

KORESPONDENSI PAPER

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

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AKTIVITAS KORESPONDENSI

No	Aktivitas	Tanggal
1	Submit Artikel	14 September 2021
2	Review dan Revisi Artikel	31 Januari 2022
3	Accepted	8 Februari 2022

1. Submit Artikel

[JGI] Submission Acknowledgement Inbox x

 Jurnal Gizi Indonesia (The Indonesian Journal of Nutrition) <jgi@fk.undip.ac.id> to me Tue, Sep 14, 2021, 12:40 PM ☆ ↶ ⋮

Ani Margawati:

Thank you for submitting the manuscript, "Differences in eating habits and physical activity before and during distance learning" to Jurnal Gizi Indonesia (The Indonesian Journal of Nutrition). With the online journal management system that we are using, you will be able to track its progress through the editorial process by logging in to the journal web site:

Manuscript URL: <https://ejournal.undip.ac.id/index.php/gi/author/submission/41387>
Username: margawati

If you have any questions, please contact me. Thank you for considering this journal as a venue for your work.

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2. Review dan Revisi Artikel

[JGI] Editor Decision Inbox x

 Ayu Rahadiyanti, S.Gz, MPH <ayurahadiyanti@live.undip.ac.id> to me Mon, Jan 31, 2022, 2:41 PM ☆ ↶ ⋮

Dear,
Ani Margawati:

We have reached a decision regarding your submission to Jurnal Gizi Indonesia (The Indonesian Journal of Nutrition), "Differences in eating habits and physical activity before and during distance learning".

Our decision is to: REVISION REQUIRED
Please revise the manuscript according to the reviewers' comments and answer all the questions. Any revisions should be clearly highlighted.

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**BUTIR-BUTIR PENILAIAN KELAYAKAN ARTIKEL UNTUK REVIEWER
JURNAL GIZI INDONESIA**

JUDUL ARTIKEL : Differences in eating habits and physical activity before and during distance learning

NO	BUTIR-BUTIR PENILAIAN	PENILAIAN*	
		YA	TIDAK
1	Informasi dalam naskah baru, Memuat artikel yang berisi karya orisinal dan mempunyai kebaruan/memberikan kontribusi ilmiah tinggi		
2	Bahan serupa pernah diterbitkan dalam bentuk lain		
3	Naskah lebih cocok untuk terbitan berkala lain		
4	Judul mencerminkan inti dari isi artikel		
5	Abstrak yang jelas dan ringkas dalam Bahasa Inggris dan/atau Bahasa Indonesia		
6	Kata kunci ada, konsisten dan mencerminkan konsep penting dalam artikel		
7	Pendahuluan berisi pokok pembahasan yang jelas dan dikemukakan dengan mengacu pada perkembangan pemikiran mutakhir (seperti diperlihatkan oleh khasanah kepustakaan maksimal 10 tahun terakhir		
8	Metode lengkap dan jelas		
9	Hasil dan pembahasan ditulis secara logis dan alur penyajian tidak terputus		
10	Tidak ada kesalahan fakta, penginterpretasian atau penghitungan data		
11	Tabel menyajikan data secara jelas dan ringkas		
12	Ilustrasi dan gambar jelas dan lengkap		
13	Semua keterangan tabel dan gambar cukup jelas		
14	Penarikan simpulan, perampatan yang meluas dan pencetusan teori baru yang dituangkan secara akurat dan berpedoman pada kaidah ilmiah		
15	Cara Pengacuan dan Pengutipan Baku dan konsistendan menggunakan aplikasi pengutipan standar Vancouver		
16	Penyusunan Daftar Pustaka Baku dan konsistendan menggunakan aplikasi pengutipan standar Vancouver		
17	Nisbah Sumber Acuan Primer berbanding Sumber lainnya mencakup >80%		
18	Khasanah kepustakaan maksimal 10 tahun terakhir		
19	Peristilahan dan Kebahasaan Berbahasa Indonesia atau berbahasa resmi PBB yang baik dan benar		

