FRUIT AND VEGETABLE CONSUMPTION, SEDENTARY ACTIVITIES, AND NUTRITION STATUS IN SENIOR HIGH SCHOOL STUDENTS DURING COVID-19 PANDEMIC: AN OBSERVATIONAL STUDY

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ABSTRACT
Introduction: Adolescent health will impact future well-being. The COVID-19 pandemic has prompted governmental imposition of restrictions on social activities. Hence, understanding the lifestyle factors, such as sedentary activities and fruit and vegetable consumption, affecting adolescents' nutritional status during the pandemic is crucial. In Samarinda, more than 18% of adolescents have inadequate nutritional status. **Aims:** to explore the relationship between sedentary activities, fruit and vegetable consumption, and the nutritional status of adolescents. **Method:** Using an online questionnaire, a cross-sectional study was conducted on 300 high school students during the COVID-19 pandemic, between October and December 2021. Sedentary activity levels were assessed using the Adolescent Sedentary Activity Questionnaire (ASAQ), while fruit and vegetable consumption was evaluated through the FFQ-SQ (Food Frequency Questionnaire-Semi Quantitative). Nutritional status was determined using z score of body mass index (BMI) for age. Data analysis employed the Chi-square test and Fisher exact test. **Results:** Gender, maternal occupation, and average monthly parental income were found to be associated with nutritional status (p=0.020; p=0.038; p=0.045). However, no significant association was observed between fruit and vegetable consumption and nutritional status (p=0.102; p=0.121). Certain sedentary activities, such as doing assignments without using a laptop/computer (p=0.029) and reading for pleasure (p=0.038), were linked to nutritional status. Fruit and vegetable consumption showed no association with the nutritional status of adolescents. **Conclusion:** Conversely, certain sedentary activities were found to be associated with nutritional status. Educating adolescents within families and schools regarding the significance of physical activity and balanced nutrition is imperative.

Keywords: stunting, polyphenols, fruit and vegetable intakes, physical activity

INTRODUCTION

The COVID-19 pandemic has prompted the Indonesian government to enforce restrictions on social activities, including in education, to curb the spread of the virus (Indonesia Ministry of Education, Culture, 2020). The shift to home learning has brought about changes in adolescents' lifestyles during the pandemic, influencing their physical activity and sedentary behavior (Xiang, Zhang and Kuwahara, 2020). The rising prevalence of sedentary behavior impacts cognitive, social-emotional, and psychological development in adolescence, potentially affecting future health outcomes (Reilly and Kelly, 2011). Increased screen time, encompassing television, computers, smartphones, and tablets with various applications, as well as engagement with social media and the internet, is linked to heightened risk of cardiovascular diseases (Stiglic and Viner,

2019). A systematic review of 51 experimental studies further underscores the necessity of health policies and programs aimed at reducing sedentary behavior and screen time, particularly in the post-COVID-19 era (Oh et al., 2022).

The consumption of vegetables and fruits significantly impacts the nutritional status of adolescents. Adequate intake of nutrients, particularly vitamins, minerals, and polyphenols, is essential for adolescent growth and development (Yang, 2020). High polyphenol consumption has been associated with lower BMI and modulation of inflammation levels among European adolescents (Wisnuwardani et al., 2020a; 2020b). According to data from Riskesdas 2018, the majority of Indonesian adolescents aged 15-19 consume fewer than five servings of fruits or vegetables per day (Indonesia Ministry of Health, 2019).

It is commonly known that eating a poor diet increases the risk of non-communicable diseases (NCDs). Therefore, encouraging healthy lifestyles and monitoring behavioral risk factors in all age groups, especially adolescents, is a top concern for public health. In order to achieve this, the WHO has developed guidelines for teenagers on the minimum amounts of physical activity and fruit and vegetable consumption (World Health Organization, 2010). ~~Even so,~~ Recent data show that teenagers consume considerably less fruits and vegetables than the suggested five servings each day. In seven African nations (Botswana, Kenya, Senegal, Swaziland, Tanzania, Uganda, and Zambia), for instance, a study conducted by Peltzer and Pengpid (2010) discovered that the majority of teenagers (77.5%) did not consume the required daily intake of fruits and vegetables.

Samarinda is the capital city of East Kalimantan and is one of the driving forces behind the development of the Nusantara Capital City (IKN), East Kalimantan. Previous study found that the university students in Samarinda had lower physical activity during the pandemic of COVID-19 (Wisnuwardani, 2022). In contrast, an increasing vegetable consumption was found in Indonesian students (Mardiyah et al., 2022). SMAN 1 Samarinda as one of senior high schools in Samarinda had 69% overweight or obese students (Setiadi, 2015). Preliminary studies conducted by researchers in early March 2021 at SMAN 1 Samarinda, utilizing an online questionnaire with 28 respondents, indicated that 35.7% of students had below-normal nutritional statuses, 53.58% had normal nutritional statuses, and 10.7% had above-normal nutritional statuses. Vegetable consumption was notably low, with only 28.6% of students consuming vegetables once a day and another 28.6% consuming vegetables 2-3 times per week. Similarly, for fruit consumption, 32.1% consumed fruit 2-3 times per week, and 28.1% consumed fruit 4-6 times per week. Riskesdas 2018 data revealed that 11.59% of Samarinda City's population aged ≥ 5 years did not consume fruits or vegetables on any given day within a week (Indonesia Ministry of Health, 2019).

