Jurnal Gizi Indonesia (The Indonesian Journal of Nutrition)

Jurnal Gizi Indonesia
(The Indonesian Journal of Nutrition)

Vol. 10, No. 2, June 2022 (122-134)
Submitted: 14 September 2021, Accepted: 08 February 2022
Online https://ejournal.undip.ac.id/index.php/jgi

Differences in Eating Habits and Physical Activity Before and During Distance Learning

Yulia Rizki Maulina[1], Ani Margawati[1*], Rachma Purwanti[1], A. Fahmy Arif Tsani[1]

ABSTRACT

Background: The COVID-19 pandemic has led to the enforcement of distance learning. This may cause negative impacts on adolescents' eating habits and physical activity.

Objectives: This study aimed to analyse the differences in eating habits and physical activity before and during distance learning in adolescents.

Materials and Methods: A cross-sectional study was conducted on a sample of 95 adolescents aged between 15-18 years. Subjects were selected using a simple random sampling method. Eating habits and physical activity variables were measured using modified Eating Habit and Lifestyle Changes in COVID-19 and Eating Habits Questionnaire. Wilcoxon Signed-Rank and McNemar tests were used to analyse the data.

Results: There was an increase in frequency of meals two times/day (9.5%) and snacking three times/day (4.2%) reported during distance learning. There were significant differences in number of meals (p=0.014) and snacking (p=0.034), carbohydrates sources intake (p=0.046), sweet food (p=0.014), snack (p=0.016), exercise (p=0.035), exercise duration (p=0.004), and exercise frequency (p=0.030) before and during distance learning. There were no significant differences in protein-sources intake, vegetable, fruit, sweetened beverages, fried food, processed food, junk food, emotional eating, physiological eating, and ways of obtaining food before and during distance learning (p >0.05).

Conclusion: Significant differences were found in eating habits comprised of the number of main meals and snacking, intake of carbohydrates sources, sweet food, snack, and physical activity before and during distance learning

Keywords: eating habit; physical activity; distance learning; adolescent

BACKGROUND

The 2019 Coronavirus disease (COVID-19) is an infectious disease that was first reported in Wuhan, China, in December 2019.[1] This disease is caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) virus transmitted through droplets of infected patients.[2] This disease has spread to more than 60 countries in the world within three months.

The COVID-19 pandemic led Indonesia to implement social restrictions policies regionally. Especially in Jakarta, the capital city of Indonesia. Jakarta is the most populous city in Indonesia so it had the highest number of COVID-19 compared to other cities.[3] This causes the activities of Jakarta residents to be severely restricted by the government, public places are closed, restaurants limit take-out or online delivery services, and social gatherings related to political, sports, entertainment, academic and cultural gatherings are stopped provisionally during the social restrictions. The public is advised not to engage in activities outside their house except to meet basic or medical needs. The restrictions include the temporary cessation of school activities so that all learning activities are carried out at their respective residences through the distance learning method.[4] Distance learning leads adolescents to feel stressed, causing discomfort such as fear and anxiety to the point that it might change their eating habits.[5,6] Staying at home leads to increased food consumption because the possibility of access to food is higher. This can disrupt mealtimes, which can maintain metabolism and protect the body from dysmetabolism and obesity.[7]

In addition, distance learning restricts adolescents to do spontaneous physical activities related to the necessities of daily life outside the house.[8] Distance learning can make teens spend hours sitting in front of a device or learning media, causing an increase in sedentary behaviour that triggers a decrease in energy levels.[8,9] Sedentary behaviour related to eating habits is directly proportional to energy intake, where energy intake is higher (an increase of 350 kcal) when sedentary behaviour increases (decrease in energy expenditure of 100 kcal).[10] Based on a recent study of Palestinian adolescents, there was an increase in food

[1] Department of Nutrition Science, Faculty of Medicine, Universitas Diponegoro
Jl. Prof. Sudarto SH, Tembalang, Semarang, Jawa Tengah 50275, Indonesia
***Correspondence:** animargawati@gmail.com, Phone: +6281325858445

e-ISSN : 2338-3119, p-ISSN: 1858-4942

intake by 50% compared to before school closures. Subjects also experienced changes in eating habits with increases in vegetable intake by 40%, fruit intake by 33%, fried food by 37%, and sweet food intake by 47%. In addition, as many as 45% of adolescents reported no physical activity while schools are closed. Factors such as staying at home and keeping a distance from other people have a significant relationship with increased intakes.[11] Another previous research by Ruiz-Roso et al. during restriction, showed intake of vegetables and fruits were increased because subjects have time to cook and intake of fried and sweet food were increased because staying at home can trigger boredom and stress, causing a change in eating patterns and increasing food consumption.[12]

Another study in Italy stated that appetite increased significantly in subjects with relatively younger age. Regarding eating habits, 37% of subjects ate healthier food, and 36% of respondents ate less healthy food. In the consumption of junk food, there was a decrease in subjects who consumed 30% compared to subjects who experienced an increase of 26%. Decreased junk food intake correlates with healthy food consumption, while increased junk food intake correlates with increased food intake and hunger after dinner. During social restriction, physical activity increased slightly (38%), especially bodyweight training. The percentage of subjects who trained five days/week also increased by 10%. This happened because subjects have more time to exercise. However, subjects who were not used to do sports did not take the opportunity to start.[13] Social restrictions change people's eating habits and physical activity. Moreover, distance learning and the psychological impact on adolescents may cause a lack of physical activity that triggers an increase in sedentary lifestyles and changes in unhealthy eating patterns. Based on the description above, this paper aimed to analyse differences in eating habits and physical activity before and during distance learning in high school students as there have not been many studies on this topic in Indonesia, especially in Jakarta.