Catatan dan perbaikan ** :

NO	BAB dan SUB BAB	KOMENTAR
1	Judul	
2	Nama Penulis dan Alamat Korespondensi	
3	Abstrak	
4	Pendahuluan : <ul style="list-style-type: none">• Latar belakang• Hasil kajian pustaka,• Tujuan penelitian	
5	Bahan dan Metode : <ul style="list-style-type: none">• Desain penelitian, waktu,• Populasi / sampel / subyek penelitian,• Variabel yang diteliti,• Teknik pengumpulan data• Teknik analisis data.	
6	Hasil : <ul style="list-style-type: none">• Grafik• Tabel• Paparan Hasil	
7	Pembahasan	
8	Simpulan	

9	Daftar Pustaka (Vancouver Syle)	
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Differences in eating habits and physical activity before and during distance learning

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 ($p=0,35$), 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: There were significant differences in eating habits comprised of the number of daily meals and snacking, carbohydrates sources intake, sweet food, snack, and physical activity before and during distance learning. There were no significant differences in eating habits comprised of protein-sources intake, fruit, vegetable, sweetened beverages, fried food, processed food, junk food, and eating behaviour 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 SARS-CoV-2 (Severe Acute Respiratory Syndrome Coronavirus 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. In Jakarta, 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 [3].

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Remote learning leads adolescents to feel stressed, causing discomfort such as fear and anxiety to the point that it might change their eating habits [4,5]. 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 [6].

In addition, distance learning restricts adolescents to do spontaneous physical activities related to the necessities of daily life outside the house [7]. 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 [7,8]. 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) [9].

Based on a recent study of Palestinian adolescents, there was an increase in food 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 [10].

This is in line with research conducted by Ruiz-Roso et al., where there was a change in food habits with an increase in intake of vegetables (43%), fruits (33%), fried food (9%), and sweet food (21%) and accompanied by a decrease in consumption of fast food (64%) during restriction. Increased intake of vegetables and fruit occurs because subjects have time to cook; meanwhile, increased intake of fried and sweet food occur because staying at home can trigger boredom and stress, causing a change in eating patterns and increasing food consumption [11].

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 [12].

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.

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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/1/2021.

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 $\alpha = 0.05$, 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. 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 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. The participants consented to participate in the study with a digital informed/parental consent form. The exclusion criterion for this study was if the subject withdrew from the study.

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; <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 [12] and Eating Habits questionnaires [13].

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 consists of 4 questions; exercise (yes/no), type of exercise

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(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. PCA is a multivariate statistical analysis method used to reduce the dimensions of interrelated variables while retaining most of the information in the data in an interpretable way [14,15]. In this study, 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 [16].

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 $p < 0.05$ is considered acceptable to meet the criteria [17]. 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 $p \geq 0.70$ [18,19]. High commonality indicates that the question items have a strong relationship with research factors. The number of existing factors can be determined if the components with total initial eigenvalues > 1.00 in the total variance explained table [16]. 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 [17,20].

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 $X^2 = 3634.027$ and p-value = 0.00. After going through the validity test using Pearson correlation and reliability test, it 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. Before the bivariate test, 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 [21]. After performing the normality test, all data were known to be not normally distributed, so that the bivariate analysis was carried out using a non-parametric test.

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 significance level (α) of 0.05 and a confidence interval of 95%. The differences between variables will be significant if $p < 0.05$. The bivariate analysis aimed to see the differences of the dependent variables towards the independent variable.

