



# Relationship Between Diet and Physical Activity with the Nutritional Status of Adolescents During the Covid 19 Pandemic at the Laboratory High School, State University of Malang

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**Abstract.** During COVID-19 pandemic era, the diets and physical activities of adolescents tended to change. The changes of the diets and physical activities were due to limited activities during the COVID-19 pandemic. The purpose of this study was to determine the relationship between diet and physical activities with adolescents' nutritional status in COVID-19 pandemic era. This study was conducted at the Laboratory High School, State University of Malang. This study was a analytical correlational study with a cross sectional design approach. The samples of this study were 171 students. The sampling technique was a purposive sampling. The measurement of the diets used the Food Frequency Questionnaire (FFQ) to determine the kind of food that was often consumed by respondents and 24-h Food Recall was carried out to represent weekday and weekend food intake. The measurement of the physical activities used International Physical Activity Questionnaire (IPAQ) short version. The measurement of adolescents' nutritional status used IMT/U and percent fat. The results of Spearman's Rho  $p$ -value = 0,000, that there is a significant correlation between diet (energy, carbohydrates, protein, fat) intake and physical activities with adolescents nutritional status (IMT/U and percent fat) during the COVID-19 pandemic at the Laboratory High School, State University of Malang.

**Keywords:** Dietary Habits · Physical Activity · Nutritional Status

## 1 Introduction

The COVID-19 pandemic has been going on for more than 2 years, starting from the date of its stipulation by WHO on March 12, 2020. Since then, COVID-19 cases have continued to increase in Indonesia [1]. This increase in Covid-19 cases has an impact on the physical activity of adolescents, which tends to decrease compared to before the pandemic [2]. In addition to physical activity, the COVID-19 pandemic also has an impact on changes in adolescent diets. This change occurs because of the need to maintain the body's immune system, protect oneself (self-protection), ban snacks outside the home, consumption of self-cooked food, and decreased appetite due to stress [3].

Adolescent diet can have an influence on the amount of nutritional content needed in an effort to support growth and development. Food consumed in balanced amounts will also provide adequate and good nutrition for the body [4]. Several factors that are stated to have an influence on a person's food selection process include knowledge, socio-cultural, and psychological factors [5]. Adolescents' diets tend to be influenced by friends and the environment when making decisions. This relates to the habit of hanging out, gathering, together at mealtimes [6]. The diet that was created was not intended to fulfill nutrition but as a form of socialization so as not to lose status. Adolescents do that as an effort to stay social and interact with friends their age without thinking about nutritional needs and the impact on their bodies [7].

In addition to diet, physical activity can also affect nutritional status. One of the benefits of physical activity is to maintain body weight in an ideal condition. Physical activity can make the body's metabolism increase and produce energy that comes from fat as an energy reserve which can then be burned as calories [8]. Lack of physical activity can cause an increase in the amount of fat that accumulates in the body. The lower the intensity of physical activity, the more likely it is to have more nutritional status (overweight) [9].

Nutritional status is a description of a person's physical condition based on his daily nutritional intake [10]. Nutritional status can be expressed in normal nutritional status, thin, and fat. Normal nutritional status when nutrient intake is balanced with energy expenditure [11]. Undernutrition and malnutrition are found when the body experiences a deficit of nutrients such as protein, carbohydrates, fats, and vitamins or a person's nutrition is below average [12]. Meanwhile, according to Sugiatmi and Handayani (2018), overnutrition status is the accumulation of excess body fat, which can cause various types of non-communicable diseases. More nutritional status can occur in many different groups, especially in adolescents [13]. Some of the factors that contribute to obesity include food intake and physical activity. Excessive food intake in adolescents can lead to overweight or obesity. Excess fat intake is often found in people who are obese than those who are not. The level of physical activity of adolescents who are obese is lower than that of non-obese adolescents. Adolescents who lead a sedentary lifestyle and do not have a high-fat diet and balanced physical activity are more likely to be obese [14].

