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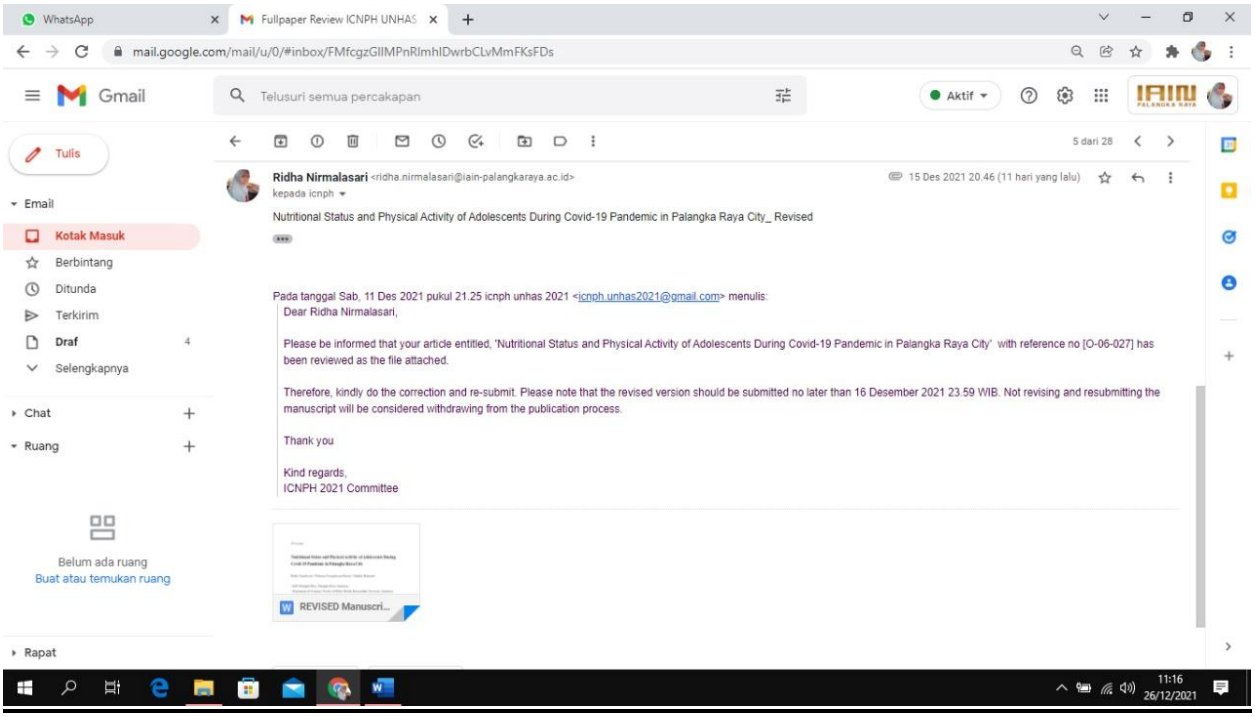