MATERIALS AND METHODS

This study is an observational analytic study with a cross-sectional design—was conducted in December 2020 with the subject of public school's students in Central Jakarta. This research has obtained approval from the Health Research Ethics Committee, Faculty of Medicine, University of Diponegoro No. 06/EC/KEPK/FK-UNDIP/I/2021. The participants consented to participate in the study with a digital informed/parental consent form. The cluster random sampling method was used to determine which schools from 5 sub-districts in Central Jakarta are chosen to collect the data. The sample size was calculated using binomial proportions with = 0.05, N (population of high school students in Jakarta) = 9,202 people, d= 10%, p= 0.5 and the probability of dropout= 20%. Based on the calculations, the minimum sample size in this study was set at 114 samples. The data was collected using the simple random sampling method. The subjects were eligible if they were students of a public high school in Central Jakarta, between 15-18 years of age, implementing distance learning since March 2020, not on a specific diet, nor engage in a physical exercise program. Based on the screening results, 19 out of 114 subjects were dropped out of the study because they did not meet the inclusion criteria. Hence, the analysed subjects were 95 samples. The data was collected through a structured questionnaire created in Microsoft Forms—consisted of more than 60 questions about socio-demographic characteristics, eating habits, physical activity during distance learning, and the previous period.

The independent variable in this study is the school hours during distance learning. The school hours were measured using a questionnaire by dividing the duration into three categories based on Ministry of Education and Culture guidelines issued under special conditions such as COVID-19; <5 hours/day, 5 hours/day, and >5 hours/day. The dependent variables in this study are eating habits and physical activity. Data on eating habits and physical activity variables were collected from filling out modified of the Eating Habit and Lifestyle Changes in COVID-19 and Eating Habits questionnaires which have been tested for validity and reliability.[13,14] The eating habits questionnaire consisted of types and amounts of food and beverages consumed per day or per week. The subject recorded the number of main meals (1-4 times/day) snacking (0-4 times/day), amount of food consumed per day, including carbohydrates sources intake (<3 servings, 3-4 servings), >4 servings), animal and plant-based protein sources intakes (0 to >4 servings), vegetables (0 to >4 servings), fruits (0 to >3 servings), and amounts of certain food per week like sweet food, sweetened beverages, fried food, processed food, snacks, and junk food (do not consume, 1-3 servings, 4-6 servings, >6 servings).

Data on eating behaviour including emotional eating (never, seldom, sometimes, always), physiological eating consisting of changes in hunger/satiety perception (no, less appetite, more appetite), and sense of hunger (before mealtime, between mealtimes, after dinner), eat late at night (yes/no), portion sizes

per meal (1 portion, >1 portions), pay attention to nutritional intake (never, sometimes, always), changes eating habits (no, unhealthy, healthier), and ways of obtaining food (cooking/purchasing). The physical activity questionnaire consisted of 4 questions; exercise (yes/no), type of exercise (outdoor, indoor), exercise duration per day (<60 minutes, 60 minutes, >60 minutes), and exercise frequency per week (<3 times, 3 times, >3 times).

The data obtained were analyzed using IBM SPSS Statistics 25 software. Data analysis was initiated by testing the instrument's validity using the Principal Component Analysis (PCA) method to reduce the dimensions of interrelated variables while retaining most of the information in the data in an interpretable way.[15,16] The method is used to determine the factors that are considered relevant, describe whether the question items are included in the same factor or not, and reduce irrelevant question items in the questionnaire.[17] Two criteria need to be met to determine whether the data is eligible to be tested; Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) p >0.50 and Bartlett's Test of Sphericity p <0.05.[18] If the data is eligible, factor analysis is carried out by looking at the extraction value with the communality standard variable p >0.50 considered high or ideally p ≥0.70.[19,20] The number of existing factors can be determined if the components with total initial eigenvalues >1.00 in the total variance explained table.[17] The interpretation of the results is made by looking at the factor loading on the rotated component matrix table, which is significant at a value of >0.30.[18,21]

The results of the construct validity test showed that there are 15 relevant factors out of 47 questions in the modified questionnaire of this study. The validity test results found that the p-value of Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) = 0.548 with Bartlett's Test of Sphericity p-value of X2 = 3634.027 and p-value = 0.00. The validity test using Pearson correlation and reliability test was found that the modification of the questionnaire on eating habits and physical activity was reliable with Cronbach's Alpha p = 0.704. There are 15 out of 60 items with an insignificant p-value; however, these items are habitual questions that are important to explore so they are still used.

Univariate analysis was performed using a frequency distribution to show the value of each variable in percentage. The data normality test was carried out using the Kolmogorov-Smirnov with a significance of 0.05 because it had a sample size of >50.[22] All data were known to be not normally distributed, so the bivariate analysis was carried out using a non-parametric test. Bivariate analysis aimed to see the differences of dependent variables towards independent variable. Differences in eating habits comprised of the number of daily meals and snacking, amount and types of food consumed, eating behaviour (except ways of obtaining food), and physical activity comprised of exercise duration and frequency before and during distance learning were analysed using the Wilcoxon signed ranks test. Differences in the variable eating habits comprised of eating behaviour (ways of obtaining food) and the variable physical activity with the sub-variable exercise were analysed using the McNemar test. The test was carried out with a confidence interval of 95% and significant if p <0.05

RESULTS

Table 1. Socio-demographic Characteristics

Characteristics	Frequency (n= 95)	Percentage (%)
Gender		
Male	33	34.7
Female	62	65.3
Age (years)		
15	16	16.8
16	37	38.9
17	30	31.6
18	12	12.6
Grade		
10th	24	25.3
11th	35	36.8
12th	36	37.9
School hours during distance learning		
<5 hours/day	14	14.7
5 hours/day	18	18.9
>5 hours/day	63	66.3

A total of 95 adolescents from several schools participated in this study. The characteristics of the subjects in the study, which included gender, age, school origin, grade, and school hours during distance learning, are presented in Table 1.

Table 1. shows that the subjects' age range is 15-18 years old and consisted of 34.7% males and 65.3% females. As many as 25.3% of the subjects are 10th-grade students, 36.8% are 11th-grade students, and 37.9% are 12th-grade students. Most students study for >5 hours/day during distance learning, while 18.9% study 5 hours/day, and 14.7% of students study <5 hours /day.

Table 2 and figure 1 presenting the frequencies of each variable and the bivariate analysis of subject eating habits.