Undernutrition and overnutrition are nutritional problems of adolescence that are common in Indonesia. The prevalence of nutritional problems for adolescents aged 16–18 years in Indonesia according to Riskesdas 2018 data shows that there are 1.4% very thin, 6.7% thin, 9.5% fat and 4.0% obese [15]. Meanwhile, in East Java Province, the nutritional status was very thin 1.12%, skinny 6.81%, very fat 11.32%, and obesity 5.06%. The prevalence of adolescent nutritional status both less and more in East Java Province has a percentage that exceeds the national prevalence. Meanwhile the prevalence of nutritional problems in Malang City is 0.72% experiencing very thin nutritional status, 9.09% thin, 13.56% overweight, and 4.44% obese [15]. This shows that the prevalence of underweight and obesity exceeds East Java Province.

Based on the results of a preliminary study conducted at the Laboratory High School, State University of Malang on adolescents aged 16–18 years, it was also found that there were nutritional problems. The selection of the category of adolescents aged 16–18 years is a period of very rapid growth and tends to have a diet that is not intended to fulfill

nutrition, but as a form of socialization so as not to lose status [7]. Respondents of the preliminary study were 60 students whose nutritional status was then measured, showing that 71.7% of students had normal nutritional status, 10% were overweight and 18.3% were obese. According to WHO (World Health Organization) the threshold value for malnutrition is 10% [16]. While the threshold value for overnutrition is based on WHO (2000) so that it is called a minimum problem of 10% and obesity is 5% [17]. This can be interpreted that the prevalence of overweight and obesity status exceeds the threshold set by WHO. Overnutrition problems including overweight and obesity in adolescents are global health problem and can affect future health and must be considered [13]. Therefore, it is necessary to conduct a study related to THE RELATIONSHIP BETWEEN DIET AND PHYSICAL ACTIVITY WITH THE NUTRITIONAL STATUS OF ADOLESCENTS DURING THE COVID-19 PANDEMIC AT THE LABORATORY HIGH SCHOOL, UNIVERSITY OF MALANG. The purpose of this study was to determine the relationship between diet and physical activity with the nutritional status of adolescents during the COVID-19 pandemic.

## 2 Method

### 2.1 Method

This research is a quantitative research with a correlated analytic design and using a cross sectional design approach, where the researcher measures each variable at the same time. Except for the Food Recall questionnaire which was carried out 2 times, so that one other measurement was carried out at a different time. The research was conducted at the Laboratory High School, State University of Malang, an institution under the auspices of the State University of Malang. The population of this study was class XI students aged 16–18 years with a total of 300 students consisting of boys and girls. Based on the total population, a sample of 171 students was obtained including male and female. Sampling was carried out using a purposive sampling technique where sample selection was carried out based on the researcher's considerations about which sample was the most useful and representative [18]. Respondents in this study had inclusion criteria including adolescents aged 16–18 years, willing to become respondents by signing informed consent, and able to communicate well.

The variables in this study include the independent variable and the dependent variable. The independent variable is diet and physical activity, while the dependent variable is nutritional status. Diet is measured using the FFQ (Food Frequency Questionnaire) to determine the frequency and determine the type of food most frequently consumed by respondents during the previous 1 month and carried out one measurement [19]. The calculation is done by adding up all the consumption frequency scores for each food ingredient so that the results of the total frequency of consumption of all foodstuffs in units per day are obtained. Then look for the mean (average) of the total score. If the FFQ value score mean then it is included in the status of frequent eating, whereas if the FFQ score < mean then it is included in the status of eating infrequently [20]. In addition to the FFQ measurement of diets using the Food Recall method which is carried out 2 times 24 h including weekday and weekend food intake to represent food intake at school and during holidays. This was done, in accordance with previous research