RESULTS

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. Socio-demographic Characteristics

Characteristics	Frequency	Percentage
	(n= 95)	(%)
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
School		
Public School A	11	11,6
Public School B	2	2,1
Public School C	4	4,2
Public School D	4	4,2
Public School E	4	4,2
Public School F	1	1,1
Public School G	8	8,4
Public School H	10	10,5
Public School I	9	9,5
Public School J	11	11,6
Public School K	14	14,7
Public School L	17	17,9
Grade		
10 th	24	25,3
11 th	35	36,8
12 th	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

Table 1. shows that the subjects' age range is 15-18 years old and consisted of 34.7% males and 65.3% females. Most of the subjects came from Public School L (17.9%) and Public School K (14.7%). 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. presenting the frequencies of each variable and the bivariate analysis of eating habits and physical activity.

Table 2. Frequency Distribution and Bivariate Analysis of Eating Habits and Physical Activity

	Before		During		p
	(n= 95)		(n= 95)		
	n	%	n	%	
The number of main meals per day					
1	2	2,1	2	2,1	0,014**
2	19	20	28	29,5	
3	69	72,6	63	66,3	

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4	5	5,3	2	2,1	
The number of snacking per day					
0	2	2,1	-	-	
1	41	43,2	38	40	
2	44	46,3	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	58,9	46	48,4	0,046 ^{a*}
>4	1	1,1	2	2,1	
Animal protein sources intake per day (portion)					
2-4	94	98,9	93	97,9	
>4	1	1,1	2	2,1	0,317 ^a
Plant-based protein sources intake per day (portion)					
0	8	8,4	7	7,4	
<2	72	75,8	71	74,7	
2-4	14	14,7	16	16,8	0,366 ^a
>4	1	1,1	1	1,1	
Vegetables intake per day (portion)					
0	15	15,8	15	15,8	
<3	52	54,7	56	58,9	
3-4	27	28,4	24	25,3	0,166 ^a
>4	1	1,1	-	-	
Fruits intake per day (portion)					
0	17	17,9	18	18,9	
<2	57	60	57	60	
2-3	18	18,9	16	16,8	0,827 ^a
>3	3	3,2	4	4,2	
Sweet food intake per week (portion)					
0	14	14,7	18	18,9	
1-3	63	66,3	67	70,5	
4-6	15	15,8	7	7,4	0,014 ^{a*}
>6	3	3,2	3	3,2	
Sweetened beverages intake per week (portion)					
0	10	10,5	9	9,5	
1-3	61	64,2	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	70,5	71	74,7	
4-6	17	17,9	12	12,6	0,109 ^a
>6	3	3,2	3	3,2	
Processed food intake per week (portion)					
0	12	12,6	13	13,7	
1-3	64	67,4	68	71,6	
4-6	17	17,9	10	10,5	0,285 ^a
>6	2	2,1	4	4,2	
Snacks intake per week (portion)					
0	16	16,8	24	25,3	
1-3	62	65,3	58	61,1	0,016 ^{a*}

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	
1-3	69	72,6	71	74,7	
4-6	8	8,4	3	3,2	0,096 ^a
>6	1	1,1	2	2,1	
Emotional eating					
Never	20	21,1	19	20	
Seldom	27	28,4	27	28,4	
Sometimes	38	40	38	40	0,467 ^a
Always	10	10,5	11	11,6	
Sense of hunger					
Before mealtime	34	35,8	32	33,7	
Between mealtimes	37	38,9	36	37,9	0,190 ^a
After dinner	24	25,3	27	28,4	
Ways of obtaining food					
Cooking	79	83,2	80	84,2	
Purchasing	16	16,8	15	15,8	1,000 ^b
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	
Exercise					
No	31	32,6	42	44,2	
Yes	64	67,4	53	55,8	0,035 ^{b*}
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	
60 minutes	13	13,7	0	0	0,004 ^{a*}
>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

^aWilcoxon signed-ranks test ^bMcNemar test; * significant at $p < 0,05$

Table 2 shows an increase in 2 times/day-meals during distance learning by 9.5%. The average number of meals before distance learning was 2.81 ± 0.551 times, whereas during distance learning was 2.68 ± 0.551 times. There is an increase in 3 times/day-snacking by 4.2% 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 a decrease in carbohydrates sources intakes of 3-4 servings/day by 10.5% 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 and an 8.5% increase in subjects who do not eat snacks during distance learning. 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.