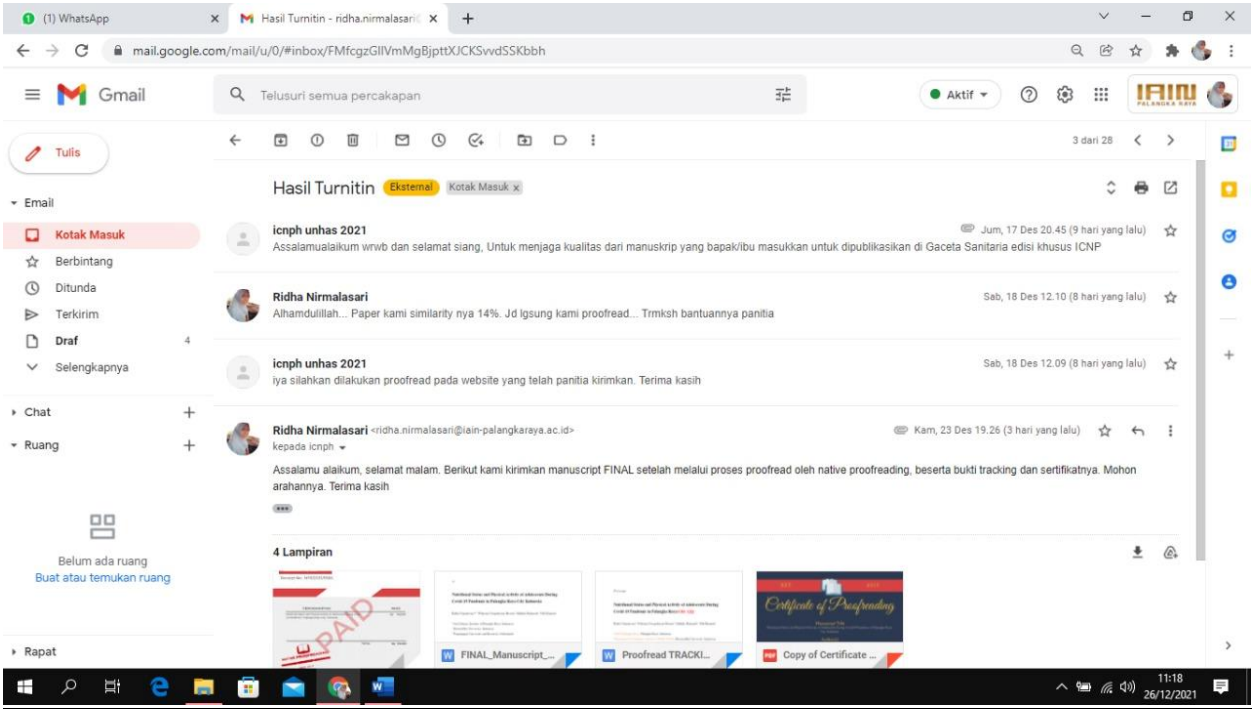

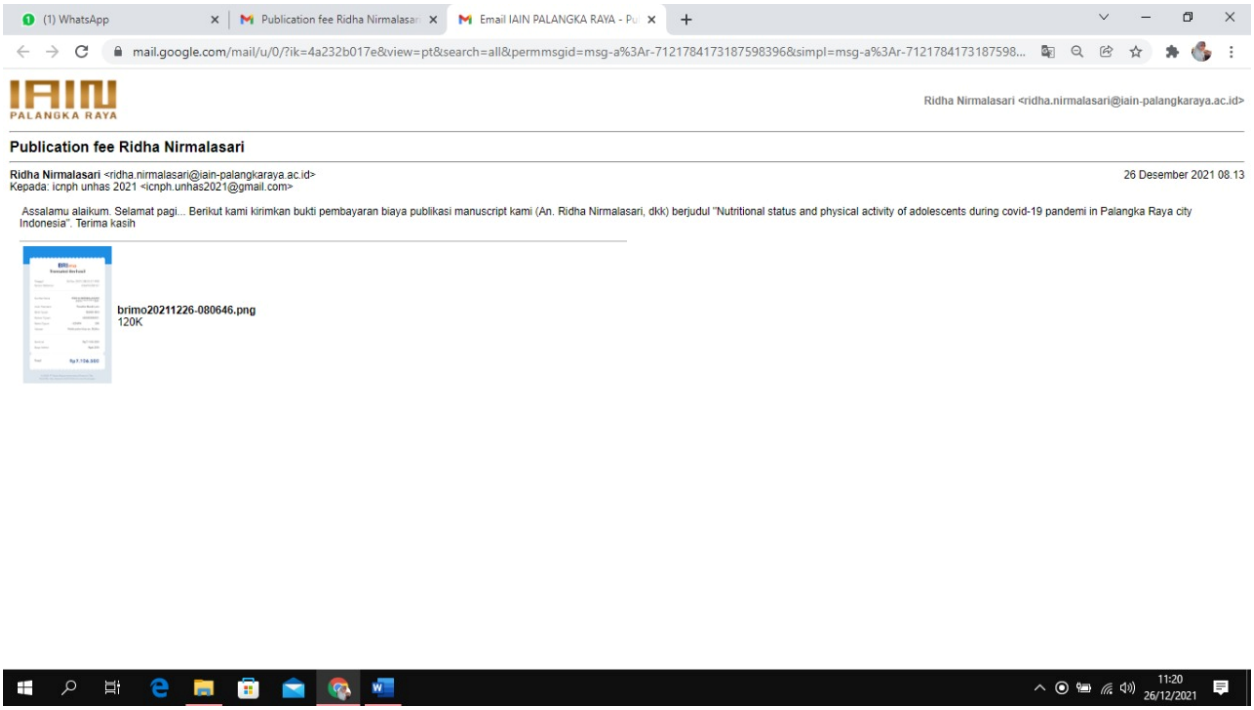
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First page

Nutritional Status and Physical Activity of Adolescents During Covid-19 Pandemic in Palangka Raya City

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Second page

Acknowledgment:

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Conflict of interest:

The authors declare that they have no conflict of interest.

Third page

ABSTRACT

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Objective: This study aimed to describe nutritional status and physical activity in adolescents during Covid-19 pandemic in Palangka Raya City.

Methods: This study is survey research method that conducted in Palangka Raya city.. The sample was 114 adolescents with incidental sampling technique.

Results: The basic result of this study was the decline of physical activity has major impact on nutritional status of adolescents. The results also showed that majority of samples with poor activity have a bigger risk to be overweight/obesity, while majority of samples with moderate activity have normal nutritional status.

Conclusions: We recommended to the government to implementing and promoting policies of nutrition improvement and health awareness on weight maintenance to deal with the health crises as impacts of Covid-19 pandemic.

Keywords: Adolescent, physical activity, nutritional status

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Fourth page

INTRODUCTION

Novel Coronavirus (Covid-19) is a type of virus that causes respiratory infections which was first discovered in the city of Wuhan at the end of 2019, then spread to various countries so that it was declared a pandemic by WHO.[1] In Indonesia, the spread of Covid-19 occurred in early 2020, which has led to an increase in the number of cases of illness and death. The President of the Republic of Indonesia took steps to accelerate the handling of Covid-19 by declaring an emergency response status and establishing a public health emergency status through Presidential Decree No. 11 of 2020 and PP No. 21 of 2020 concerning Large-Scale Social Restrictions (PSBB).[2]

The COVID-19 pandemic has caused many changes in various sectors of life, daily life and activities in society, one of that is in sector of education. There are about 7.5 million students and 45 million students who are affected and who have to do learning from home.[3] Undeniably, the online learning model with various implementations, it also leaves various negative impacts on students such as lack of understanding of learning materials, students outside the region who are constrained by access to information due to lack of signal, neglected character education, and giving more assignments. This impact causes students to further improve their own abilities and efforts to be able to align with the current education system.(reference)?