with the aim of producing a more optimal picture of food consumption and providing variations on the respondent's food intake [19]. In general, the use of Food Recall is to determine the frequency of the respondent's meal that has occurred during the previous 24 h without changing the food supply and eating habits of the respondent. Measurable diets include consumption of energy, carbohydrates, protein, and fat which are analyzed using the Nutrisurvey application. The distribution of dietary pattern categorization includes more consumption ( $>120\%$  AKG), sufficient ( $90\text{--}<120\%$  AKG), and less ( $<90\%$  AKG) [21]. Physical activity was measured using the IPAQ (International Physical Activity Questionnaire) short version which has been tested for validity and reliability in 12 countries (14 locations) during 2000 with the final results being acceptable for use in various languages [22]. Measurement of physical activity based on METs criteria, high cut off point  $> 6.0$  METs, moderate  $3.0\text{--}6.0$  METs, and low  $< 3.0$  METs [23]. While the determination of nutritional status is based on measurements of weight, height, and percent body fat. Anthropometric measurements include weight measured using a digital scale with an accuracy of 0.1 kg and height measured using a Microtoise Staturmeter with an accuracy of 0.1 cm to determine the nutritional status determined based on the z-score BMI/U in adolescents aged 16–18 years. With a standard deviation score (z-score) based on WHO 2007. Classification of determining nutritional status based on BMI/U includes obesity ( $> + 2$  SD), overweight ( $+1$  SD to  $+2$  SD), good nutrition (normal) ( $-2$  SD to  $+1$  SD), poor nutrition (thinness) ( $-3$  SD to  $< -2$  SD), and poor nutrition (severely thinness) ( $< -3$  SD) [24]. Percent body fat was measured using BIA (Bioelectrical Impedance Analysis) with an accuracy of 0.01% which was assessed based on the criteria for obesity  $> 35\%$ , overfat  $> 30\text{--}35\%$ , normal  $16\text{--}30\%$ , and underfat  $< 16\%$  [25]. This research has been declared to have passed the ethical test with No. 201/HRECC.FODM/IV/2022 by the research ethics committee of the Faculty of Dentistry, Universitas Airlangga on April 28, 2022.

## 2.2 Processing and Data Analysis

Data analysis was carried out including univariate and bivariate analysis. Univariate analysis is used to describe the frequency distribution and the distribution of the proportion of the independent variables, the dependent variable, as well as a description of the characteristics of the respondents. Meanwhile, the bivariate analysis used Spearman's Rho correlation test with numerical data to analyze the relationship between diet (energy, carbohydrates, protein, fat) and physical activity with adolescent nutritional status (BMI/U and percent body fat).

## 3 Result and Discussion

The results of the univariate analysis to determine the characteristics of the respondents are shown in Table 1, which shows that out of a total of 171 respondents, the most dominant was 17 years old, as many as 102 students with a percentage of 59.6%. Overall, more than half of the respondents were women with a percentage of 63.2% and the remaining 36.8% were men.

**Table 1.** Characteristics of respondents.

Variable	Amount	Percentage
	n	%
<b>Age</b>		
16 years	59	34.5
17 years	102	59.6
18 years	10	5.8
<b>Total</b>	171	100.0
<b>Gender</b>		
Man	63	36.8
Woman	108	63.2
<b>Total</b>	171	100.0

### 3.1 Dietary Habit

The frequency distribution of respondents’ energy consumption was mostly found in the sufficient category as many as 163 respondents (95.5%), in the more category there were 7 respondents (4.1%), and the less category there was 1 respondent (0.6%). Energy is a nutrient needed by adolescents in supporting processes in the body, including the process of circulation and blood flow, heart rate, breathing, digestion, supporting the growth process, doing physical activity, and other physiological processes. Energy is determined by the amount of carbohydrates, proteins, and fats found in food. So that to meet energy needs, adequate and nutritionally balanced food intake is needed [26].

The distribution of the frequency of carbohydrate consumption of respondents, mostly found in the sufficient category as many as 118 respondents (69.0%), the more category as many as 32 respondents (18.7%), and the less category as many as 21 respondents (12.3%). Adolescents need carbohydrates as a source of energy. Adequate carbohydrate intake for adolescents can provide good physical fitness [27].

The distribution of the frequency of protein consumption of respondents, mostly found in the more category as many as 88 respondents (51.5%), the sufficient category as many as 79 respondents (46.2%), and the less category there are 4 respondents (2.3%). Consumption of more protein in adolescence based on research results show that the food they consume is mostly from animal and vegetable protein sources in excess. Consuming excess protein can directly lead to obesity. When dietary protein intake exceeds requirements, most of the excess protein is converted to body fat [28]. However, adequate protein consumption has an important role in iron absorption as an effort to prevent anemia in adolescents, especially adolescent girls [29].

The distribution of the frequency of respondents’ fat consumption was mostly found in the sufficient category as many as 119 respondents (69.6%), the more category as many as 32 respondents (18.7%), and the less category as many as 20 respondents (11.7%). Adequate fat intake for adolescents can be useful as food reserves stored in adipose tissue [30] (Table 2).