The 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 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 ($p=0, 14$), snacks ($p=0.016$), physical activity included exercise ($p=0.035$), exercise duration ($p=0.004$) and exercise frequency ($p=0.030$) before and during distance learning with $p < 0.05$.

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 3. 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 3. presents certain types of most consumed food and beverages during distance learning.

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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 [22]. Meanwhile, school hours are set at least 24 hours a week during distance learning [23]. 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 in 2 times/day-meals during distance learning. This 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]. Eating <3 times/day has a positive relationship with increased BMI, body fat percentage, subcutaneous and visceral fat tissue, and increases the risk of overeating and unhealthy food choices [25,26]. This is in line with the study results, which showed an increase in subjects who ate >1 portion in one meal during distance learning.

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 [27]. 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 [28,29].

There is a decrease in subjects who consumed 3-4 servings of carbohydrates sources per day during distance learning. 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 [30]. 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 [31].

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 [32]. 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 [33].

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 [34,35]. In adults with normal weight and overweight, consumption of energy-dense snacks is associated with weight gain [36]. 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 [37].

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 [38]. During adolescent development, protein is needed to build new tissues and maintain existing tissues [39]. 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 [40].

Risikesdas 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%) [41]. 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 [31].

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 [42,43]. Physiologically, consuming fatty food and high-sugar drinks increases the production of serotonin and dopamine, which affect mood for the better [44]. 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 [45]. In addition, the sodium contained in processed food may cause water retention in the body, causing bloating, swelling, and weight gain [46].

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 [47]. 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 [48].

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 [12]. 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 [49]. 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 [49–51]. 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 [52].

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 [53]. 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 [54].

Consumption of home-cooked meals has a significant relationship with indicators of a healthier diet [55]. Cooking their food will allow individuals to control the ingredients used and the portion served [56]. Research shows that individuals who cook at home consume lower calories than those who cook less [57].

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 [58]. 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 [30]. 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% [30].

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 [59]. 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 [60,61]. 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 [62–64].

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 [62]. This activity is sufficient to increase energy expenditure to improve the body's metabolic health by controlling the glycemic index [65]. Adolescents are expected to do 60 minutes/day of moderate-intensity physical activity such as aerobics or physical exercise outside of school hours [62]. 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.

LIMITATIONS

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.

The questionnaire used in this study is a questionnaire adopted from the Eating habits and lifestyle changes research during COVID-19 lockdown: an Italian survey and the Eating habits questionnaire [12,13]. After testing the validity and reliability, it is known that the questionnaire is a reliable instrument, but some questions are not valid. The questions are still used with the consideration of the researcher.

CONCLUSION

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 $p > 0.05$.

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**BUTIR-BUTIR PENILAIAN KELAYAKAN ARTIKEL UNTUK REVIEWER
JURNAL GIZI INDONESIA**

JUDUL ARTIKEL : **Differences in eating habits and physical activity before and during distance learning**