Physical activity is very influential in maintaining a person's physical and mental health. According to WHO (2017), physical activity is defined as the burning of calories as a result of the work of skeletal muscles in every movement of the body.[4] An adolescent who regularly does physical activity has good self-confidence, self-concept, as well as less stress and feelings of anxiety.[5] Staying at home during the Covid-19 pandemic can have a negative impact on unhealthy lifestyle behaviors in society, including adolescents. The fact that occurred in the field, it was found that most adolescents did not know the benefits of physical activity, unhealthy living behavior and the existence of various facilities also affected the level of physical health in adolescents. Lifestyle changes to sedentary life (lack of movement) accompanied by excessive eating patterns increase the risk of overweight and obesity.[6] The availability of food delivery (delivery services with applications) in the city of Palangka Raya is one of the triggers for a sedentary lifestyle among students. Based on the results of initial interviews with 32 students, information was obtained that 100% of them have food delivery

service applications (such as gojek, grab, maxim), 75% (24 students) often use the application to order food (2-3 times/week).

Nutritional status is the main indicator of a country to determine the health status of the community.[7] One of the groups that are vulnerable to nutritional problems is the adolescent group. Adolescents are vulnerable to nutritional problems because their growth is very fast so that need for nutrients increases in children late teens.[8] In 2014, more than 1.9 billion people aged ≥ 18 years experienced overweight and more than 600 million people in the world are obese.[9] Based on the results of Riskesdas in 2013, the prevalence of obese in adolescents aged 13-15 years was 10.8%, consisting of 8.3% overweight and 2.5% obese. Meanwhile, the prevalence of obesity in adolescents aged 16-18 years was 7.3% consisting of 5.7% overweight and 1.6% obese.[10] Based on the results of Riskesdas 2018, since 2007–2018, the problem of overweight and obesity aged ≥ 18 years has increased, with 8.6%–13.6% for overweight and 10.5%–21.8% for obesity. In the age range of 20–24 years, there are 8.4% of the overweight, and 12.1% were obese.[11] Meanwhile, in the city of Palangka Raya, obesity cases increased in 2016 compared to 2015. The increase in obesity cases in men occurred 10 times compared to 2015, while obesity cases in women increased by 12 times.[12] Based on the exposure to the problems that occurred, this study aims to determine the description of the physical activity of adolescents during the Covid-19 pandemic in Palangka Raya City.

MATERIALS AND METHODS

This research is a survey method that conducted in Palangka Raya City, Central Kalimantan, in September 2021. The population in this study is adolescents aged 18-20 years who are conducting lecture studies in Palangka Raya City. The sample was obtained as many as 114 adolescents referring to the Lemeshow formula and the sampling technique using non-probability sampling with Incidental Sampling technique. The meaning of Incidental Sampling is anyone who coincidentally/incidentally meets with the researcher can be used as a sample, if it is deemed that the person who happened to be met is suitable as a data source. Collecting data using a questionnaire and interview methods which include basic information on respondents, nutritional status based on anthropometric data (Body Mass Index), and physical activity using the IPAC questionnaire (International Physical Activity Questionnaire). Data analysis used quantitative (univariate) analysis. The processed data was then analyzed using the SPSS program version?. Furthermore, the data is presented in the form of a frequency distribution table and explained in the form of a narrative.

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RESULT

Based on the research conducted, the results obtained can be seen in the following tables: The results showed that total sample of 114 people, most of them had normal nutritional status (43.9%). As for the sample with abnormal nutritional status, there are undernutrition (25.5%) and overweight/obesity (30.7%) (Table 1).

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Table 1. Frequency Distribution of Nutritional Status among Adolescents in Palangkaraya City 2021

Nutritional Status	n = (114)	%
Very thin (<17,0)	14	12,30
Skinny (17,0-18,4)	15	13,20
Normal (18,5-25,0)	50	43,90
Fat (25,1-27,0)	26	22,80
Very fat (>27,0)	9	7,90

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From table 2, it can be seen that most of the samples are female (73.7%) while the male is only 26.3%. At the age of the sample, most were at the age of 19 years by 45.6%, while the least was at the age of 18 years (26.3%). Then based on the semester of lectures, most of the samples were in first semester (48.2%) and the least was in fifth semester (18.4%). Based on place of residence, most of the samples lived with their parents at 73.7% and a small proportion lived with other families at 7.0% (Table 2).

Table 2. Frequency Distribution of General Characteristics of Adolescents in Palangka Raya City 2021

Characteristics	n = (114)	%
Gender		
Man	30	26,30
Woman	84	73,70
Age (year)		
18	30	26,30
19	52	45,60
20	32	28,10
Semester		
1	55	48,20
3	38	33,30

5	21	18,40
Residence		
Parent	84	73,70
Cost/contract	22	19,30
Another family	8	7,00

In the general characteristics of the sample by gender, most of the women had an abnormal nutritional status of 61.9% compared to 40.0% of men. Based on age, most of the samples had abnormal nutritional status at the age of 19 years by 57.7%. Based on the semester level, most of the samples had abnormal nutritional status in semester 1 of 48.8%. Based on place of residence, most of the students who lived with their parents had abnormal nutritional status as much as 59.5% (Table 3).