**Table 2.** Distribution of dietary frequency.

Energy Consumption	Frequency	Percentage
	n	%
More (>120% AKG)	7	4.1
Adequate (90–< 120% AKG)	163	95.5
Less (<90% AKG)	1	0.6
Amount	171	100.0
<b>Carbohydrate Consumption</b>		
More (>120% AKG)	32	18.7
Adequate (90–< 120% AKG)	118	69.0
Less (<90% AKG)	21	12.3
Amount	171	100.0
<b>Protein Consumption</b>		
More (>120% AKG)	88	51.5
Adequate (90–< 120% AKG)	79	46.2
Less (<90% AKG)	4	2.3
Amount	171	100.0
<b>Fat Consumption</b>		
More (>120% AKG)	32	18.7
Adequate (90–< 120% AKG)	119	69.6
Less (<90% AKG)	20	11.7
Amount	171	100.0

Information:

1. Overconsumption, if > 120% AKG
2. Adequate Consumption, if 90–< 120% AKG
3. Less Consumption, if < 90% AKG [21].

Respondents in this study consumed the most types of food from main food sources, including staple foods, animal side dishes, and vegetable side dishes. The type of staple food most frequently consumed by respondents is rice. Rice is the staple food of Indonesians and is part of the culture. According to the results of research by Mokoginta and Manampiring [31], adolescents tend to consume rice as a staple food at least more than once a day. Rice is chosen as a staple food every day because it is a family food that is consumed from generation to generation [31].

The type of animal side dish most frequently consumed by respondents is chicken. This is related to the results of research found by Mokoginta and Manampiring [31], that chicken meat has a price that tends to be cheaper, so it can adjust to the economic status of the population. Chicken meat is not only rich in protein, but also increases fat

**Table 3.** Frequency of food consumption.

No	Food Type	Mean Value	FFQ Score	Category
1	Staple food	11.47	13.95	Often
2	Animal side dishes	11.47	12.86	Often
3	Vegetable side dishes	11.47	15.99	Often
4	Vegetables	11.47	10,20	Seldom
5	Fruits	11.47	7.86	Seldom

Information:

1. Frequent Consumption, if FFQ score mean
2. Infrequent Consumption, if FFQ score < mean [20]

intake in the body. Therefore, excessive consumption of chicken meat will also lead to excessive levels of body fat intake [31].

The type of vegetable side dish most frequently consumed by respondents is tempeh. This is good for supporting protein needs for adolescents. In addition, tempeh can also meet the iron needs, especially for young women to prevent anemia [32]. WHO recommends focusing and prioritizing protein intake during the COVID-19 pandemic as a basic effort to form a strong immune system (building block), namely by implementing and familiarizing the consumption of side dishes with high protein [33]. This is because protein consumption has a role in the formation of immunoglobulins which function to fight viruses [34].

Respondents in this study were found to rarely consume foods such as vegetables and fruits. While the consumption of vegetables and fruits is very important to pay attention to the amount during the COVID-19 pandemic. Vegetables and fruits contain antioxidants that play an important role in fighting harmful compounds in the body and boosting immunity [33]. In addition, vegetables and fruits contain various types of vitamins that can play a role in increasing the body's immune system, including vitamins A, C and E [34]. So that the consumption of vegetables and fruits during the COVID-19 pandemic needs to be increased and the amount considered in an effort to meet daily intake. The type of vegetable most frequently consumed by respondents was carrots. This is related to the research of Wijayanti, et al. [35] that carrots are the most consumed vegetables by adolescents [35]. While the type of fruit that is most often consumed by respondents is bananas. This is in accordance with the research of Mokoginta and Manampiring [31], that adolescents consume the most bananas at least once a day. This is because bananas are easier to obtain than other types of fruit [31] (Table 3).