Consumption of nutritionally balanced foods is imperative for school students. SMAN 1 Samarinda, situated in Samarinda City, is recognized as a leading educational institution (Setiadi, 2015). Given this context, the researcher seeks to investigate the potential correlation between vegetable and fruit consumption, sedentary activity, and the nutritional status of students at SMAN 1 Samarinda amidst the COVID-19 pandemic. This study endeavors to elucidate the relationship between vegetable and fruit consumption, sedentary activity, and the nutritional status of SMAN 1 Samarinda students during the COVID-19 pandemic.

METHODS
Study Population

This cross-sectional study involved adolescents from SMAN 1 Samarinda and was conducted between August and October 2021. Data collection utilized

Google Forms links and questionnaire sheets distributed to respondents via WhatsApp groups for classes X, XI, and XII. The total population comprised 1076 students from class X (MIPA and IPS), class XI (MIPA), and class XII (MIPA). A sample size of 311 respondents was selected proportionally across each grade level using probability sampling techniques, specifically proportionate stratified random sampling.

Inclusion criteria for sample selection included active enrollment at SMAN 1 Samarinda, ages 15-18 years, willingness to participate in the study, and accessibility via telephone or social media. Exclusion criteria encompassed students who were unwell during the study period and those who did not complete all variables of the research questionnaire. Ethical approval for the research was obtained under letter No. 130/KEPK-FK/XII/2021 from the Health Research Ethics Commission of the Faculty of Medicine, Mulawarman University. The method includes a description of the population, the study location and timing, the sample size differences, and the sampling technique. Research variables, data collection, data analysis, and, if possible, the ethics test and ethics test number are attached.

The Consumption of Vegetable and Fruit

Vegetable and fruit consumption refers to all types of vegetables and fruits consumed by respondents within the past month. The Vegetable and Fruit Questionnaire utilized the FFQ-SQ (Food Frequency Questionnaire-Semi Quantitative) and was administered online. Objective criteria categorized consumption levels as follows: low (never or ≤3 times per month), medium (1-6 times per week), and high (daily consumption or ≥1 time per day) (Augusto, Cobayashi and Augusto, 2014).

Sedentary Activity

Sedentary activity encompasses the respondent's weekly lifestyle, primarily involving sitting or lying down (e.g., computer use, reading, TV watching, laptop-based assignments, gaming, and other similar activities), excluding sleep. The questionnaire employed for assessment is based on the Adolescent Sedentary Activity Questionnaire (ASAQ) and was administered online. Criteria for classification included low (sedentary behavior exceeding 2 hours per day), moderate (sedentary behavior spanning 2-5 hours per day), and high (sedentary behavior surpassing 5 hours per day) (Young et al., 2014).

Nutrition Status

Nutrition status of adolescents was determined using WHO z-score for body mass index for age (BMI for age). The BMI was calculated based on the respondents' self-reported weight and height. The classifications used were: normal (BMI for age z-score of $< +1SD$ to $< -2SD$), overweight (BMI for age z-score of $> +1SD$), obesity (BMI for age z-score of $> +2SD$), thinness (BMI for age z-score of $< -2SD$), and severe thinness (BMI for age z-score of $< -3SD$) (Prabhu et al., 2020).

Data Analysis

Data analysis involved univariate analysis, which included frequency distribution of respondent characteristics, sedentary activities, vegetable and fruit consumption, and nutritional status. The relationship between sedentary activities, vegetable and fruit consumption, and adolescent nutritional status was determined using the Chi-square and Fisher statistical tests, with a significance level set at 95%.

RESULT
Characteristics of Respondents

The majority of respondents were 17 years old, female, the mother's last

education was college, the father's occupation was private while the mother did not work and high economic social. Good nutritional status was most prevalent among female students and mothers who did not work (Table 1).

Table 1 presents differences in nutritional status according to gender, maternal occupation, and monthly income. It indicates that a higher proportion of girls exhibit good nutritional status compared to boys, while boys tend to have higher rates of overweight. From the table, it shows that the sexes variable as a significant relationship with the nutritional status (p value=0.020). Mothers who are not employed tend to have more children with good nutritional status, whereas those employed in government positions tend to have more overweight children. Families with incomes surpassing the provincial average tend to have more cases of both over and undernourished children. Conversely, families earning below the provincial minimum wage tend to have more children with good nutritional status.

There were no variations in nutritional status based on child age, maternal education, or paternal occupation. However, a significant number of children with normal nutritional status were observed among mothers with at least a secondary school education or higher. Similarly, well-nourished children were also noted among fathers who were employed in the private sector.

Sedentary Activity, Vegetable and Fruit Consumption, and Nutrition Status

There was no discernible correlation between fruit and vegetable consumption, sedentary behavior, and nutritional status. The majority of respondents reported consuming vegetables (58.7%) and fruits (63.0%) infrequently, falling into the low category, which includes never, once per month, or 2-3 times per month (Fig. 1&2).