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Table 3. Distribution of Nutritional Status Based on General Characteristics of Adolescents in Palangka Raya City 2021

Characteristics	Nutritional Status						Total	
	Under		Normal		Over			
	n	%	n	%	n	%	n	%
Gender								
Man	6	20,0	18	60,0	6	20,0	30	100,0
Woman	23	27,4	32	38,1	29	34,5	84	100,0
Age (year)								
18	8	26,7	12	40,0	10	33,3	30	100,0
19	16	30,8	22	42,3	14	26,9	52	100,0
20	5	15,6	16	50,0	11	34,4	32	100,0
Semester								
1	13	23,6	28	50,9	14	25,5	55	100,0
2	10	26,3	16	42,1	12	31,6	38	100,0
3	6	28,6	6	28,6	9	42,9	21	100,0
Residence								
Parent	21	25,0	34	40,5	29	34,5	84	100,0
Cost/contract	5	22,7	14	63,6	3	13,6	22	100,0
Another family	3	37,5	2	25,0	3	37,5	8	100,0

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Based on the proportion of physical activity of the sample, most of the samples have moderate activity of 42.1%. Meanwhile, the sample with less activity was 36.0% and over activity was 21.9% (Table 4).

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Table 4. Frequency Distribution of Adolescent Physical Activity in Palangka Raya City 2021

Physical Activity	n = (114)	%
Less	41	36,00
Moderate	48	42,10
Over	25	21,90

The results of the crosstabulation of physical activity with nutritional status in the sample (Table 5) show that the sample who has less activity has a bigger risk of experiencing overweight/obesity (58.5%), while most of the samples with moderate activity had normal nutritional status (62.5%).

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Table 5. Crosstabulation of Physical Activity with Nutritional Status in Adolescents in Palangka Raya City 2021

Physical Activity	Nutritionl Status						Total	
	Under		Normal		Over			
	n	%	n	%	n	%	n	%
Less	11	26,8	6	14,6	24	58,5	41	100,0
Moderate	12	25,0	30	62,5	6	12,5	48	100,0
Over	16	24,0	14	56,0	5	20,0	25	100,0

DISCUSSION

1. Overview of Nutritional Status in Adolescent

Based on the results of measurements of Body Mass Index (BMI) conducted on 114 students as research samples, it was found that most of the samples had normal nutritional status of 43.9%. This is in line with the research in Saudi Arabia conducted by Jalal et al (2021) where there are 46.0% of students who are able to maintain their weight (BMI) during their term lockdown Covid-19, while others students experienced weight gain (32.0%) and weight loss (22.0%).[13] Normal nutritional status can occur if the body gets enough nutrients that are used efficiently, so that the possibility of physical growth, brain development, and work ability reaches optimal levels.[14]

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According to Irianto (2014), the factors that influence nutritional status include the level of education, family knowledge and skills. The higher the education, knowledge and skills of the family, the better the level of one's food security.[15] Students are defined as individuals who are studying at the tertiary level where they are considered to have a high level of intelligence, brilliance in thinking and planning in action.[16] Therefore, the number of respondents with normal nutritional status can be due to the better level of formal education of respondents which is a factor in determining whether or not someone easily absorbs and understands the nutritional information obtained, so that it affects the attitudes and behavior of respondents in meeting their nutritional needs.

This study also showed that there was an increase in nutritional status problems in the sample where overweight (30.7%) had a greater proportion than undernutrition (25.5%). The research by Jia et al (2020) conducted a national online survey in China with a sample of adolescents with an average age range of 19.8 ± 2.3 years, it was found that the average BMI of adolescents increased significantly from 21.8 to 22.1 kg/m2 with the increasing prevalence of overweight (21.4%) and obesity (10.5%) as well as increased sedentary activity during the Covid-19 pandemic.[17] Nutritional problems in adolescents will have a negative impact on the level of public health, for example, a decrease in learning concentration, the risk of giving birth to a baby with low birth weight, and a decrease in physical fitness.[18] A person who has poor nutritional status has a risk of infectious disease, while someone who is above normal weight has a risk of degenerative disease.[19] Students as late teens are the stage of the period that occurs the growth spurt, there are peak growth, body weight (peak weight velocity) and bone mass (peak bone mass/ PBM) where these changes will affect changes in body composition, rapid growth and physical activity so that it affects the nutritional needs of late adolescents.[20] Nutritional problems in adolescents arise due to poor nutritional intake, that is an imbalance between nutritional intake and the recommended nutritional adequacy.

Based on the distribution of the general characteristics of the sample, the results showed that most of the female respondents had abnormal nutritional status (27.4% malnutrition and 34.5% overnutrition) compared to male respondents. Genetic factors are the basic capital in achieving the results of the growth process.[21] Putra (2017) in his research shows that female students have 2 times the tendency to have abnormal nutritional status than boys.[22] Based on age, it was found that the majority of respondents had abnormal nutritional status at the age of 19 years (under 30.8% and over 26.9%). This study is in line with research in Botswana which revealed that nutritional status changes with age and level of study. This is because there are

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several lifestyle habits such as spending long time in front of the computer to do tasks, and the occurrence of stress that can increase or decrease a person's appetite.[23]