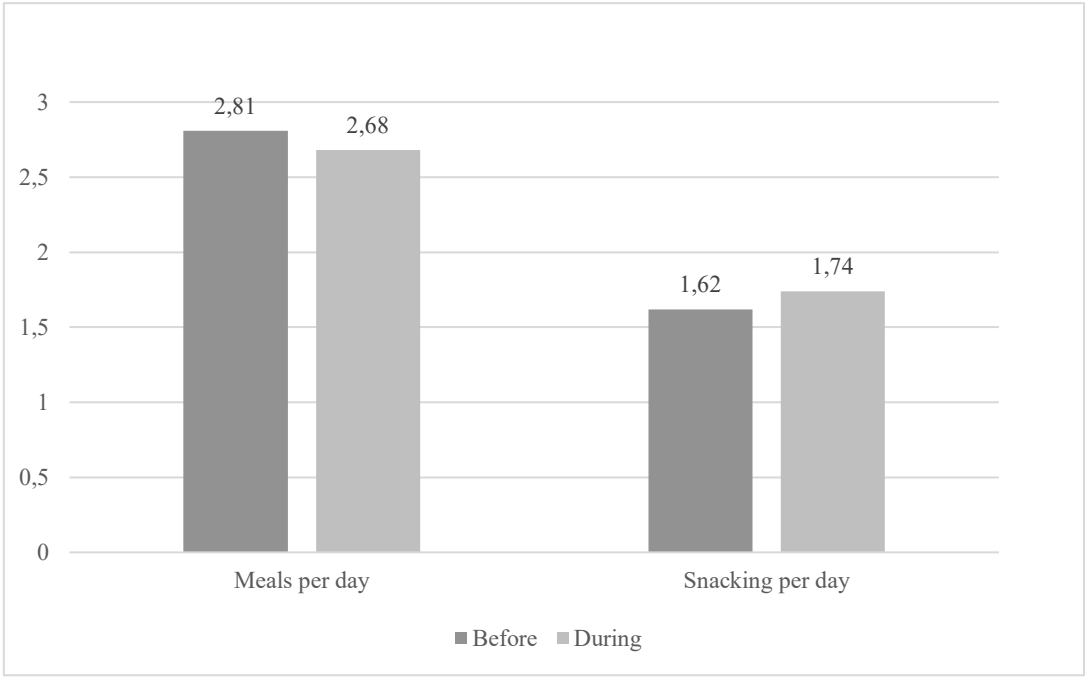

Figure 1. Mean of Food Intake (Meals and Snacking) Per Day Before and During Distance Learning

Table 2 shows 9.5% increase number of subjects in 2 times/day-meals during distance learning from 20% into 29.5%.. The average number of meals before distance learning presented in figure 1 was 2.81±0.551 times, whereas during distance learning was 2.68±0.551 times. There is an increase number of subjects in 3 times/day-snacking from 7.4% into 11.6% during distance learning. The average number of snacking before distance learning was 1.62±0.702 times, whereas during distance learning increased to 1.74±0.703 times. The frequency distribution table shows 10.5% decrease in carbohydrates sources intakes of 3-4 servings/day from 58.9% into 48.4% during distance learning. Most subjects consumed animal protein intakes of 2-4 servings/day and plant-based protein intake <2 servings/day during distance learning. Some subjects consumed <3 servings of vegetables/day and <2 servings of fruit/day during distance learning.

In certain types of food, there is an 8.4% decrease in subjects consuming sweet food of 4-6 servings/week from 15.8% before distance learning into 7.4% during distance learning and 8.5% increase in subjects who do not eat snacks during distance learning from 16.8% into 25.3%. Before and during distance learning, the average subject consumed sweetened beverages, fried food, processed food, and junk food as much as 1-3 servings/week. On average, before and during distance learning subjects sometimes have emotional eating, feel hungry after dinner, and obtain food by cooking.

Results of the analysis presented in Table 2. found that there are significant differences in the number of meals (p=0.014) and snacking (p=0.034), type and amount of carbohydrates sources intake (p=0.046), sweet food (p=0.14) and snacks (p=0.016). No significant differences in the type and amount of animal protein (p = 0.317) and plant-based protein (p = 0.366), vegetables (p = 0.166), fruits (p = 0.827), sweetened beverages (p = 0.166), fried food (p=0.109), processed food (p=0.285) and junk food (p=0.096), emotional eating (p=0.467) and physiological eating (p=0.190), and ways of obtaining food (p= 1.000) before and during distance learning with $p > 0.05$.

Table 2. Frequency Distribution and Bivariate Analysis of Eating Habits

Variables	Before (n= 95)		During (n= 95)		*p*
	n	%	n	%	
The number of main meals per day					
1	2	2.1	2	2.1	
2	19	20	28	29.5	
3	69	72.	63	66.3	0.014[a*]
4	5	5.3	2	2.1	
The number of snacking per day					
0	2	2.1	-	-	
1	41	43.	38	40	
2	44	46.	45	47.4	0.034[a*]
3	7	7.4	11	11.6	
4	1	1.1	1	1.1	
Carbohydrates sources intake per day (portion)					
<3	38	40	47	49.5	
3-4	56	58.	46	48.4	0.046[a*]
>4	1	1.1	2	2.1	
Animal protein sources intake per day (portion)					
2-4	94	98.	93	97.9	0.317[a]
>4	1	1.1	2	2.1	
Plant-based protein sources intake per day (portion)					
0	8	8.4	7	7.4	
<2	72	75.	71	74.7	
2-4	14	14.	16	16.8	0.366[a]
>4	1	1.1	1	1.1	
Vegetables intake per day (portion)					
0	15	15.	15	15.8	
<3	52	54.	56	58.9	
3-4	27	28.	24	25.3	0.166[a]
>4	1	1.1	-	-	
Fruits intake per day (portion)					
0	17	17.	18	18.9	
<2	57	60	57	60	
2-3	18	18.	16	16.8	0.827[a]
>3	3	3.2	4	4.2	
Sweet food intake per week (portion)					
0	14	14.	18	18.9	
1-3	63	66.	67	70.5	
4-6	15	15.	7	7.4	0.014[a*]
>6	3	3.2	3	3.2	
Sweetened beverages intake per week (portion)					
0	10	10.	9	9.5	
1-3	61	64.	68	71.6	
4-6	19	20	13	13.7	0.166[a]
>6	5	5.3	5	5.3	
Fried food intake per week (portion)					
0	8	8.4	9	9.5	
1-3	67	70.	71	74.7	
4-6	17	17.	12	12.6	0.109[a]
>6	3	3.2	3	3.2	