Likewise, in terms of sedentary activity, the majority (97.7%) engage in high sedentary activity (Fig.3). Although there was no significant difference, respondents with high vegetable consumption most exhibited good nutritional status (53.8%). A similar pattern was observed with high sedentary activity, where the majority of respondents demonstrated good nutritional status (66.9%) (Table 2).

## Sedentary Activity Type and Nutritional Status

The relationship between Types of Sedentary Activities and Nutritional Status of Students of SMAN 1 Samarinda during the COVID-19 pandemic is shown in Table 3. In the sedentary activity variable, small screen recreation (SSR), which includes watching TV, films/DVDs, and computer use for gaming, no significant relationship was observed with the students' nutritional status.

Table 1. Relationship of demographic characteristics with student nutrition status

Variable	Nutrition Status n(%)				n (%)	P-values
	Thinness	**Good**	**Overweight**	**Obesity**		
Age (years)						0.585
15	4 (8.3)	36 (75)	2 (4.2)	6 (12.5)	45 (100)	
16	18 (20.2)	53 (59.3)	15 (16.9)	3 (3.4)	89 (100)	
17	8 (6.9)	82 (70.7)	15 (12.9)	11 (9.5)	116 (100)	
18	8 (17)	30 (63.8)	6 (12.8)	3 (6.4)	47 (100)	
Sexes						**0.020**
Girls	20 (11.4)	127 (72.2)	22 (12.5)	7 (4)	176 (100)	
Boys	18 (14.5)	74 (59.7)	16 (12.9)	16 (12.9)	124 (100)	

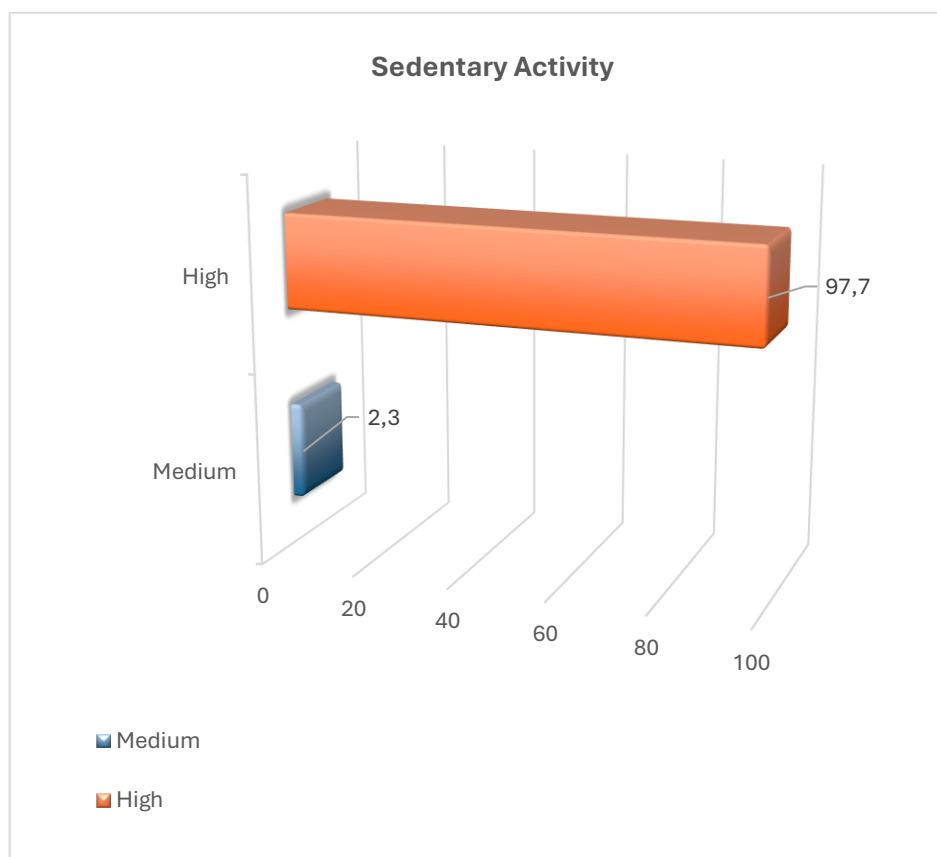| Variable	Nutrition Status n(%)				n (%)	P-values
	Thinness	**Good**	**Overweight**	**Obesity**		
Maternal education						0.299
Elementary school	3 (23.1)	8 (61.5)	2 (15.4)	0	13 (100)	
Junior high school	0	12 (92.3)	1 (7.7)	0	13 (100)	
Senior high school	20 (16.4)	82 (67.2)	13 (10.7)	7 (5.7)	122 (100)	
University	15 (9.9)	99 (65.1)	22 (14.5)	16 (10.5)	152 (100)	
Father's occupation						0.059
Civil servant	8 (11.8)	42 (61.8)	12 (17.6)	6 (8.8)	68 (100)	
Private employee	9 (8.7)	79 (76)	10 (9.6)	6 (5.8)	104 (100)	
Self-employed	10 (13.5)	52 (70.3)	7 (9.5)	5 (6.8)	31 (100)	
Military/ Police	2 (22.2)	2 (22.2)	3 (33.3)	2 (22.2)	9 (100)	
Labor	3 (42.9)	3 (42.9)	1 (14.3)	0	7 (100)	
Unemployed	4 (19)	11 (52.4)	2 (9.5)	4 (19)	21 (100)	
Others	2 (11.8)	12 (70.6)	3 (17.6)	0	17 (100)	
Mother's occupation						**0.038**
Civil servant	5 (9.1)	29 (52.7)	12 (23.6)	8 (14.5)	55 (100)	
Private employee	6 (17.1)	23 (65.7)	3 (8.6)	3 (8.6)	35 (100)	
Self-employed	2 (12.5)	8 (50)	4 (25)	2 (12.5)	16 (100)	
Unemployed	25 (13.5)	133 (71.9)	18 (9.7)	9 (4.9)	185 (100)	
Others	0	8 (88.9)	0	1 (11.1)	17 (100)	
Average monthly income*						0.050
< UMP	15 (17.9)	59 (70.2)	8 (9.5)	2 (2.4)	84 (100)	
≥ UMP	23 (60.5)	142 (65.7)	30 (13.9)	21 (9.7)	216 (100)	