In addition, it was also found that most of the students who had abnormal nutritional status were at the first semester (23.6% less nutrition and over 25.5%). First year students are identified as students who have just felt the euphoria of the beginning of the lecture period. First year students are faced with a big change in their lives, where there is a transition process from a senior in high school (SMA) to a new person in college. This transition period can be a stressful time for individuals entering early adulthood, where they experience a double transition, namely psychological and institutional development.[24] Therefore, stress is a vulnerable problem experienced by first year students. The stressor for new students in the 2020/2021 academic year has increased with the Covid-19 pandemic situation which requires lecture activities to be carried out online. A study conducted by Sari (2020) on 70 first-year nursing students at a Health Sciences College (STIKES) in Kediri showed that most students experienced moderate stress during online lectures. The impact of this stress will affect a person's nutritional status.[25]

Then based on the condition of residence, the majority of respondents who have abnormal nutritional status are those who live with their parents (25.0% less nutrition and over 34.5%). The role of parents is needed to form good eating habits/ patterns for their children because parents have a very close role with them. In addition, parents also act as facilitators of good nutrition. Sulistyoningsih (2011) states that the role of parents is related to the nutritional status of children where the higher the role of parents, the better the nutritional status of children (normal), but on the other hand, if the role of parents is low, children tend to experience nutritional problems. In this case, parents can be role models about good eating habits so that it has an impact on their children's eating patterns.[26]

2. Overview of Physical Activity in Adolescent

The results showed that most of the samples had moderate physical activity category of 42.1%. This research is in line with Delimasari (2017) which shows that the majority of students do moderate activities as much as 71.4%. In this study, respondents tend to do moderate activities such as sweeping, cooking, lifting light items, and walking.[27] According to American College of Sports Medicine (ACSM) (2015), physical activity is a positive behavior as a controller of energy balance, every body movement will cause an increase, expenditure, or burning of energy.[28] High physical activity will break down energy in fat reserves to be used,

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but low activity will make fat reserves accumulate which causes an increase in a person's weight.[29]

Less activity in adolescence will tend to be less active in later life. This is one of the factors that cause obesity.[30] In this study, 36.0% of the samples had mild activity. This is in line as Unicef (2021) reported that during the Covid-19 period there was 52.0% decrease in physical activity in adolescents compared to the pre-pandemic period. Then it was reported that 33.0% did not do physical activity and another 25.0% were categorized as doing less than one hour of physical activity per week. On the other hand, only 7% of teens engage in more than 6 hours of physical activity per week.[31] Study in UK conducted by Robinson et al (2021) predicts that the lifestyle that occurs during the Covid-19 pandemic is overeating and low physical activity. This decrease in physical activity is due to the implementation ofphysical distancing/ lockdown thus limiting the movement of a person in order to prevent transmission of the virus.[32]

In this study, it was also found that 58.5% of samples with less activity had a bigger risk of experiencing more nutritional status. Physical activity is one of the causes that affect a person's nutritional status. Light physical activity will cause a decrease in fitness and the risk of obesity or obesityoverweight. This is because a lot of energy is accumulated in the body and there is no burning of calories due to insufficient activity.[33] Excess body weight is caused by an increase in energy stores in the form of fat tissue, usually in the abdominal cavity or hips, due to decreased energy use.[34] According to Condello et al (2016), the combination of insufficient physical activity and high energy intake is responsible for overweight and obesity. The more active a person is in physical activity, the more energy is expended. Meanwhile, if the energy intake is excessive without being balanced by physical activity balanced, it is easy for teenagers to be overweight.[35] Vertical (2012) suggests that low physical activity has a 3 times greater chance of causing overweight than heavy physical activity.[36]

According to WHO (2016), physical activity is one of the determinants of a person's nutritional status.[37] A Jordanian study by Al-Hourani et al (2021) revealed that during the period lockdown, the mean weight and body mass index in children and adolescents showed a significant increase ($p<0.001$). In addition, it was also reported that more than 50% of subjects spent more than 3 hours in front of the screen and a significant increase in food consumption compared to beforelockdown.[38] Students as students now spend most of their time studying from home so they tend to spend hours sitting in front of the computer. In addition, the presence of lecture assignments is also a trigger for stress and poor food consumption patterns for students. This tends to lead to a lack of physical activity and increased stress. Research by

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Philipouet al (2020) found that weight gain during the Covid-19 pandemic was highly correlated with exercise, boredom caused by isolation, anxiety/depression, increased eating, consumption of snacks, and unhealthy foods such as cereals and sweets.[39]

Results of research in Turkey by Yilmaz et al (2020) on students affected by Covid-19 stated that there were significant changes both in terms of limitations in activities and behavior in buying food. Most of the students admitted that they had increased the amount of food and snacks they consumed during the pandemic compared to their pre-pandemic habits.[40] According to Putra (2017), this indicates that light physical activity allows the energy consumed not to be expended through physical activity and the energy will form fat. Different results are found in respondents with strenuous physical activity which allows the energy that enters the body to be released through physical activity so that fat is not formed in the body.[22] Based on the findings of research results in Poland by Glinkowska & Glinkowski (2018) stated that the risk of obesity or overweight in adolescents who are not active in physical activity can increase 2 times ($p<0.01$).[41] This is in accordance with the theory of Nhantumbo et al (2013) which revealed that someone who has excessive body weight but has good activity is very likely to have a normal nutritional status than someone who has normal nutritional status but is not healthy due to low physical activity.[42]

CONCLUSION

Currently, the Covid-19 pandemic is becoming a major topic of conversation around the world because of its impact on changes in aspects of life, especially health. The conclusion in this study was that 43.9% of adolescents were able to maintain their nutritional status. In addition, it was also found that there was an increase in nutritional status problems in adolescents, there are 30.7% experienced an increase in BMI and 25.5% experienced a decrease in BMI where both susceptible to various health problems. Based on physical activity, it was found that the majority of adolescents had moderate physical activity of 42.1%. But on the other hand, there are 36.0% of adolescents who experience an increase in light activity which can be one of the factors causing obesity in adolescents.