### 3.2 Physical Activity

The distribution of the frequency of physical activity of respondents, the highest percentage is in the category of moderate physical activity, which is 108 respondents (63.2%), heavy physical activity is 17 respondents (9.9%), and light physical activity is 46 respondents (26.9%). Based on these results, light physical activity is greater in number than heavy physical activity. According to research by Sulistyorini et al. [36], that the most

**Table 4.** Distribution of physical activity frequency.

Physical Activity	Frequency	Percentage
	n	%
Weight (>6.0 METs)	17	9.9
Moderate (3.0–6.0 METs)	108	63.2
Mild (< 3.0 METs)	46	26.9
Amount	171	100.0

Information:

1. Heavy Physical Activity, if > 6.0 METs
2. Moderate Physical Activity, if 3.0–6.0 METs
3. Light Physical Activity, if < 3.0 METs [23]

physical activity of adolescents during the COVID-19 pandemic was light physical activity [36]. This proves that the physical activity of adolescents during the COVID-19 pandemic tends to be lower than before the pandemic. A study of adolescents in the city of Mataram stated that the physical activity of adolescents during the COVID-19 pandemic tended to decrease compared to before the pandemic. Physical activity in adolescence is closely related to school activities. However, during the COVID-19 pandemic, school activities are closed and adolescents are more likely to stay at home. In addition, the presence of fear and awareness of COVID-19 infection increases the likelihood that adolescents will be active at home [37]. This decline in physical activity is associated with government policies in an effort to prevent the transmission of the COVID-19 virus through travel restrictions, the application of social distancing, to the new normal era. With this policy, all community activities must ultimately be limited [1]. The limited community activities have an influence on the physical activities that teenagers usually do. Where activities such as extracurricular activities, sports, scouts, paskibra, and other activities that are usually carried out by adolescents, are no longer carried out during the covid-19 pandemic. So that the physical activity of adolescents during the COVID-19 pandemic is reduced from before [2] (Table 4).

### 3.3 Nutritional Status

The frequency distribution of nutritional status based on the BMI/U index was mostly found in the normal category as many as 121 respondents (70.8%), obesity as many as 25 respondents (14.6%), over nutrition as many as 23 respondents (13.5%), and malnutrition 2 respondents (1.2%). The percentage of overweight and obesity categories, respectively 13.5% and 14.6%, was declared to exceed the threshold value set by WHO. The threshold value is said to be a nutritional problem, at least 10%, while obesity is 5% [17]. Overnutrition is a picture of a person’s body when the body is in a condition of body weight that is more than the normal weight it should be. Obesity (overweight) is the occurrence of excess fat in the body [38] (Table 5).



**Table 5.** Frequency distribution of nutritional status (IMT/U).

Nutritional status	Frequency	Percentage
	n	%
Obesity (> +2 SD)	25	14.6
More Nutrition (+1 SD to +2 SD)	23	13.5
Normal (-2 SD + 1 SD)	121	70.8
Malnutrition (-3 SD < -2 SD)	2	1.2
Amount	171	100.0

Information:

1. Obesity, if (> +2 SD)
2. More Nutrition, if (+1 SD to +2 SD)
3. Normal, if (-2 SD +1 SD)
4. Malnutrition, if (-3 SD < -2 SD) [24].

**Table 6.** Frequency distribution of percent fat.

Fat Percent	Frequency	Percentage
	n	%
Obesity (>35%)	28	16.4
<i>Overfat</i> (>30-35%)	32	18.7
Normal (16-30%)	97	56.7
<i>Underfat</i> (<16%)	14	8.2
Amount	171	100.0

Information:

1. Obesity, if > 35%
2. *Overfat*, if > 30-35%
3. Normal, if 16-30%
4. *Underfat*, if < 16% [25]

The frequency distribution of the percent body fat of respondents was in the normal category of 97 respondents (56.7%), obesity as many as 28 respondents (16.4%), overfat as many as 32 respondents (18.7%), and underfat by 14 respondents (8, 2%). The percentage of overweight and obesity categories in total is almost close to the normal category. Percent body fat is defined as the ratio of the mass of fat in a person’s body to his total body weight. Percent body fat is commonly used to assess a person’s body composition and nutritional status [39] (Table 6).

**Table 7.** Relationship between diet and nutritional status.

Variable	<i>p-value</i>	<i>r</i>
Energy consumption with nutritional status	0.000	0.372
Consumption of carbohydrates with nutritional status	0.000	0.661
Consumption of protein with nutritional status	0.000	0.471
Consumption of fat with nutritional status	0.000	0.395

### 3.4 Relationship Between Diet and Nutritional Status of Adolescents During the Covid-19 Pandemic

Based on statistical tests, it is known that there is a relationship between energy consumption and adolescent nutritional status. The relationship was declared significant with  $p\text{-value} = 0.000$ . Spearman's Rho correlation test  $r = 0.372$  showed a relationship that had a moderate strength (moderate) with a positive direction. This provides an explanation that when there is an increase in energy consumption, it can lead to an increase in nutritional status and vice versa.