NO	BUTIR-BUTIR PENILAIAN	PENILAIAN*	
		YA	TIDAK
1	Informasi dalam naskah baru, Memuat artikel yang berisi karya orisinal dan mempunyai kebaruan/memberikan kontribusi ilmiah tinggi	V	
2	Bahan serupa pernah diterbitkan dalam bentuk lain		V
3	Naskah lebih cocok untuk terbitan berkala lain		V
4	Judul mencerminkan inti dari isi artikel	V	
5	Abstrak yang jelas dan ringkas dalam Bahasa Inggris dan/atau Bahasa Indonesia	V	
6	Kata kunci ada, konsisten dan mencerminkan konsep penting dalam artikel	V	
7	Pendahuluan berisi pokok pembahasan yang jelas dan dikemukakan dengan mengacu pada perkembangan pemikiran mutakhir (seperti diperlihatkan oleh khasanah kepustakaan maksimal 10 tahun terakhir	V	
8	Metode lengkap dan jelas	V	
9	Hasil dan pembahasan ditulis secara logis dan alur penyajian tidak terputus	V	
10	Tidak ada kesalahan fakta, penginterpretasian atau penghitungan data	V	
11	Tabel menyajikan data secara jelas dan ringkas	V	
12	Ilustrasi dan gambar jelas dan lengkap	V	
13	Semua keterangan tabel dan gambar cukup jelas	V	
14	Penarikan simpulan, perampatan yang meluas dan pencetusan teori baru yang dituangkan secara akurat dan berpedoman pada kaidah ilmiah	V	
15	Cara Pengacuan dan Pengutipan Baku dan konsistendan menggunakan aplikasi pengutipan standar Vancouver	V	
16	Penyusunan Daftar Pustaka Baku dan konsistendan menggunakan aplikasi pengutipan standar Vancouver	V	
17	Nisbah Sumber Acuan Primer berbanding Sumber lainnya mencakup >80%	V	
18	Khasanah kepustakaan maksimal 10 tahun terakhir	V	
19	Peristilahan dan Kebahasaan Berbahasa Indonesia atau berbahasa resmi PBB yang baik dan benar	V	

Catatan dan perbaikan **: :

NO	BAB dan SUB BAB	KOMENTAR
1	Judul	baik
2	Nama Penulis dan Alamat Korespondensi	-
3	Abstrak	baik
4	Pendahuluan : <ul style="list-style-type: none"> • Latar belakang • Hasil kajian pustaka, • Tujuan penelitian 	
5	Bahan dan Metode : <ul style="list-style-type: none"> • Desain penelitian, waktu, • Populasi / sampel / subyek penelitian, • Variabel yang diteliti, • Teknik pengumpulan data • Teknik analisis data. 	teknik analisis data ada yang perlu diringkas, masih terlalu panjang
6	Hasil : <ul style="list-style-type: none"> • Grafik • Tabel • Paparan Hasil 	hasil frekuensi makan, supaya lebih dinarasikan dengan baik, sehingga data frek ini sesuai dengan praktek riil di lapangan, didekatkan dengan kelaziman frek makan sebaiknya data frek makan, disajikan dalam grafik batang, jauh lebih mudah dipahami (menurun/meningkat saat PJJ)

7	Pembahasan	alinea yang msh membahas satu ide gagasan harap disatukan
8	Simpulan	
9	Daftar Pustaka (Vancouver Syle)	

Differences in eating habits and physical activity before and during distance learning

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 ($p=0,35$), 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: There were significant differences in eating habits comprised of the number of daily meals and snacking, carbohydrates sources intake, sweet food, snack, and physical activity before and during distance learning. There were no significant differences in eating habits comprised of protein-sources intake, fruit, vegetable, sweetened beverages, fried food, processed food, junk food, and eating behaviour 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 SARS-CoV-2 (Severe Acute Respiratory Syndrome Coronavirus 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. In Jakarta, public places are closed, restaurants limit take-out or online delivery services, and social gatherings related to

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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 [3].

Remote learning leads adolescents to feel stressed, causing discomfort such as fear and anxiety to the point that it might change their eating habits [4,5]. 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 [6].

In addition, distance learning restricts adolescents to do spontaneous physical activities related to the necessities of daily life outside the house [7]. 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 [7,8]. 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) [9].

Based on a recent study of Palestinian adolescents, there was an increase in food 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 [10].

This is in line with research conducted by Ruiz-Roso et al., where there was a change in food habits with an increase in intake of vegetables (43%), fruits (33%), fried food (9%), and sweet food (21%) and accompanied by a decrease in consumption of fast food (64%) during restriction. Increased intake of vegetables and fruit occurs because subjects have time to cook; meanwhile, increased intake of fried and sweet food occur because staying at home can trigger boredom and stress, causing a change in eating patterns and increasing food consumption [11].