This research is expected to be a forum for increasing information and motivation to always make efforts to improve public health status, especially during this Covid-19 pandemic. For the government, it is hoped that this research will become a reference in its seriousness in responding to the presence of the Covid-19 pandemic so that it is able to intervene through an effective and efficient approach in handling health nutrition problems, especially for adolescents. It is also hoped that this research can contribute or become a reference material in

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the development of further research, such as by analyzing other factors that trigger changes in a person's nutritional status.

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Nutritional status and physical activity of adolescents during Covid-19 pandemic in Palangka Raya City Indonesia

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Abstract
Background: The Covid-19 pandemic has brought changes in various life sectors, such as unhealthy lifestyle behaviors in adolescents due to the negative impact of online learning. Several studies have shown that stress and lack of physical activity influence nutritional status. Therefore, this study aimed to describe adolescents' nutritional status and physical activity during the Covid-19 pandemic in Palangka Raya City.
Methods: This study is employed a survey method conducted in Palangka Raya city using 114 adolescents with incidental sampling technique.
Results: The direct result was that the decline of physical activity has a significant impact on the nutritional status of adolescents. Furthermore, most samples with poor activity have a bigger susceptibility to being overweight/obese, while those with moderate activity have normal nutritional status.
Conclusions: It was recommended that the government implement and promote nutrition improvement policies and health awareness on weight maintenance to deal with the health crises as impacts of the Covid-19 pandemic.

Keywords: Nutritional status; Physical activity; Adolescent; Covid-19 pandemic; Lifestyle.

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Conflict of interest

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Introduction

Novel Coronavirus (Covid-19) causes respiratory infections, leading to an increase in the number of cases of illness and death; therefore, it was declared a pandemic by WHO.[1] In Indonesia, the pandemic has caused many changes in various sectors of life, one of which is education. About 45 million students study from home, and around 7.5 million are already affected by the virus.[2] Undeniably, the online learning model with various implementations also leaves various negative impacts, such as lack of understanding of learning materials, lack of signal, neglected character education, and giving more assignments. This causes students to improve further their abilities and aligns with the current education system.[3]

Physical activity is very influential in maintaining physical and mental health. It was defined by WHO (2017) as the burning of calories following the work of skeletal muscles in every body movement.[4] An adolescent who regularly performs physical activity has good self-confidence, self-concept, and less stress and feelings of anxiety.[5] Staying at home during the pandemic can lead to unhealthy lifestyle behaviors in society. Most adolescents did not know the benefits of physical activity, unhealthy living behavior, and the existence of various facilities, which affected their level of physical health. Meanwhile, lifestyle changes to sedentary life accompanied by excessive eating patterns increase the risk of overweight and obesity.[6]

Nutritional status is the leading indicator of a country to determine community health,[7] and one group that are vulnerable to nutritional problems is the adolescent group. In 2014, more than 1.9 billion people aged ≥ 18 years experienced overweight, and more than 600 million worldwide were obese.[8] Based on the results of Riskesdas in 2013, the prevalence of obesity in adolescents aged 13-15 years was 10.8%, consisting of 8.3% overweight and 2.5% obese. Meanwhile, the prevalence in adolescents aged 16-18 years was 7.3% consisting of 5.7% overweight and 1.6% obese.[9] Therefore, the problem of overweight and obesity aged ≥ 18 years has increased, with 8.6%–13.6% for overweight and 10.5%–21.8% for obesity since 2007–2018. In 20–24 years, 8.4% experienced overweight, and 12.1% were obese.[10] Meanwhile, in Palangka Raya, obesity cases increased in 2016 compared to 2015. The increase in men and women occurred ten and twelve times compared to 2015, respectively.[11] Based on the exposure to the problems, this study aimed to describe adolescents' nutritional status and physical activity during the Covid-19 pandemic in Palangka Raya City.

Materials and Methods

This survey method was conducted in Palangka Raya City, Central Kalimantan, in September 2021. The population used was adolescents aged 18-20 years who are conducting lecture studies in any college of Palangka Raya City. Furthermore, about 114 adolescents referring to the Lemeshow formula using non-probability and Incidental Sampling techniques were obtained. This technique was carried out by distributing questionnaires to students used as data sources according to the criteria: aged 18-20 years, ready to be a participant, and not suffering from chronic diseases. In addition, the recruitment of participants was conducted using several campus side such as lecturers and staff to provide information about this study.

Data collection was conducted using a questionnaire and interview methods, including basic information on respondents, nutritional status based on anthropometric data (Body Mass Index), and physical activity using the IPAQ (International Physical Activity Questionnaire). It was mostly done with online questionnaires (basic information of participants and physical activity) by *Zoho Form* while still providing assistance and information on the procedure for filling out the

questionnaire. This method was conducted since the Covid-19 pandemic caused limited meetings, and participants felt safe and comfortable answering the questions. Meanwhile, the measurement of nutritional status was carried out by personnel trained previously using validated measurements of weight (digital scales) and height (microtoise). Finally, quantitative (univariate) analysis using the SPSS program (IBM SPSS statistics version 22.0) was presented in a frequency distribution table and then explained in the form of a narrative.