Data are presented as number of participants and percentage. Bold: statistical significance when p<0.05. Spearmen test was used for nutrition status and age, and $X2$ test for other variables.*UMP: provincial minimum wage (Rp 3.200.000,00)
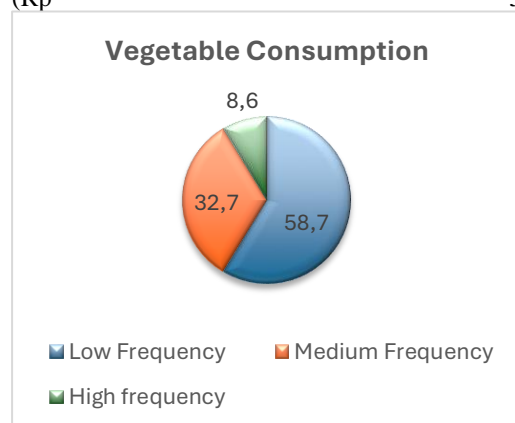
Figure 1. Proportion of Vegetable Consumption among Adolescents
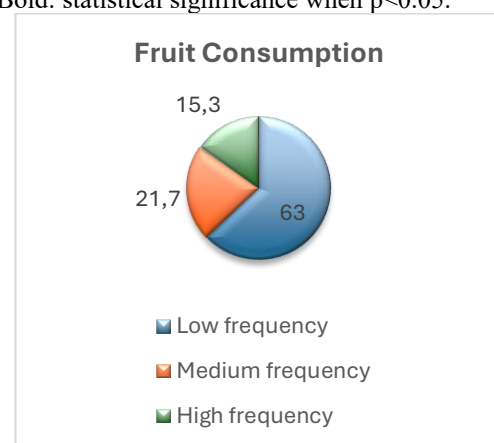
Figure 2. Proportion of Fruit Consumption among Adolescents

Figure 3. Proportion of Sedentary Activity among Adolescents

Table 2. The association between vegetable and fruit consumption, sedentary activity with nutritional status

| Variable | Nutrition Status n(%) | | | | n (%) | P-values* |
	Thinness	Good	Overweight	Obesity		
Vegetable consumption						0.102
Low	24 (13.6)	117 (66.5)	17 (9.7)	18 (10.2)	176 (100)	

Variable	Nutrition Status n(%)				n (%)	P-values*
	Thinness	Good	Overweight	Obesity		
Medium	9 (9.2)	70 (71.4)	15 (15.3)	4 (4.1)	98 (100)	
High	5 (19.2)	14 (53.8)	6 (23.1)	1 (3.8)	26 (100)	
Fruit consumption						0.121
Low	22 (11.6)	129 (68.3)	23 (12.2)	15 (7.9)	189 (100)	
Medium	8 (12.3)	47 (72.3)	4 (6.2)	6 (9.2)	65 (100)	
High	8 (17.4)	25 (54.3)	11 (23.9)	2 (4.3)	46 (100)	
Sedentary activity						0.299
Medium	1 (14.3)	5 (71.4)	0	1 (14.3)	7 (100)	
High	37 (12.6)	196 (66.9)	38 (13)	22 (7.5)	293 (100)	

Low: never or 1 time/month or 2-3 times/month

Medium: 1 time/week or 2-3 times/week or 4-6 times/week.

High: 1 time/day or 2-3 times/day or 3 times/day

* Relationship between fruit and vegetable consumption, sedentary activity and nutritional status were performed by Chi-square test.