The relationship between carbohydrate consumption and nutritional status was found to be  $p\text{-value} = 0.000$ , it is known that there is a significant relationship between carbohydrate consumption and nutritional status in adolescents. Spearman's Rho correlation test  $r = 0.661$  defines a fairly strong relationship with a positive direction. This provides an explanation that an increase in carbohydrate consumption can lead to an increase in nutritional status and vice versa.

The relationship between protein consumption and nutritional status was found to be  $p\text{-value} = 0.000$ , it is known that there is a significant relationship between protein consumption and nutritional status in adolescents. Spearman's Rho correlation test  $r = 0.471$  showed a relationship that had moderate strength with a positive direction. This provides an explanation that if a person's protein consumption increases, his nutritional status can also increase and vice versa.

The relationship between fat consumption and nutritional status was found to be  $p\text{-value} = 0.000$ , it is known that there is a significant relationship between fat consumption and nutritional status in adolescents. Spearman's Rho correlation test  $r = 0.395$  showed a moderately strong relationship with a positive direction. This provides an explanation that increased fat consumption can lead to an increase in nutritional status and vice versa (Table 7).

These results are related to the results of research at Ciawi Vocational School in Bogor, that there is a relationship between energy, carbohydrates, protein and adolescent nutritional status [40]. Another study conducted at State Junior High School 13 Manado City, it is known that there is a relationship between fat intake and nutritional status of BMI/U [41]. In addition, research that has been conducted in a State Junior High School (full day school) in Malang City, also found a relationship between diet and nutritional status. So, when a person's diet is getting better and more balanced, the more likely it is to get good nutrition [5].

**Table 8.** Relationship between diet and percent fat.

Variable	<i>p-value</i>	<i>r</i>
Energy consumption with fat percent	0.000	0.358
Consumption of carbohydrates with percent fat	0.000	0.349
Consumption of protein with percent fat	0.000	0.315
Consumption of fat with fat percent	0.000	0.757

The relationship between energy consumption and percent fat ( $p\text{-value} = 0.000$ ,  $r = 0.358$ ), the relationship between carbohydrate consumption and percent fat ( $p\text{-value} = 0.000$ ,  $r = 0.349$ ), and the relationship between protein consumption and percent fat ( $p\text{-value} = 0.000$ ,  $r = 0.315$ ), this value is defined as a significant positive relationship with moderate strength. This explains that if the consumption of energy, carbohydrates, and protein increases, the percentage of body fat also increases, and vice versa.

Furthermore, regarding the relationship between fat consumption and percent fat, the  $p\text{-value} = 0.000$  and the Spearman’s Rho correlation test  $r = 0.757$ . This proves that there is a positive and significant relationship, and defines a fairly strong relationship between fat consumption and percent fat. Therefore, increasing fat consumption can increase body fat percent (Table 8).

These results are consistent with research that has been conducted at SMK Hidayah Semarang, which found a fairly strong relationship between energy intake and percent body fat in adolescents aged 16–18 years. This means that when a person’s energy intake is high, it can increase his body fat percentage [42]. In addition, a study by Rahman et al. [13], also found a link between fat intake and percent body fat. Consumption of sufficient fat can prevent excess fat from accumulating in the body which can increase body fat percentage. Fat is the largest calorie supplier in a food, 1 g of fat is equivalent to 9 cal. Therefore, a high fat intake can make the body fat percentage also high [43].

Energy is the result of the metabolism of nutrients including carbohydrates, proteins and fats contained in a food. If body fat is in excess (overload) it will be reserved in the form of triglycerides in adipose tissue. The liver and muscles are places where carbohydrates are stored as glycogen. While protein is stored by the body as protein. Carbohydrates and protein have limited storage space. So when there is excess glucose and amino acids in the body, it will be converted into fatty acids which are then stored in the form of triglycerides in adipose tissue. A previous study in Norway found that there was a positive relationship between protein intake and percent body fat. So if protein intake is increased, it can increase the percentage of body fat [44].