Result

About 56.2% of the total sample were malnourished (undernutrition 25.5% and overnutrition 30.7%) compared with normal nutritional status (43.9%) (Table 1).

Table 1 Frequency distribution of nutritional status among adolescents in Palangkaraya City 2021.

Nutritional Status	n = (114)	%
Very thin (<17.0)	14	12.30
Skinny (17.0-18.4)	15	13.20
Normal (18.5-25.0)	50	43.90
Overweight (25.1-27.0)	26	22.80
Obese (>27.0)	9	7.90

Table 2 showed that most of the samples were female (73.7%), while 26.3% were male. At the age of the sample, most were at the age of 19 (45.6%), while the least was at 18 years (26.3%). Based on the semester of lectures, most of the samples were in the first semester (48.2%) and the least in the fifth semester (18.4%). Finally, based on place of residence, most of them lived with their parents (73.7%), and a small proportion lived with other families (7.0%) (Table 2).

Table 2 Frequency distribution of general characteristics of adolescents in Palangka Raya City 2021.

Characteristics	n = (114)	%
Gender		
Man	30	26.30
Woman	84	73.70
Age (year)		
18	30	26.30
19	52	45.60
20	32	28.10
Semester		
1	55	48.20
3	38	33.30
5	21	18.40
Residence		
Parent	84	73.70
Boarding house	22	19.30
Another family	8	7.00

In the general characteristics of the sample by gender, most of the women had 61.9% undernutrition and overnutrition compared to men with 40.0%. Based on age, most of the samples had undernutrition and overnutrition at 19 years (57.7%). Based on the semester level, most of them with 48.8% had undernutrition and overnutrition in semester 1. Finally, based on the place of residence, most of the students with 59.5% who lived with their parents had abnormal nutritional status (Table 3).

Table 3 Distribution of nutritional status based on general characteristics of adolescents in Palangka Raya City 2021.

Characteristics	Nutritional Status						Total	
	Undernutrition		Normal		Overnutrition			
	N	%	N	%	n	%	N	%
Gender								
Man	6	20.0	18	60.0	6	20.0	30	100.0
Woman	23	27.4	32	38.1	29	34.5	84	100.0
Age (year)								
18	8	26.7	12	40.0	10	33.3	30	100.0
19	16	30.8	22	42.3	14	26.9	52	100.0
20	5	15.6	16	50.0	11	34.4	32	100.0
Semester								
1	13	23.6	28	50.9	14	25.5	55	100.0
2	10	26.3	16	42.1	12	31.6	38	100.0
3	6	28.6	6	28.6	9	42.9	21	100.0
Residence								
Parent	21	25.0	34	40.5	29	34.5	84	100.0
Boarding house	5	22.7	14	63.6	3	13.6	22	100.0
Another family	3	37.5	2	25.0	3	37.5	8	100.0

Based on the proportion of physical activity of the sample, more respondents had moderate activity than those with less and excess activities with 42.1%, 36.0% and 21.9%, respectively (Table 4).

Table 4 Frequency distribution of adolescent physical activity in Palangka Raya City 2021.

Physical Activity	n = (114)	%
Less	41	36.00
Moderate	48	42.10
Excess	25	21.90

The results of the crosstabulation of physical activity with nutritional status in the sample (Table 5) showed that those with less activity had a more significant susceptibility to being overweight/obesity with a percentage of 58.5%. In comparison, 62.5% of the samples with moderate activity had normal nutritional status.

Table 5 Crosstabulation of physical activity with nutritional status in adolescents in Palangka Raya City 2021.

Physical Activity	Nutritional Status			Total
	Undernutrition	Normal	Overnutrition	

	n	%	n	%	n	%	n	%
Less	11	26.8	6	14.6	24	58.5	41	100.0
Moderate	12	25.0	30	62.5	6	12.5	48	100.0
Excess	16	24.0	14	56.0	5	20.0	25	100.0

Discussion

Overview of nutritional status in adolescent

The results showed that most of the samples with a 56.2% were malnourished, specifically 25.5% of undernutrition and 30.7% of overnutrition than those of 43.9% with normal nutritional status. Confinement due to the Covid-19 pandemic can influence dietary profiles, especially adolescents highly susceptible to acquiring bad eating habits. Social isolation during the pandemic-included lockdown/quarantine resulted in more severe effects on nutritional status. In a Dutch study, overeating, primarily through snacking, was reported in 20-32% of respondents during the pandemic, whereas 7-15% reported behavior predisposed to undernutrition by skipping warm meals. These dietary habits have important implications for the health impact of the pandemic.[12]

This study also showed an increase in nutritional status problems in the sample where overweight/obesity (30.7%) had a more significant proportion than undernutrition (25.5%). The study by Jia et al. (2020) conducted a national online survey in China with a sample of adolescents, where their average BMI increased significantly from 21.8 to 22.1 kg/m2 with the increasing prevalence of overweight and obesity at 21.4% and 10.5%, respectively, as well as increased sedentary activity during the pandemic.[13] Nutritional problems negatively impact the level of public health, for example, a decrease in learning concentration, the risk of giving birth to a baby with low birth weight, and a decrease in physical fitness.[14] People with poor nutritional status are exposed to infectious disease, while those with overnutrition are exposed to degenerative disease.[15]