Table 3. The association between type of sedentary activity and nutritional status of students

Variable	Nutrition Status n(%)				n (%)	P-Values*
	Underweight	Good	Overweight	Obesity		
Watching TV						0.817
High	16 (14.2)	76 (75)	12 (14.2)	8 (8.6)	112 (100)	
Low	22 (11.7)	125 (66.5)	26 (13.8)	15 (14.4)	188 (100)	
Watching movies						0.187
High	16 (12.3)	85 (65.4)	22 (16.9)	7 (5.4)	130 (100)	
Low	22 (12.9)	116 (68.2)	16 (9.4)	16 (9.4)	170 (100)	
Playing computer						0.503
High	19 (15.2)	78 (80.4)	13 (15.2)	10 (9.2)	120 (100)	
Low	19 (10.6)	123 (68.3)	25 (13.9)	13 (7.2)	180 (100)	
Working on assignments using a computer/laptop						0.738
High	16 (12.3)	84 (64.6)	18 (16.5)	12 (9.2)	130 (100)	
Low	22 (12.9)	117 (68.8)	20 (11.8)	11 (6.5)	170 (100)	
Working on assignments without using a computer/laptop						**0.029**
High	13 (10.4)	95 (76)	9 (7.2)	8 (6.4)	125 (100)	
Low	25 (14.3)	106 (60.6)	29 (16.6)	15 (8.6)	175 (100)	
Reading for pleasure						**0.017**
High	16 (13.7)	78 (66.7)	20 (17.1)	3 (2.6)	117 (100)	
Low	22 (12.0)	123 (67.2)	18 (9.8)	20 (10.9)	183 (100)	
Tutoring courses						0.526
High	9 (9.3)	68 (70.1)	14 (14.4)	6 (6.2)	97 (100)	
Low	29 (14.3)	133 (65.5)	24 (11.8)	17 (8.4)	203 (100)	
Driving						0.281
High	17 (156)	66 (60.6)	15 (13.8)	11 (10.1)	109 (100)	

Variable	Nutrition Status n(%)				n (%)	P-Values*
	Underweight	**Good**	**Overweight**	**Obesity**		
Low	21 (11)	135 (70.7)	23 (12)	12 (6.3)	191 (100)	
Doing hobbies						0.593
High	13 (13)	67 (67)	10 (10)	10 (10)	100 (100)	
Sitting and relaxing by playing mobile phones/tables/gadgets						0.270
High	10 (8.6)	80 (69)	18 (15.5)	8 (8.9)	116 (100)	
Low	28 (15.2)	121 (65.8)	20 (10.9)	15 (8.2)	184 (100)	
Playing/practicing musical instruments						0.936
High	8 (10.8)	52 (70.3)	9 (12.2)	5 (6.8)	74 (100)	
Low	30 (13.3)	149 (65.9)	29 (12.8)	18 (8)	226 (100)	
SUM	38 (12.7)	201 (67)	38 (12.7)	23 (7.7)	300 (100)	

Low: ≤ 120 minutes/day. High: > 120 minutes/day.
*Chi-square test or Fisher test was used in this analysis, with significant value < 0.05.

DISCUSSION

This study revealed that female adolescents constituted the majority of respondents and had an obese and overweight prevalence of around 16.5%. Notably, adolescent girls were found to have twice the amount of body fat compared to boys (Oktaviani, 2012). Furthermore, the study identified that male adolescents exhibited the highest prevalence of obesity, reaching 12.9%. Data from the Non-Communicable Disease Risk Collaboration (2018) supports this observation, indicating a higher prevalence of obesity among adolescent boys compared to girls (Maehara et al., 2019). Additionally, it is noted that adolescent boys have higher calorie requirements than girls (Maehara et al., 2019). This difference in calorie needs may contribute to higher energy, protein, carbohydrate, and fat consumption among boys, thereby increasing the likelihood of overweight status (Marshall et al., 2004). Unlike obese women, obese men may be less inclined to pursue weight loss, as they may not experience the same level of body image insecurity. It also demonstrated that over half of adolescents consumed low vegetables and fruits (never or 1 time/month or 2-3 times/month), about 58.7% and 63%, respectively. Nevertheless, it is noticeable that 19.9% of over nutrition adolescents and 13.6% of thinness adolescents consume vegetable infrequently, while fruit consumption showed similar findings. These findings are similar to those observed in the Netherlands, where girls were found to consume more fruits and vegetables compared to boys (Ridder et al., 2018).

The findings of this study align with research conducted by Salsabila (2020), indicating no significant relationship between vegetable consumption and fruit consumption with adolescent nutritional status. Similarly, (Łuszczki et al., 2019) there was no significant correlation between fruit and vegetable consumption and the nutritional quality of children in the school canteen. Moreover, research conducted by Noerfitri, Putri AND Febriati, 2020) yielded similar results, demonstrating no relationship between vegetable consumption and fruit consumption with nutritional status in university students.

Whilst there is no direct correlation between the intake of vegetables and fruits and nutritional status, there is a notable trend indicating that teenagers who ingested vegetables and fruits often (once a day, 2-3 times a day, or 3 times a day) tended to have good nutritional status. Aside from the consumption of vegetables and fruits, the nutritional status of adolescents can be influenced by other variables, such as inadequate intake of whole grains and excessive consumption of sugary meals and beverages, fats, refined grains, and processed foods (Heslin, 2023). However, this study did not investigate the dietary factors associated with these specific meals.