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 [12].

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

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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 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 $\alpha = 0.05$, 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. 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 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. The participants consented to participate in the study with a digital informed/parental consent form. The exclusion criterion for this study was if the subject withdrew from the study.

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; <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-1912 and Eating Habits questionnaires [13].

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

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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 consists 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. PCA is a multivariate statistical analysis method used to reduce the dimensions of interrelated variables while retaining most of the information in the data in an interpretable way [14,15]. In this study, 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 [16].

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 $p < 0.05$ is considered acceptable to meet the criteria [17]. 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 $p \geq 0.70$ [18,19]. High commonality indicates that the question items have a strong relationship with research factors. The number of existing factors can be determined if the components with total initial eigenvalues > 1.00 in the total variance explained table [16]. 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 [17,20].

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 $X^2 = 3634.027$ and p-value = 0.00. After going through the validity test using Pearson correlation and reliability test, it 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. Before the bivariate test, 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 [21]. After performing the normality test, all data were known to be not normally distributed, so that the bivariate analysis was carried out using a non-parametric test.

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 significance level (α) of 0.05 and a confidence interval of 95%. The

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differences between variables will be significant if $p < 0.05$. The bivariate analysis aimed to see the differences of the dependent variables towards the independent variable.

RESULTS

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. 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
School		
Public School A	11	11,6
Public School B	2	2,1
Public School C	4	4,2
Public School D	4	4,2
Public School E	4	4,2
Public School F	1	1,1
Public School G	8	8,4
Public School H	10	10,5
Public School I	9	9,5
Public School J	11	11,6
Public School K	14	14,7
Public School L	17	17,9
Grade		
10 th	24	25,3
11 th	35	36,8
12 th	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

Table 1. shows that the subjects' age range is 15-18 years old and consisted of 34.7% males and 65.3% females. Most of the subjects came from Public School L (17.9%) and Public School K (14.7%). 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. presenting the frequencies of each variable and the bivariate analysis of eating habits and physical activity.

Table 2. Frequency Distribution and Bivariate Analysis of Eating Habits and Physical Activity

Before	During	<i>P</i>
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Sebaiknya tabel eating habits dan PA dipisah saja

	(n= 95)		(n= 95)		
	n	%	n	%	
The number of main meals per day					
1	2	2,1	2	2,1	
2	19	20	28	29,5	
3	69	72,6	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	43,2	38	40	
2	44	46,3	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	58,9	46	48,4	0,046 ^a
>4	1	1,1	2	2,1	
Animal protein sources intake per day (portion)					
2-4	94	98,9	93	97,9	
>4	1	1,1	2	2,1	0,317 ^a
Plant-based protein sources intake per day (portion)					
0	8	8,4	7	7,4	
<2	72	75,8	71	74,7	
2-4	14	14,7	16	16,8	0,366 ^a
>4	1	1,1	1	1,1	
Vegetables intake per day (portion)					
0	15	15,8	15	15,8	
<3	52	54,7	56	58,9	
3-4	27	28,4	24	25,3	0,166 ^a
>4	1	1,1	-	-	
Fruits intake per day (portion)					
0	17	17,9	18	18,9	
<2	57	60	57	60	
2-3	18	18,9	16	16,8	0,827 ^a
>3	3	3,2	4	4,2	
Sweet food intake per week (portion)					
0	14	14,7	18	18,9	
1-3	63	66,3	67	70,5	
4-6	15	15,8	7	7,4	0,014 ^a
>6	3	3,2	3	3,2	
Sweetened beverages intake per week (portion)					
0	10	10,5	9	9,5	
1-3	61	64,2	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	70,5	71	74,7	
4-6	17	17,9	12	12,6	0,109 ^a
>6	3	3,2	3	3,2	
Processed food intake per week (portion)					