Variables	Before (n= 95)		During (n= 95)		*p*
	n	%	n	%	
Processed food intake per week (portion)					
0	12	12.6	13	13.7	0.285[a]
1-3	64	67.4	68	71.6	
4-6	17	17.9	10	10.5	
>6	2	2.1	4	4.2	
Snacks intake per week (portion)					
0	16	16.8	24	25.3	0.016[a*]
1-3	62	65.3	58	61.1	
4-6	12	12.6	9	9.5	
>6	5	5.3	4	4.2	
Junk food intake per week (portion)					
0	17	17.9	19	20	0.096[a]
1-3	69	72.6	71	74.7	
4-6	8	8.4	3	3.2	
>6	1	1.1	2	2.1	
Emotional eating					
Never	20	21.1	19	20	0.467[a]
Seldom	27	28.4	27	28.4	
Sometimes	38	40	38	40	
Always	10	10.5	11	11.6	
Sense of hunger					
Before mealtime	34	35.8	32	33.7	0.190[a]
Between mealtimes	37	38.9	36	37.9	
After dinner	24	25.3	27	28.4	
Ways of obtaining food					
Cooking	79	83.2	80	84.2	1.000[b]
Purchasing	16	16.8	15	15.8	
Paying attention to nutrition intake					
Never	34	35.8	-	-	
Sometimes	48	50.5	-	-	
Always	13	13.7	-	-	
Change in eating habits					
No	-	-	53	55.8	
Yes, healthier	-	-	25	26.3	
Yes, unhealthy	-	-	17	17.9	
Change in hunger/satiety perception					
No	-	-	36	37.9	
Yes, more appetite	-	-	34	35.8	
Yes, less appetite	-	-	25	26.3	
Portion size(s) in each meals					
1 portion	78	82.1	72	75.8	
>1 portions	17	17.9	23	24.2	
Eat late in the night					
No	53	55.8	55	57.9	
Yes	42	44.2	40	42.1	

[a]Wilcoxon signed-ranks test [b]McNemar test; [*]significant at p<0.05

Table 3. Frequency Distribution and Bivariate Analysis of Physical Activity

Variables	(n=95)		(n=95)		p
	n	%	n	%	
Exercise					
No	31	32.6	42	44.2	0.035[b*]
Yes	64	67.4	53	55.8	
Exercise type					
Do not exercise	31	32.6	42	44.2	
Outdoor	42	44.2	6	6.3	
Indoor	22	23.2	47	49.5	
Exercise duration per day					
Do not exercise	31	32.6	42	44.2	
<60 minutes	39	41.1	41	43.2	0.004[a*]
60 minutes	13	13.7	0	0	
>60 minutes	12	12.6	12	12.6	
Exercise frequency per week					
Do not exercise	31	32.6	42	44.2	
<3 times	49	51.6	40	42.1	0.030[a*]
3 times	11	11.6	9	9.5	
>3 times	4	4.2	4	4.2	

[a]Wilcoxon signed-ranks test [b]McNemar test; [*]significant at p<0.05

Results in Table 3, physical activity variables show an increase in the number of subjects who do not exercise by 11.6% during distance learning. All subjects who exercised for 60 minutes/day before distance learning do not exercise during distance learning. In addition, there is a decrease in the frequency of exercise <3 times/week by 9.5% during distance learning. Results of the analysis presented in Table 3. found that there are significant differences in the physical activity included exercise (p=0.035), exercise duration (p=0.004) and exercise frequency (p=0.030) before and during distance learning with p <0.05.

Table 4. Distribution of Most Consumed Food and Beverages during Distance Learning

Types of Food and Beverages	n	%
Sweet food		
Do not consume	17	17.9
Chocolate or confectionery	48	50.5
Baked products (e.g cake or cookie)	21	22.1
Other	9	9.5
Sweetened beverages		
Do not consume	9	9.5
Bubble tea	48	50.5
Soft drinks	6	6.3
Other	32	33.7
Fried foods		
Do not consume	9	9.5
French fries	42	44.2
Fritters	34	35.8
Other	10	10.5
Processed foods		
Do not consume	13	13.7
Sausages/meatballs	21	22.1
Nugget	41	43.2
Other	20	21.1
Snacks		
Do not consume	22	23.2
Chips	35	36.8
Extruded snacks	32	33.7
Other	6	6.3
Junk food		
Do not consume	19	20
Starchy meatballs (Bakso aci)	13	13.7
Crackers soup (Seblak)	41	43.2
Other	22	23.2

Table 4. presents certain types of most consumed food and beverages during distance learning. Table 4 showed the distribution of the most consumed of sweet food were chocolate or confectionery (50.5%) while the most consumed of sweet drinks were bubble tea (50.5%). The most consumed fried foods were

french fries (44.2%), the most consumed of processed foods were nuggets (43.2%), the most consumed of snacks were chips (36.8%) and the most consumed of junk food were crackers soup such as seblak (43.2%)

DISCUSSION

Distance learning is a learning method from home carried out in a state of emergency COVID-19 pandemic. This method is meant to limit exposure to the spread of the virus that can occur in schools. Before distance learning, school hours ran for 8 hours/day.[21] Meanwhile, school hours are set at least 24 hours a week during distance learning.[22] This study indicates that most of the subjects study for >5 hours/day during distance learning. This happens because the online meeting schedule is tentative, and students are often given assignments outside of school hours so that students tend to study until the afternoon and even at night.