Other significant variables include environmental and social influences (Heslin, 2023). The environment might take the form of parental support, particularly from mother. As seen in this study, there is an association between mother's occupation and adolescent nutritional status, with unemployed mothers having a higher likelihood of having children with good nutritional status, whereas mothers working in government positions have a higher likelihood of having overweight children.

Similar results were seen in another study in Saudi Arabia which showed a significant relationship between mother's occupation and adolescents nutritional status (Fatima, 2020). This can be attributed to the number of hours the mother spends while working which may affect her child's food intake (Mori et al., 2021). In the sedentary behavior category known as small screen recreation (SSR), encompassing activities such as television viewing, watching films or DVDs, and

engaging in computer gaming, no notable correlation was found concerning the nutritional status of the students.

These findings align with research conducted by Smetanina et al. (2015), indicating that the duration spent in front of a computer or TV does not correlate with overweight or obesity. It suggests that the use of TV or computers cannot reliably indicate the physical activity levels of overweight or obese children, who may engage in passive hobbies like music or art, contrary to those with normal or lower weight, who may have more active hobbies like basketball, football, or athletics (Smetanina et al., 2015).

A study of Australian adolescents found that overall screen time (≥2 h/d) and sitting time (h/d) were inversely related to daily fruit and vegetable intake. Participants who spent ≥2 hours per day on screens were 47% and 34% less likely to consume ≥2 servings of fruit and ≥3 servings of vegetables, respectively, compared to those who spent <2 hours per day on screens (Fletcher et al., 2018). A longitudinal study in the United States also found that increases in screen time were associated with higher consumption of low nutritional quality meals and beverages and decreased consumption of fruits and vegetables (Falbe et al., 2014).

Additionally, research by Biddle et al. (2010) suggests a positive albeit weak relationship between screen time and increased fat levels in young individuals. However, it's worth noting that screen time, including TV viewing and computer use, among children and adolescents with normal BMI, is generally associated with being active, healthy, and free from non-communicable diseases commonly observed in adults (Biddle et al., 2010).

This study is one of the few that looks at the relationships between various sedentary behaviors and fruit and vegetable consumption in adolescent, a group that is both at high risk of leading unhealthy lifestyles and should be encouraged to lead healthy lives. The findings support the government's suggestions to increase the physical activity and consumption of fruit and vegetables (Indonesian Ministry of Health, 2014). This finding raises the possibility that diet-related therapies aimed at reducing sedentary behavior may also have a beneficial impact on diet. This potential of examining recreational screen time and total sedentary time can be made possible by ensuring that assessments of such programs incorporate measures of nutritional intake.

In line with this, it is essential to group target populations based on their physical activity levels, sedentary behaviors, and snack, fruit, and vegetable consumption habits, as was done in the Netherlands in school-based programs (Gubbels et al., 2012; Krijger et al., 2023). By segmenting the target group in this way, health promotion programs aimed at encouraging healthy lifestyle can be more precisely tailored and effective. This approach allows for the identification of specific behavioral patterns and enables the implementation of more targeted interventions to improve the overall health and well-being of adolescents.

The limitation in this research was that it was only conducted in one school in Samarinda but with a fairly large sample with probability sampling. Besides, related to the conditions of the COVID-19 pandemic, the nutritional status of respondents is only measured based on self-reported measurements of respondents' height and weight independently without being accompanied by researchers. Future research should be conducted on a broader scope of high schools to gain comprehensive understanding of the factors that may contribute to adolescents' malnutrition during and after the pandemic.

CONCLUSIONS

Gender, maternal occupation , and average monthly income were significantly

associated with adolescent nutritional status. However, there was no significant association observed between vegetable and fruit consumption and nutritional status during the COVID-19 pandemic. Notably, significant relationships were detected in sedentary activities such as performing tasks without using a computer/laptop and engaging in reading for pleasure with nutritional status. Based on the results above, the school may build a collaboration with the Community Health Center to provide education and other health promotion strategies related to increasing vegetable and fruit consumption and preventing sedentary activities in students.

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REFERENCES

Augusto, R.A., Cobayashi, F. and Augusto, M. (2014). Associations between low consumption of fruits and vegetables and nutritional deficiencies in Brazilian schoolchildren. *Public Health Nutrition,* 18(5), pp.927–935. https://doi.org/10.1017/S13689800 14001244

Biddle, S.J.H., Pearson, N., Ross, G.M. and Braithwaite, R. (2010). Tracking of sedentary behaviours of young people: A systematic review. *Preventive Medicine*, [online] 51(5), pp.345–351. https://doi.org/10.1016/j.ypmed.20 10.07.018

Falbe, J., Willett, W.C., Rosner, B., Gortmaker, S.L., Sonneville, K.R. and Field, A.E. (2014). Longitudinal relations of television , electronic games , and digital versatile discs with changes in diet in adolescents. *The American Journal of Clinical Nutrition*, 100(4), 1173–1181. https://doi.org/10.3945/ajcn.114.08 8500

Fatima, W. (2020). Assessment of Nutritional Status and its Related Factors among Female Adolescent Girls : A School based Study in Arar city , Kingdom of Saudi Arabia Assessment of Nutritional Status and its Related Factors among Female Adolescent Girls : A School based Study in Arar city, Kingdom of Saudi Arabia. *International Journal of Medical Research & Health Sciences*, 8(2).pp. 133-144.