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0	12	12,6	13	13,7	
1-3	64	67,4	68	71,6	
4-6	17	17,9	10	10,5	0,285 ^a
>6	2	2,1	4	4,2	
Snacks intake per week (portion)					
0	16	16,8	24	25,3	
1-3	62	65,3	58	61,1	
4-6	12	12,6	9	9,5	0,016 ^{a*}
>6	5	5,3	4	4,2	
Junk food intake per week (portion)					
0	17	17,9	19	20	
1-3	69	72,6	71	74,7	
4-6	8	8,4	3	3,2	0,096 ^a
>6	1	1,1	2	2,1	
Emotional eating					
Never	20	21,1	19	20	
Seldom	27	28,4	27	28,4	
Sometimes	38	40	38	40	0,467 ^a
Always	10	10,5	11	11,6	
Sense of hunger					
Before mealtime	34	35,8	32	33,7	
Between mealtimes	37	38,9	36	37,9	0,190 ^a
After dinner	24	25,3	27	28,4	
Ways of obtaining food					
Cooking	79	83,2	80	84,2	
Purchasing	16	16,8	15	15,8	1,000 ^b
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	
Exercise					
No	31	32,6	42	44,2	
Yes	64	67,4	53	55,8	0,035 ^{b*}
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	
60 minutes	13	13,7	0	0	0,004 ^{a*}
>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	
3 times	11	11,6	9	9,5	0,030 ^{a*}
>3 times	4	4,2	4	4,2	

^aWilcoxon signed-ranks test ^bMcNemar test; * significant at $p < 0,05$

Table 2 shows an increase in 2 times/day-meals during distance learning by 9.5%. The average number of meals before distance learning was 2.81 ± 0.551 times, whereas during distance learning was 2.68 ± 0.551 times. There is an increase in 3 times/day-snacking by 4.2% 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 a decrease in carbohydrates sources intakes of 3-4 servings/day by 10.5% 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 and an 8.5% increase in subjects who do not eat snacks during distance learning. 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.

The 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 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 ($p=0,14$), snacks ($p=0.016$), physical activity included exercise ($p=0.035$), exercise duration ($p=0.004$) and exercise frequency ($p=0.030$) before and during distance learning with $p < 0.05$.

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 3. Distribution of Most Consumed Food and Beverages during Distance Learning

Types of Food and Beverages	n	%
Sweet food		
Do not consume	17	17,9

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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 3. presents certain types of most consumed food and beverages during distance learning.

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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 [22]. Meanwhile, school hours are set at least 24 hours a week during distance learning [23]. 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 in 2 times/day-meals during distance learning. This 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]. Eating <3 times/day has a positive relationship with increased BMI, body fat percentage, subcutaneous and visceral fat tissue, and increases the risk of overeating and unhealthy food choices [25,26]. This is in line with the study results, which showed an increase in subjects who ate >1 portion in one meal during distance learning.

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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 [27]. 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 [28,29].

There is a decrease in subjects who consumed 3-4 servings of carbohydrates sources per day during distance learning. 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 [30]. 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 [31].

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 [32]. 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 [33].

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 [34,35]. In adults with normal weight and overweight, consumption of energy-dense snacks is associated with weight gain [36]. 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 [37].

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

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and other macronutrient intakes [38]. During adolescent development, protein is needed to build new tissues and maintain existing tissues [39]. 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 [40].

Risquesdas 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%) [41]. 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 [31].

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 [42,43]. Physiologically, consuming fatty food and high-sugar drinks increases the production of serotonin and dopamine, which affect mood for the better [44]. 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 [45]. In addition, the sodium contained in processed food may cause water retention in the body, causing bloating, swelling, and weight gain [46].

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 [47]. 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 [48].

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 [12]. 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 [49]. 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 [49–51]. 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 [52].

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 [53]. 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 [54].

