by telephone.

5. Conclusion

During the pandemic, the proportion of obese and centrally obese children was higher than those of overweight children. Obese children habitually consume high calorie density foods, while the intake of fiber such as vegetables and fruit is very low for all children. The Average physical activity a day is around 9-12 minutes, and secondary activities such as watching TV, playing games, and surfing internet are more than 3 hours per day.

6. References

- [1] Singhal T. Review on COVID-19 disease so far. *Indian J Pediatr.* 2020;87(April):281–6.
- [2] WHO. Coronavirus Disease 2019 (COVID-19) World Health Situation Report - 1. Vol. 2019, WHO Indonesia Situation Report. 2020.
- [3] Tosepu R, Gunawan J, Effendy DS, Ahmad LOAI, Lestari H, Bahar H, et al. Correlation between weather and Covid-19 pandemic in Jakarta, Indonesia, *Science of The Total Environment.* *Sci Total Environ.* 2020;725.
- [4]. Sipahutar T, Eryando T. COVID-19 Case Fatality Rate and Detection Ability in Indonesia. *2020;(1):14–7.*
- [5] WHO. Considerations for school-related public health measures in the context of Annex to Considerations in adjusting public health and social measures in the context of COVID-19. *World Heal Organ Interim Guid [Internet].* 2020;(May):1–6. Available from: <https://www.who.int/publications-detail/risk->
- [6] Kementerian Pendidikan dan Kebudayaan RI. SURAT EDARAN MENDIKBUD NOMOR 1 TAHUN 2020 [Internet]. Jakarta; 2020. Available from: <http://pgdikmen.kemdikbud.go.id/read-news/surat-edaran-mendikbud-nomor-1-tahun-2020#>

- [7] Yuksel HS, Şahin FN, Maksimovic N, Drid P, Bianco A. School-based intervention programs for preventing obesity and promoting physical activity and fitness: A systematic review. *Int J Environ Res Public Health*. 2020;17(1).
- [8] Pietrobelli A, Pecoraro L, Ferruzzi A, Heo M, Faith M, Zoller T, et al. Effects of COVID-19 Lockdown on Lifestyle Behaviors in Children with Obesity Living in Verona, Italy: A Longitudinal Study. *Obesity*. 2020;28(8):1382–5.
- [9] DiPietro L, Buchner DM, Marquez DX, Pate RR, Pescatello LS, Whitt-Glover MC. New scientific basis for the 2018 U.S. Physical Activity Guidelines. *J Sport Heal Sci [Internet]*. 2019;8(3):197–200. Available from: <https://doi.org/10.1016/j.jshs.2019.03.007>
- [10] Riskesdas 2018. Hasil utama riskesdas 2018. 2018;61.
- [11] Ochiai H, Shirasawa T, Nishimura R, Yoshimoto T, Minoura A, Oikawa K, et al. Changes in overweight/obesity and central obesity status from preadolescence to adolescence: A longitudinal study among schoolchildren in Japan. *BMC Public Health*. 2020;20(1):1–8.
- [12] Departement JH. Data Monitoring on Covid-19 Cases [Internet]. Jakarta; 2021. Available from: <https://corona.jakarta.go.id/en/data-pemantauan>
- [13] Zhang F, Xiong Y, Wei Y, Hu Y, Wang F, Li G, et al. Obesity predisposes to the risk of higher mortality in young COVID-19 patients. *J Med Virol [Internet]*. 2020;92(11):2536–42. Available from: <http://dx.doi.org/10.1002/jmv.26039>
- [14] Pulungan AB, Julia M, Batubara JR, Hermanussen M. Indonesian National Synthetic Growth Charts. *Res Artic “Indonesian Natl Synth Growth Charts” Acta Sci Paediatr*. 2018;1(August):20–34.
- [15] Senbanjo IO, Adejuyigbe EA. Prevalence of overweight and obesity in Nigerian preschool children. *Nutr Health*. 2007;18(4):391–9.
- [16] Olaya B, Moneta MV, Pez O, Bitfoi A, Carta MG, Eke C, et al. Country-level and individual correlates of overweight and obesity among primary school children: A cross-sectional study in seven European countries. *BMC Public Health [Internet]*. 2015;15(1). Available from: ???
- [17] NHS Digital. National Child Measurement Programme Key Findings [Internet]. 2016. Available from: <https://digital.nhs.uk/data-and-information/publications/statistical/national-child-measurement-programme/2015-16-school-year>
- [18] An R. Projecting the impact of the coronavirus disease-2019 pandemic on childhood obesity in the United States: A microsimulation model. *J Sport Heal Sci [Internet]*. 2020;9(4):302–12. Available from: <https://doi.org/10.1016/j.jshs.2020.05.006>
- [19] Simbolon D, Yorita E, Talib RA. The risk of hypertension in adulthood as a consequence of adolescent obesity. *Kesmas*. 2019;14(1):28–36.
- [20] Reilly JJ, Kelly J. Long-term impact of overweight and obesity in childhood and adolescence on

morbidity and premature mortality in adulthood: Systematic review. *Int J Obes.* 2011;35(7):891–8.

[21] Henrique P, Augusto J, Péricles E. Physical activity and nutrition education at the school environment aimed at preventing childhood obesity : evidence from systematic reviews &. *J Pediatr (Rio J)* [Internet]. 2016;92(1):15–23. Available from: <http://dx.doi.org/10.1016/j.jpeds.2015.06.005>

[22] Biddle SJ., Ciaccioni S, Thomas G, Vergeer I. Physical activity and mental health in children and adolescents: An updated review of reviews and an analysis of causality. *Psychol Sport Exerc* [Internet]. 2019;42:146–55. Available from: <https://www.sciencedirect.com/science/article/abs/pii/S1469029218303315>