Fletcher, E.A., Mcnaughton, S.A., Crawford, D., Cleland, V., Gatta, D., Hatt, J., Dollman, J. and Timperio, A. (2018). Associations between sedentary behaviours and dietary intakes among adolescents. *Public Health Nutrition*, 21(6), pp.1115–1122. https://doi.org/10.1017/S13689800 1700372X

Gubbels, J.S., Kremers, S.P., Goldbohm, R.A., Stafleu, A. and Thijs, C. (2012). Energy Balance-Related Behavioural Patterns In 5-Year-Old Children And The Longitudinal Association With Weight Status Development In Early Childhood. *Public Health and Nutrition,* 15**,** pp.1402-1410. https://doi.org/10.1017/S13689800 11003089

Heslin, A.M. (2023). Impact of nutrition science on human health : Past perspective and future directions '. In: *Postgraduate Symposium Proceedings of the Nutrition Society Adolescent nutrition and health : characteristics , risk factors and opportunities of an overlooked life stage Proceedings of the Nutrition Society*.

https://doi.org/10.1017/S00296651
23002689

Indonesia Ministry of Education, Culture, Research andTechnology. (2020). *Pedoman Penyelenggaraan Belajar Dari Rumah Dalam Masa Penyebaran Corona Virus Disease (Covid-19).*

Indonesian Ministry of Health. (2014). *Balanced Nutrition Guidelines*. Ministry of Health of Republic iIdonesia.

Indonesia Ministry of Health. (2019). *Laporan Nasional RISKESDAS 2018. Lembaga Penerbit Balitbangkes*.

Krijger, A., Steenbergen, E., Schiphof-Godart, L., Van Rossum, C., Verkaik-Kloosterman, J., Elstgeest, L., Ter Borg, S., Raat, H. and Joosten, K. (2023). Clusters Of Lifestyle Behaviours And Their Associations With Socio-Demographic Characteristics In Dutch Toddlers. *European Journal of Nutrition,* 62**,** pp. 1143-1151. https://doi.org/10.1007/s00394-022-03056-x

Łuszczki, E., Sobek, G., Bartosiewicz, A., Baran, J., Weres, A., Dereń, K. and Mazur, A. (2019). Analysis of Fruit and Vegetable Consumption by Children in School Canteens Depending on Selected Sociodemographic Factors. *Medicina (Kaunas, Lithuania)*, 55(7), p. 397. https://doi.org/10.3390/medicina55070397

Maehara, M., Rah, J.H., Roshita, A., Suryantan, J., Rachmadewi, A. and Izwardy, D. (2019). Patterns and risk factors of double burden of malnutrition among adolescent girls and boys in Indonesia. *PLoS ONE*, 14(8), pp.15–18. https://doi.org/10.1371/journal.pone.0221273

Mardiyah, S. D., P., Wicaksono, D. S., L. and Fransiska. (2022). Dampak

Pandemi COVID-19 terhadap Perubahan Perilaku Makan Mahasiswa di Indonesia. *Amerta Nutrition,* 6, pp**.** 298-305. https://doi.org/10.20473/amnt.v6i3.2022.298-305

Marshall, S.J., Biddle, S.J.H., Gorely, T., Cameron, N. and Murdey, I. (2004). Relationships between media use, body fatness and physical activity in children and youth: a meta-analysis. *International Journal of Obesity and Related Metabolic Disorders,*28(10), pp.1238–1246. https://doi.org/10.1038/sj.ijo.0802706

Mori, S., Asakura, K., Sasaki, S. and Nishiwaki, Y. (2021). Relationship between maternal employment status and children ' s food intake in Japan. *Environmental Health and Preventive Medicine*, [online] pp.1–10. https://doi.org/10.1186/s12199-021-01026-z

Noerfitri, Putri, T.W. and Febriati, R.U.(2020). Hubungan antara Kebiasaan Melewatkan Sarapan , Konsumsi Sayur Buah dan Fast Food , Aktivitas Fisik, Aktivitas Sedentary dengan Kejadian Gizi Lebih (Relationship Between the Habits of Skipped Breakfast, Consumption of Vegetables Fruits and Fast Food). *Jurnal Ilmiah Kesehatan Masyaraka 13*(2),56–63. https://doi.org/10.52022/jikm.v13i2.205

Oh, C., Carducci, B., Vaivada, T. and Bhutta, Z.A. (2022). Interventions to Promote Physical Activity and Healthy Digital Media Use in Children and Adolescents : A Systematic Review. *Pediatrics*, 149(Suppl 5). https://doi.org/10.1542/peds.2021-053852I

Oktaviani, W.D. (2012). Hubungan

Kebiasaan Konsumsi Fast Food, Aktivitas Fisik, Pola Konsumsi, Karakteristik Remaja Dan Orang Tua Dengan Indeks Massa Tubuh (Imt) (Studi Kasus Pada Siswa Sma Negeri 9 Semarang Tahun 2012). *Jurnal Kesehatan Masyarakat Universitas Diponegoro,* 1(2).