Consumption of home-cooked meals has a significant relationship with indicators of a healthier diet [55]. Cooking their food will allow individuals to control the ingredients used and the portion served [56]. Research shows that individuals who cook at home consume lower calories than those who cook less [57].

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 [58]. 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 [30]. 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% [30].

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 [59]. 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 [60,61]. 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 [62–64].

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 [62]. This activity is sufficient to increase energy expenditure to improve the body's metabolic health by

controlling the glycemic index [65]. Adolescents are expected to do 60 minutes/day of moderate-intensity physical activity such as aerobics or physical exercise outside of school hours [62]. 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.

LIMITATIONS

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.

The questionnaire used in this study is a questionnaire adopted from the Eating habits and lifestyle changes research during COVID-19 lockdown: an Italian survey and the Eating habits questionnaire [12,13]. After testing the validity and reliability, it is known that the questionnaire is a reliable instrument, but some questions are not valid. The questions are still used with the consideration of the researcher.

CONCLUSION

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 $p > 0.05$.

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[JGI] [ID-41387] Revised Version Acknowledgement

1 message

Jurnal Gizi Indonesia (The Indonesian Journal of Nutrition) <jgi@fk.undip.ac.id>

Mon, Feb 7, 2022 at 3:18 PM

Reply-To: Ani Margawati <animargawati@gmail.com>

To: Ani Margawati <animargawati@gmail.com>

Ani Margawati:

Thank you for submitting the revision of manuscript, "Differences in eating habits and physical activity before and during distance learning" to Jurnal Gizi Indonesia (The Indonesian Journal of Nutrition). With the online journal management system that we are using, you will be able to track its progress through the editorial process by logging in to the journal web site:

Manuscript URL: <https://ejournal.undip.ac.id/index.php/jgi/author/submission/41387>

Username: margawati

Editor: Ayu Rahadiyanti, S.Gz, MPH

If you have any questions, please contact me. Thank you for considering this journal as a venue for your work.

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3. Accepted

[JGI] Editor Decision > Inbox x**Ayu Rahadiyanti, S.Gz, MPH** <ayurahadiyanti@live.undip.ac.id>
to me ▾

Tue, Feb 8, 2022, 10:33AM

Dear,
Ani Margawati:

We have reached a decision regarding your submission to Jurnal Gizi Indonesia (The Indonesian Journal of Nutrition), "Differences in eating habits and physical activity before and during distance learning".

Our decision is to: ACCEPTED

Ayu Rahadiyanti, S.Gz, MPH
Department of Nutrition Science, Faculty of Medicine, Universitas Diponegoro
ayurahadiyanti@live.undip.ac.id
Department of Nutrition Science, Faculty of Medicine, Universitas DiponegoroJurnal Gizi Indonesia (The Indonesian Journal of Nutrition) (e-ISSN: 2338-3119)
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Tue, Feb 8, 2022, 10:40 AM

Selamat Siang,
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Bersamaan dengan email ini, kami melampirkan LoA atas nama Ani Margawati dengan judul artikel "Differences in eating habits and physical activity before and during distance learning". Mohon dapat di cek kembali, Terima kasih.

Best Regards,
Tim Redaksi JGI**Jurnal Gizi Indonesia (The Indonesian Journal of Nutrition)**Department of Nutrition Science, Faculty of Medicine, Universitas Diponegoro
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Semarang, 8 Februari 2022

No : 003/UN7.5.4.4/JGI/SK/2022
Subject : Manuscript acceptance letter

Dear Authors,

Based on the recommendations from the peer review board. I am delighted to inform you that your following manuscript has been accepted for publication in 'Jurnal Gizi Indonesia (The Indonesian Journal of Nutrition)'.
'

Title : Differences in eating habits and physical activity before and during distance learning

Authors : Ani Margawati

Submission ID: 41387

Status : **Accepted**

Thank you for your attention.

Best Regards,

Editor-in-Chief,



Ahmad Syauqy, S.Gz., M.P.H., Ph.D.

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