Based on the study results, there is an increase number of subjects with 2 times/day-meals and decrease number of subjects with 3 times/day-meals during distance learning Eating less than 3 times/day was included as a poor diet. Under normal conditions, each individual is advised to consume the main food 3 times a day. This study is in line with previous research which stated that the majority of students eat twice a day during the pandemic.[23] However, this research is in contrast with another study which found an increase in eating meals 5 times/day by 31.1% during social distancing, where previously it was 19.9%.[24]

The risk of overeating also corresponds to an increase in the frequency of 3 times/day-snacking during distance learning. The results of this study are compatible with other studies that stated that 18.9% of subjects snacking 3 times/day among the 21.1% of the subjects who are snacking more frequently during social restrictions.[25] Increased consumption of distractions can occur because of the tendency to feel hungry at dinner time. This is in line with the increase in subjects who feel hungry at dinner time during distance learning compared to before. Irregular snacking poses a risk to adolescent health, including cardiovascular, neurological, and metabolic complications, especially when done at a young age. Irregular snacking can affect the number of main meals and may increase snacking between meals.[26,27]

The recommended consumption of carbohydrates sources in a day is 3-4 servings.[23] This research showed there is a decrease number of subjects who consumed 3-4 servings of carbohydrates sources per day during distance learning and an increase number of subjects who consumed less than 3 of carbohydrates sources per day. In another study, a similar thing was found where there was a decrease in consumption of carbohydrates-based food to 13% of subjects during social restrictions compared to the previous 16.7% of subjects.[28] A decrease in consumption occurs because the subject feels less appetite during distance learning. Carbohydrates are the body's primary source of energy. The body requires adequate carbohydrates intake so as not to break down protein to meet energy needs. In addition, the body needs carbohydrates to break down fat and prevent the buildup of ketone bodies in the blood.[29]

There is a decrease in sweet food consumption of 4-6 servings/week during distance learning, where some subjects reduced their consumption to 1-3 servings/week, and several other subjects stopped consuming sweet food. This is due to subjects who try to change their eating habits to be healthier during distance learning. The addition of sugar to food aims to increase palatability and is used to preserve food. Although required in certain clinical conditions, additional sugar is not necessary for a healthy adolescent diet.[30] Excessive consumption of sweet food can cause cavities, weight gain, and increased blood glucose levels so that the consumption of sugar in sweet food is limited to 50 grams/day.[31] There is an increase in the number of subjects who do not eat snacks during distance learning. This result is different from other studies, which found an increase in the consumption of snacks during social distancing compared to before.[24] The increased number of subjects who do not eat snacks was due to the subjects changing their eating habits to be healthier during distance learning.

A study found acrylamide compounds, carcinogenic substances, in starchy snacks that have gone through the roasting and frying process.[32,33] In adults with normal weight and overweight, consumption of energy-dense snacks is associated with weight gain.[34] This also applies to children and adolescents where the total number of snacks consumed is associated with overweight status, but the risk of being overweight tends to be low.[35] There are no changes in animal and plant-based protein sources consumed during distance learning compared to before. On average, subjects consumed chicken and beef as sources of animal protein and consumed tofu and tempeh as sources of plant-based protein before and during distance learning. Based on research conducted in America, protein intake is more stable than carbohydrates intake. This shows that the body's biological mechanism strictly regulates protein intake to affect the elements of food and other macronutrient intakes.[36] During adolescent development, protein is needed to build new tissues and maintain existing tissues.[37] Animal protein has more complete amino acids, higher nutritional quality, and is more

easily absorbed by the body, while plant-based protein contains isoflavones which function as antioxidants and anti-cholesterol, so that they need to be consumed together every day to achieve balanced nutrition.

There are no differences in the intake of vegetables and fruits before and during distance learning. On average, spinach and water spinach are the most consumed vegetables. At the same time, mango, orange, and apple are the most consumed fruits before and during distance learning. These results confirm a previous study that found no difference in fruit and vegetable intake during restriction.[38]

Riskesdas 2018 data shows that 67.9% of Indonesian teenagers only consume 1-2 servings of fruit/vegetables/day. In addition, almost all Indonesian teenagers have not met their daily needs for vegetables and fruits (96.4%).[39] Vegetables and fruits are a high-fibre food group that is good for the body because they take longer to digest, thus providing a more prolonged feeling of fullness. In addition, the fibre contained in vegetables and fruits also serves to bind cholesterol and prevent constipation.[29]

There are no differences in the consumption of sweetened beverages and fried food before and during distance learning. During distance learning, the most consumed sweetened beverage is bubble tea, and fried food most often consumed is french fries. Fried food and sweetened beverages are fatty and high sugar drinks with a mood-boosting effect.[40,41] Physiologically, consuming fatty food and high-sugar drinks increases the production of serotonin and dopamine, which affect mood for the better.[42] However, excessive consumption can have adverse effects such as weight gain. No difference was found in the consumption of processed food and junk food before and during distance learning. Most of the subjects eat processed food because it is easy to be obtained, could be stored for a long time, and easy to serve. Although there is limited access to leave the house regarding the intake of junk food, some subjects choose to make their food at home or using a delivery service.

Processed food and junk food tend to be high in sodium, high in calories, and contain low nutritional value. Adolescents with normal weight should consume junk food in small amounts, while teenagers on a diet are recommended to limit their consumption of junk food. Regular consumption of junk food and processed food can increase the risk of chronic diseases such as cardiovascular, type 2 diabetes, liver disease, and cancer.[43] In addition, the sodium contained in processed food may cause water retention in the body, causing bloating, swelling, and weight gain.[44] Before and during distance learning, no significant differences in subjects who sometimes eat because of emotional eating were identified, possibly because the data were collected when some subjects already adapted to the pandemic conditions. Emotional eating is a tendency to overeat as a form of response to negative emotions that are felt.[45] Difficulty regulating emotions, feeling unhappy with body image, being on a diet, boredom, childhood habits, and social influences are some of the factors that may cause emotional eating.[46]

There are no significant differences in the self-reported sense of hunger before and during distance learning. However, there is an increase in subjects who declared to feel hungry after dinner during distance learning compared to before. Increased hunger after dinner occurred related to activities before bedtime, increased appetite, and the tendency to consume snacks at night.[13] In this study, it was found that 35.8% of subjects felt enhanced appetite during distance learning.