Prabhu, S. A., Shukla, N. K. and Mandala, S. R. (2020). Assessment of Nutritional Status of Rural Children (0-18 years) in Central India Using World Health Organization (WHO) Child Growth Standards 2007. *Indian Journal of Community Medicine,* 45**,** pp.323-327. https://doi.org/10.4103/ijcm.IJCM_348_19

Peltzer, K. and Pengpid, S. (2010). Fruits and vegetables consumption and associated factors among in-school adolescents in seven African countries. *International Journal of Public Health*, 55(6), pp. 669–678. https://doi.org/10.1007/s00038-010-0194-8

Reilly, J.J. and Kelly, J. (2011). Long-term impact of overweight and obesity in childhood and adolescence on morbidity and premature mortality in adulthood: systematic review. *International Journal of Obesity*, [online] 35(7), pp.891–898. https://doi.org/10.1038/ijo.2010.22 2

Ridder, M.A.M., Koning, M., Visscher, T.L.S., Hirasing, R.A., Seidell, J.C. and Renders, C.M. (2018). Energy Balance-Related Behavior And Anthropometric Measures Among Adolescents Across Three Educational Levels: A Cross-Sectional Study In Dutch Schools. *Health Education and Behavior,* 45**,** 349-358. https://doi.org/10.1177/109019811 7715666

Salsabila, L. (2020). *Hubungan Pengetahuan, Pola Makan Dan Kebiasaan Konsumsi Sayur Dan Buah Dengan Status Gizi Pada Remaja Usia 15-18 Tahun Di Kelurahan Duren Mekar, Depok*. Universitas Pembangunan Nasional Veteran Jakarta.

Setiadi, K. (2015). *Hubungan Antara Usia Dan Indeks Massa Tubuh Dengan Kadar Asam Urat Pada Remaja Di Sma Negeri 1*. Sekolah Tinggi Ilmu Kesehatan Muhammadiyah. Sarjana's Thesis.

Smetanina, N., Albaviciute, E., Babinska, V., Karinauskiene, L. and Albertsson-wikland, K. (2015). Prevalence of overweight / obesity in relation to dietary habits and lifestyle among 7 – 17 years old children and adolescents in Lithuania. *BMC Public Health*, 15, pp.1–9. https://doi.org/10.1186/s12889-015-2340-y

Stiglic, N. and Viner, R.M. (2019). Effects of screentime on the health and well-being of children and adolescents : a systematic review of reviews. *BMJ Open,* 99(1). https://doi.org/10.1136/bmjopen-2018-023191

Wisnuwardani, R.W., Henauw, S. De, Ferrari, M., Forsner, M., Gottrand, F., Huybrechts, I., Kafatos, A.G., Kersting, M., Knaze, V., Manios, Y., Marcos, A., Molnár, D., Rothwell, J.A., Rupérez, A.I., Scalbert, A., Widhalm, K., Moreno, L.A. and Michels, N. (2020a). Total Polyphenol Intake Is Inversely Associated with a Pro / Anti-Inflammatory Biomarker Ratio in European Adolescents of the HELENA Study. *Journal of Nutrition*, [online] 150(6), pp.1610–1618. https://doi.org/10.1093/jn/nxaa064

Wisnuwardani, R.W., Henauw, S. De, Forsner, M. and Gottrand, F.(2020b). Polyphenol intake and metabolic syndrome risk in

European adolescents : the HELENA study. *European Journal of Nutrition,* 59(2), pp.801–812. https://doi.org/10.1007/s00394-019-01946-1

Wisnuwardani, R. W. N., R. Saputri, A. and Kurniawati, E. R. (2022). Perubahan Aktivitas Fisik dan Konsumsi Makanan Ultra Proses Pada Mahasiswa Selama Pandemi COVID-19: Penelitian Observasional *Media Gizi Indonesia (National Nutrition Journal),* 17**,** pp.293-301. https://doi.org/10.20473/mgi.v17i3.293-301

World Health Organization (2010). *Global status report on noncommunicable diseases*.

Xiang, M., Zhang, Z. and Kuwahara, K. (2020). Impact of COVID-19 pandemic on children and adolescents' lifestyle behavior larger than expected. Progress in Cardiovascular Diseases. *Progress in Cardiovascular Diseases*, [online] 63(4), pp.531–532. https://doi.org/10.1016/j.pcad.2020.04.013

Yang, N. and Kim, K. (2020). Is the Perceived Fruit Accessibility Related to Fruit Intakes and Prevalence of Overweight in Disadvantaged Youth: A Cross-Sectional Study. *Nutrients,* 12(11), p.3324. https://doi.org/10.3390/nu12113324

Young, D.R., Reynolds, K., Sidell, M., Brar, S., Ghai, N.R., Sternfeld, B.,Jacobsen, S.J., Slezak, J.M., Caan, B. and Quinn, V.P. (2014). Effects of Physical Activity and Sedentary Time on the Risk of Heart Failure. *Circulation. Heart Failure*, 7(1), pp.21–27. https://doi.org/10.1161/CIRCHEARTFAILURE.113.000529