**3.5 Relationship Between Physical Activity and Nutritional Status of Adolescents During the Covid-19 Pandemic**

Based on the statistical test of the relationship between physical activity and nutritional status, it was found that the  $p\text{-value} = 0.000$ , it was known that there was a relationship

between physical activity and adolescent nutritional status. The relationship is significant. Spearman's Rho correlation test  $r = -0.437$  showed a relationship that had moderate strength (moderate) with negative (opposite) direction between physical activity and nutritional status. This defines that low intensity physical activity can lead to obesity and vice versa. The incidence of obesity in addition to low physical activity is also followed by excessive food intake. Therefore, if the body receives excessive food intake but is not accompanied by adequate and appropriate physical activity, it can lead to overweight and obesity [2].

These results are in agreement with previous research, namely in SMA Negeri 1 Jambi, which found a link between physical activity and the occurrence of overnutrition. Doing physical activity can cause increased energy requirements (energy expenditure), so that when the intensity of physical activity is low, it is possible to make the impact of overweight and obesity [45]. In addition, these results are related to previous research conducted at a State Junior High School (full day school) in Malang City which found a link between physical activity and nutritional status, so that when a person's physical activity is low, it will have an impact on nutritional status (BMI/U.) which can lead to overweight and even obesity [5]. However, this is different from the results of research conducted on students of the Department of Public Health, State University of Malang, in that there was no relationship between physical activity and nutritional status due to multifactorial factors that could affect nutritional status. Physical activity is mentioned only as one of the factors that determine nutritional status. It is stated that there are other factors that can have an influence on nutritional status, namely food intake [46].

Based on the statistical test of the relationship between physical activity and percent fat,  $p\text{-value} = 0.000$ , it was found that there was a significant relationship between physical activity and percent body fat. Spearman's Rho correlation test  $r = -0.287$  showed that there was a relationship that had moderate strength (moderate) with a negative (opposite) direction between physical activity and percent body fat. This shows that low physical activity can lead to obesity and vice versa.

This result is in agreement with the results of research found by Amelia and Syauqy [44], that there is a significant negative relationship between physical activity and percent body fat. So that the high level of physical activity that a person does, has an influence on the percentage of body fat which tends to decrease and vice versa. Doing physical activity can increase metabolism, burn fat stored in the body and use it as energy. Physical activity is a movement that occurs in the musculoskeletal system so that it can cause energy expenditure. Muscle movement during physical activity can break down triglycerides in adipose tissue so that they turn into free fatty acids, which then become energy [44]. However, this is different from the results of a study conducted at Pangudi Luhur Domenico Savio Junior High School Semarang, that physical activity is not related to body fat percentage. This is because adolescents who are overweight and obese are almost comparable to those who are underfated, so that physical activity with percent body fat cannot describe a significant relationship [47].

## 4 Conclusion

Based on the results and discussion, it can be concluded that found a significant relationship with a positive direction between diet (energy, carbohydrates, protein, and fat) and nutritional status (BMI/U and percent body fat) of adolescents during the covid-19 pandemic. So when the consumption of a diet that includes energy, carbohydrates, protein, and fat increases, it can lead to an increase in the nutritional status of adolescents including BMI/U and percent body fat. There is a significant relationship with a negative (opposite) direction between physical activity and nutritional status (BMI/U and percent body fat) of adolescents during the COVID-19 pandemic. So when the intensity of physical activity carried out by adolescents in the low category can cause nutritional status (BMI/U and percent body fat) to be in the category of overweight and obesity.

As a suggestion for class XI students of the Laboratory High School, State University of Malang to better maintain their dietary intake by increasing the consumption of vegetables and fruits and reducing high-calorie foods during the covid-19 pandemic. In addition, continue to do physical activity regularly during the COVID-19 pandemic in an effort to improve the immune system and maintain an ideal body weight. A balanced intake of food and balanced with adequate physical activity will certainly create a good nutritional status.

Suggestions for Laboratory High School, State University of Malang to be able to make policies or regulations in an effort to improve the quality of students' diet and physical activity. For example, providing information to students about the importance of balanced nutrition can be through banners installed in every corner of the school, so that students hope that they can be read and provide additional knowledge. In addition, related to efforts to increase physical activity, it can be done with joint exercise at least once a week on a regular basis.

For further research to be able to examine the factors that influence the diet and physical activity of adolescents during the covid-19 pandemic to be able to find out more specifically related to the causes of overnutrition and obesity problems in adolescents.

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