Leptin and ghrelin are part of the body's physiological mechanism to regulate food intake.[47] Leptin, sometimes referred to as satiety hormone, functions to inhibit appetite and stimulates increased energy expenditure. In contrast, a hunger hormone, ghrelin, stimulates hunger by increasing neuropeptide Y (NPY) release, an appetite stimulator.[47–49] Ghrelin levels tend to decrease in individuals who overeat and increase in individuals who eat less. In individuals with normal weight, increased leptin levels inhibit NPY and suppress appetite. Low-carbohydrates food can reduce leptin resistance, while food high in protein and fibre can inhibit ghrelin.[50]

There are no significant differences in the ways of obtaining food before and during distance learning. This contrasts with research conducted in America, where most parents who have children at school age (5-18 years) limit purchasing food from outside their houses and increase home-cooked meals for their families during the pandemic.[51] There is no difference in ways of obtaining food before and during distance learning because most family members have time to cook. Besides, cooking at home also tends to cost less than buying food.[52] Consumption of home-cooked meals has a significant relationship with indicators of a healthier diet.[53] Cooking their food will allow individuals to control the ingredients used and the portion served.[54] Research shows that individuals who cook at home consume lower calories than those who cook less.[55]

There is a decrease in the number of subjects, duration, and exercise frequency during distance learning. This result is consistent with another study in which there was a decrease in subjects who exercised

during social distancing.[56] Before distance learning, some subjects spent 60 minutes/day exercising, while no subjects exercised for 60 minutes/day during distance learning. Another study found a decrease in subjects who exercise >60 minutes/session by 11.9% during social distancing. The decrease of subjects who do not exercise was similar to other studies which found a decrease in exercise <3 times / week to 32.3% where before social restrictions was 35.4%.[28]

Social restrictions are reported to cause negative feelings, lack of personal space, and social pressure in adolescents, limiting their willingness and possibility to remain active.[57] Moreover, obstacles such as much schoolwork, lack of free time, limited space for movement, and the loss of opportunities to participate in sports at school may change the habits of teenagers, which is essential to form behaviour in current conditions.[58,59] Exercise can become a routine and a way to stay in touch with family and friends. Exercise is beneficial for improving bone and muscle strength, balance, flexibility, and fitness. In addition, exercise is also good for mental health, reduces the risk of depression and anxiety, and improves mood.[60–62]

Teenagers are advised to be able to eat food according to the recommendation of Tumpeng Gizi Seimbang. Besides, it might be good for teenagers to do physical activity with light intensity for 3-4 minutes, such as walking or stretching to relax the muscles and improve blood circulation during school hours.[60] This activity is sufficient to increase energy expenditure to improve the body's metabolic health by controlling the glycemic index.[63] Adolescents are expected to do 60 minutes/day of moderate-intensity physical activity such as aerobics or physical exercise outside of school hours.[60] In terms of research, it is recommended to conduct further research regarding the factors that influence eating habits before and during distance learning that were not examined in this study, such as nutritional status, socioeconomic status, stress level, and lifestyle.

The limitations of this study used categorical analysis to see the difference in the variables; however, it cannot show the magnitude of the decrease or increase numerically for each variable value. This research data was collected online using Microsoft Forms, so there are limitations in the validity of the data even though the researchers had tried to validate the data.

CONCLUSIONS

There are significant differences in adolescents' eating habits and physical activity during distance learning. Significant differences were found in eating habits comprised of the number of main meals and snacking, intake of carbohydrates sources, sweet food, snack, and physical activity before and during distance learning with $p < 0.05$. However, there are no significant differences in eating habits comprised of intake of animal and plant-based protein sources, vegetable, fruit, sweetened beverages, fried food, processed food, junk food, and eating behaviour with $p > 0.05$.

REFERENCES

1. Wang C, Horby PW, Hayden FG, Gao GF. A novel coronavirus outbreak of global health concern. Lancet. 2020;395(10223):470–3.
2. Rothe C, Schunk M, Sothmann P, Bretzel G, Froeschl G, Wallrauch C, et al. Transmission of 2019-nCoV infection from an asymptomatic contact in Germany. N Engl J Med. 2020;382(10):970–1.
3. Philips V, Wicaksono TY. Karakter dan persebaran Covid-19 di Indonesia: Temuan awal. CSIS Comment. 2020;(April):1–12.
4. Gubernur Daerah Khusus Ibukota Jakarta. Peraturan Gubernur Daerah Khusus Ibukota Jakarta No. 33 Tahun 2020 tentang Pelaksanaan Pembatasan Sosial Berskala Besar dalam Penanganan Corona Virus Disease 2019 (COVID-19) di Provinsi Daerah Khusus Ibukota Jakarta. Peraturan Gubernur Nomor 33 Tahuun 2020 2020 p. 19.
5. Anton SD, Miller PM. Do negative emotions predict alcohol consumption, saturated fat intake, and physical activity in older adults? Behav Modif. 2005;29(4):677–88.
6. Hossain MM, Sultana A, Purohit N. Mental health outcomes of quarantine and isolation for infection prevention: a systematic umbrella review of the global evidence. Epidemiol Health. 2020;42:1–11.
7. Zarrinpar A, Chaix A, Panda S. Daily eating patterns and their impact on health and disease circadian rhythms and metabolism. Trend Endocrinol Metab. 2016;27(2):69–83.
8. Margaritis I, Houdart S, El Ouadrhiri Y, Bigard X, Vuillemin A, Duché P. How to deal with COVID-19 epidemic-related lockdown physical inactivity and sedentary increase in youth? Adaptation of Anses' benchmarks. Arch Public Heal. 2020;78(1):1–6.
9. Hobbs M, Pearson N, Foster PJ, Biddle SJH. Sedentary behaviour and diet across the lifespan: An

updated systematic review. Br J Sports Med. 2015;49(18):1179–88.
10. Epstein LH, Paluch RA, Consalvi A, Riordan K, Scholl T. Effects of manipulating sedentary behavior on physical activity and food intake. J Pediatr. 2002;140(3):334–9.
11. Allabadi H, Dabis J, Aghabekian V, Khader A, Khammash U. Impact of COVID-19 lockdown on dietary and lifestyle behaviours among adolescents in Palestine. Dyn Hum Heal. 2020;7(2):1–11.
12. 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.
13. Di Renzo L, Gualtieri P, Pivari F, Soldati L, Attinà A, Cinelli G, et al. Eating habits and lifestyle changes during COVID-19 lockdown: An Italian survey. J Transl Med. 2020;18(1):1–15.
14. Public Library of Science. Eating Habits Questionnaire [Internet]. Vol. 58, Public Library of Science. 2012 [cited 2020 Jul 30]. p. 9–10. Available from: https://storage.googleapis.com/plos-corpus-prod/10.1371/journal.pone.0143293/1/pone.0143293.s003.pdf?X-Goog-Algorithm=GOOG4-RSA-SHA256&X-Goog-Credential=wombat-sa%40plos-prod.iam.gserviceaccount.com%2F20220203%2Fauto%2Fstorage%2Fgoog4_request&X-Goog-Date=
15. Meyers L, Gamst G, Guarino AJ. Applied Multivariate Research: Design and Interpretation. California: SAGE; 2006. 1 p.
16. Jollife IT, Cadima J. Principal component analysis: A review and recent developments. Philos Trans R Soc A. 2016;374(2065):1–16.
17. Budiastuti D, Bandur A. Validitas dan Reabilitas Penelitian. Jakarta: Mitra Wacana Media; 2018. 150–169 p.
18. Hail JF, Black B, Babin B, Anderson R, Tatham RL. Multivariate Data Analysis. 6th ed. Upper Saddle River: Pearson Education; 2006.
19. Santos RDO, Gorgulho BM, Castro MA De, Fisberg RM, Marchioni DM, Baltar VT. Principal component analysis and factor analysis: Differences and similarities in nutritional epidemiology application. Rev Bras Epidemiol. 2019;22(E19004):1–14.
20. Mishra P, Pandey CM, Singh U, Gupta A, Sahu C, Keshri A. Descriptive statistics and normality tests for statistical data. Ann Card Anaesth. 2019;22(1):67–72.
21. Menteri Pendidikan dan Kebudayaan Republik Indonesia. Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 23 Tahun 2017 Tentang Hari Sekolah. Indonesia; 2017 p. 1–9.
22. Kementrian Pendidikan Kebudayaan Riset dan Teknologi Republik Indonesia. Keputusan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 719/P/2020 tentang Pedoman Pelaksanaan Kurikulum pada Satuan Pendidikan dalam Kondisi Khusus. 719/P/2020 Indonesia; 2020.
23. Utami AM, Kurniati AM, Ayu DR, Husin S, Liberty IA. Perilaku makan dan aktivitas fisik mahasiswa pendidikan dokter di masa pandemi COVID-19. J Kedokt dan Kesehat Publ Ilm Fak Kedokt Univ Sriwij. 2021;8(3):179–92.
24. Błaszczyk-Bębenek E, Jagielski P, Bolesławska I, Jagielska A, Nitsch-Osuch A, Kawalec P. Nutrition behaviors in polish adults before and during COVID-19 lockdown. Nutrients. 2020;12(3084):1–16.
25. Deschasaux-Tanguy M, Druesne-Pecollo N, Esseddik Y, De Edelenyi FS, Allès B, Andreeva VA, et al. Diet and physical activity during the coronavirus disease 2019 (COVID-19) lockdown (March-May 2020): Results from the French NutriNet-Santé cohort study. Am J Clin Nutr. 2021;113(4):924–38.
26. Nickols-Richardson SM, Piehowski KE, Metzgar CJ, Miller DL, Preston AG. Changes in body weight, blood pressure and selected metabolic biomarkers with an energy-restricted diet including twice daily sweet snacks and once daily sugar-free beverage. Nutr Res Pract. 2014;8(6):695–704.
27. Association AD. American Dietetic Association Foundation Survey finds children skipping meals, snacking frequently [Internet]. 2014. Available from: http://www.eatright.org/
28. Sánchez-Sánchez E, Ramírez-Vargas G, Avellaneda-López Y, Orellana-Pecino JI, García-Marín E, Díaz-Jimenez J. Eating habits and physical activity of the spanish population during the covid-19 pandemic period. Nutrients. 2020;12(9):1–12.
29. Insel PM, Turner RE, Ross D. Carbohydrates: Simple Sugars and Complex Chains. In: Discovering Nutrition. 2006. p. 96–124.
30. Paglia L, Friuli S, Colombo S, Paglia M. The effect of added sugars on children's health outcomes: Obesity, Obstructive Sleep Apnea Syndrome (OSAS), Attention-Deficit/Hyperactivity Disorder (ADHD) and chronic diseases. Eur J Paediatr Dent. 2019;20(2):127–32.
31. Kementrian Kesehatan Republik Indonesia. Permenkes No. 41 Tahun 2014 Tentang Pedoman Gizi

Seimbang. Indonesia; 2014 p. 17–45.
32. El-Sayyad HI, Abou-Egla MH, El-Sayyad FI, El-Ghawet HA, Gaur RL, Fernando A, et al. Effects of fried potato chip supplementation on mouse pregnancy and fetal development. Nutrition. 2011;27(3):343–50.
33. Becalski A, Lau BPY, Lewis D, Seaman SW. Acrylamide in foods: Occurrence, sources, and modeling. J Agric Food Chem. 2003;51(3):802–8.
34. Hendriksen MAH, Boer JMA, Du H, Feskens EJM, Van Der A DL. No consistent association between consumption of energy-dense snack foods and annual weight and waist circumference changes in Dutch adults. Am J Clin Nutr. 2011;94(1):19–25.
35. Nicklas TA, Yang SJ, Baranowski T, Zakeri I, Berenson G. Eating patterns and obesity in children - The Bogalusa Heart Study. Am J Prev Med. 2003;25(1):9–16.
36. Lieberman HR, Fulgoni VL, Agarwal S, Pasiakos SM, Berryman CE. Protein intake is more stable than carbohydrate or fat intake across various US demographic groups and international populations. Am J Clin Nutr. 2020;112(1):180–6.
37. Mclntosh SN. Basic Nutrition and Diet Therapy. Missouri: Elsevier Inc.; 2017.
38. Pietrobelli A, Pecoraro L, Ferruzzi A, Heo M, Zoller T, Antoniazzi F, 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.
39. Badan Litbangkes. Laporan Provinsi DKI Jakarta: Riskesdas 2018. Laporan Provinsi DKI Jakarta. Jakarta: Lembaga Penerbit Badan Penelitian dan Pengembangan Kesehatan; 2019. 1–535 p.
40. Devonport TJ, Nicholls W, Fullerton C. A systematic review of the association between emotions and eating behaviour in normal and overweight adult populations. J Health Psychol. 2019;24(1):3–24.
41. Evers C, Stok F, de Ridder DTD. Feeding your feelings: Emotion regulation strategies and emotional eating. Personal Soc Psychol Bull. 2010;36(6):792–804.
42. Muscogiuri G, Barrea L, Savastano S, Colao A. Nutritional recommendations for CoVID-19 quarantine. Eur J Clin Nutr. 2020;74(6):850–1.
43. Australians HI for western. Junk Food [Internet]. [cited 2020 Sep 20]. Available from: https://healthywa.wa.gov.au/
44. Association AH. Excess sodium hurts your health and your looks [Internet]. 2014 [cited 2020 Sep 20]. Available from: https://sodiumbreakup.heart.org/
45. Tatjana van S, Floris A van de L, Jan F.J. van L, Peter L, Henk van den H, Guy R, et al. The dieting dilemma in patients with newly diagnosed type 2 diabetes: Does dietary restraint predict weight gain 4 years after diagnosis? Heal Psychol. 2007;26(1):105–12.
46. Smith M, Robinson L, Segal J, Segal R. Emotional Eating and How to Stop It [Internet]. 2019 [cited 2020 Sep 20]. Available from: https://www.helpguide.org/
47. Hall JE. Dietary balances; regulation of feedings; obesity and starvation; vitamins and minerals. In: Guyton and Hall Textbook of Medical Physiology t. 13rd ed. Philadelphia: Elsevier; 2016. p. 892–3.
48. Bartness TJ, Keen-Rhinehart E, Dailey MJ, Teubner BJ. Neural and hormonal control of food hoarding. Am J Physiol - Regul Integr Comp Physiol. 2011;301(3).
49. Isnel P, Ross D, McMahon K, Bernstein M. Spotlight on Metabolism and Energy Balance. In: Discovering Nutrition. Burlington: Jones & Bartlett Learning; 2019. p. 248.
50. Magee E. Your "Hunger Hormones" [Internet]. Nourish by WebMD. 2017 [cited 2021 Jan 7]. Available from: https://www.webmd.com/diet/features/your-hunger-hormones#1
51. Adams EL, Caccavale LJ, Smith D, Bean MK. Food Insecurity, the home food environment, and parent feeding practices in the era of COVID-19. Obesity. 2020;28(11):2056–63.
52. Norman P Spack Daniel E Shumer NJN. Cooking at home: A strategy to comply with U.S. dietary guidelines at no extra cost. Physiol Behav. 2017;176(12):139–48.
53. Mills S, Brown H, Wrieden W, White M, Adams J. Frequency of eating home cooked meals and potential benefits for diet and health: Cross-sectional analysis of a population-based cohort study. Int J Behav Nutr Phys Act. 2017;14(1):1–11.
54. Robinson L, Segal J, Segal R. Cooking at Home [Internet]. HelpGuide. 2020 [cited 2020 Sep 27]. Available from: https://www.helpguide.org/
55. Harvard Health Publishing. Get Cooking at Home [Internet]. Harvard Health Publishing. 2017 [cited 2020 Sep 27]. Available from: https://www.health.harvard.edu/
56. Ismail LC, Osaili TM, Mohamad MN, Marzouqi A Al, Jarrar AH, Jamous DOA, et al. Eating habits and

lifestyle during covid-19 lockdown in the united arab emirates: A cross-sectional study. Nutrients. 2020;12(11):1–20.
57. Leavey C, Eastaugh A, Kane M. Generation COVID-19; Building The Case To Protect Young People's Future Health [Internet]. The Health Foundation. 2020 [cited 2021 Apr 21]. Available from: https://www.health.org.uk/
58. Ng K, Cooper J, McHale F, Clifford J, Woods C. Barriers and facilitators to changes in adolescent physical activity during COVID-19. BMJ Open Sport Exerc Med. 2020;6(1):1–9.
59. Knittle K, Heino M, Marques MM, Stenius M, Beattie M, Ehbrecht F, et al. The compendium of self-enactable techniques to change and self-manage motivation and behaviour v.1.0. Nat Hum Behav. 2020;4(2):215–23.
60. WHO (World Health Organization). #HealthyAtHome - Physical Activity [Internet]. World Health Organization. 2020 [cited 2020 Dec 20]. Available from: https://www.who.int/
61. Schuch FB, Vancampfort D, Firth J, Rosenbaum S, Ward PB, Silva ES, et al. Physical activity and incident depression: A meta-analysis of prospective cohort studies. Am J Psychiatry. 2018;175(7):631–48.
62. Schuch FB, Stubbs B, Meyer J, Heissel A, Zech P, Vancampfort D, et al. Physical activity protects from incident anxiety: A meta-analysis of prospective cohort studies. Depress Anxiety. 2019;36(9):846–58.
63. Joy L. Staying Active during COVID-19 [Internet]. American College of Sports Medicine. 2020 [cited 2020 Dec 27]. Available from: https://www.exerciseismedicine.org/