Based on the distribution of the general characteristics, the results showed that most of the females had nutritional problems, specifically 27.4% undernutrition and 34.5% overnutrition compared to males. According to Putra (2017), female students tend to have nutritional problems than males. Based on age, most respondents had nutritional problems at the age of 19 years with undernutrition and overnutrition at 30.8% and 26.9%, respectively. [16] This study is in line with the study in Botswana, which revealed that nutritional status changes with age and level of study. This is because of several lifestyle habits, such as spending a long time in front of the computer to do tasks and stress, which can increase or decrease appetite.[17]

Most of the students who had nutritional problems were in the first semester with 23.6% undernutrition and overnutrition 25.5%. First-year students are faced with a significant change in their lives, where there is a transition process from senior in high school to a new person in college that can be a stressful time for individuals entering early adulthood.[18] The stressor for new students in the 2020/2021 academic year has increased with the Covid-19 pandemic, which requires lecture activities to be carried out online. Sari (2020) conducted a study on 70 first-year nursing students at a Health Sciences College (STIKES) in Kediri, where most experienced moderate stress during online lectures. The impact of this stress will affect a person's nutritional status.[19]

Based on the residence condition, most respondents with nutritional problems live with their parents, where 25.0% suffering from undernutrition and 34.5% from overnutrition. Sulistyoningsih (2011) stated that the role of parents is related to the nutritional status of children. This role is directly proportional to the nutritional status of children (standard). In this case, parents can be role models about good eating habits to impact their children's eating patterns.[20]

Overview of physical activity in adolescent

The results showed that most samples had a moderate physical activity of 42.1%. Although according to the American College of Sports Medicine (ACSM) (2015), physical activity is a positive behavior as a controller of energy balance since every body movement can cause an increase, expenditure, or burning of energy.[21] Therefore, less activity in adolescence will tend to be less active in later life, causing obesity[22] and this study, 36.0% of the samples had less activity. Unicef (2021) reported that during the Covid-19 period, there was a 52.0% decrease in physical activity in adolescents compared to the pre-pandemic period. On the other hand, only 7% of teens engage in more than 6 hours of physical activity per week.[23] A study in the UK conducted by Robinson et al (2021) predicts that the lifestyle during the pandemic is overeating and low physical activity. This decrease in physical activity is due to the implementation of distancing/lockdown, which limited movement to prevent transmission of the virus.[24]

This study also found that 58.5% of samples with less activity had a more significant susceptibility to being overweight/obese. This is because much energy is accumulated in the body without burning calories due to insufficient activity.[25] According to Condello et al. (2016), the combination of insufficient physical activity and high energy intake is responsible for overweight and obesity. The more active a person is in physical activity, the more energy is expended. Meanwhile, when the energy intake is excessive without being balanced by physical activity, adolescents will quickly become overweight/obese.[26]

Al-Hourani et al. (2021) revealed that during the lockdown, the mean weight and body mass index in children and adolescents showed a significant increase ($p<0.001$). In addition, more than 50% of subjects spent more than 3 hours in front of the screen and a significant increase in food consumption compared to before lockdown.[27] Philipouet al (2020) found that weight gain was highly correlated with exercise, boredom caused by isolation, anxiety/depression, increased eating, consumption of snacks, and unhealthy foods such as cereals and sweets.[28]

Results of a study in Turkey by Yilmaz et al. (2020) on students affected by Covid-19 stated that there were significant changes in terms of limitations in activities and behavior in buying food. Most of the students admitted that they had increased the amount of food and snacks consumed compared to their pre-pandemic habits.[29] The findings in Poland (2018) stated that the risk of obesity or overweight in adolescents active in physical activity can increase two times ($p<0.01$).[30] This is under the theory of Nhantumbo et al. (2013), where people with excessive body weight and good activity are very likely to have a normal nutritional status than someone who has normal nutritional status but is not healthy due to low physical activity.[31]

Conclusion

Currently, the Covid-19 pandemic is becoming a significant topic of conversation worldwide because of its impact on changes in aspects of life, especially health. The direct result was that the decline of physical activity has a significant impact on the nutritional status of adolescents. This also showed that most samples with poor activity have a more significant susceptibility to being overweight/obese. In contrast, most samples with moderate activity have normal nutritional status.

This study is expected to be a forum for increasing information and constant motivation to improve public health, especially during this Covid-19 pandemic. It is recommended as a reference in responding to the presence of the Covid-19 pandemic through an effective and efficient approach in handling health nutrition problems, especially for adolescents. Furthermore, it can contribute or

become a reference material in further study, such as by analyzing other factors that trigger changes in a person's nutritional status.

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What are the implications of the results obtained?
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What is known about the subject? In a maximum of 300 characters, explain the state of scientific knowledge about the subject addressed in the study, referring to the reviews available.

What does the study performed add to the literature? Describe what the study performed provides to the existing evidence, in a single sentence of a maximum of 200 characters.

What are the implications of the results obtained? Add a sentence (200-character maximum) in which implications arising as to existing evidence in the practice, research, policies or public healthcare in the results obtained are indicated.

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First page

Nutritional Status and Physical Activity of Adolescents During Covid-19 Pandemic in Palangka Raya City, Indonesia

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Second page

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Third page

ABSTRACT

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Fourth page

INTRODUCTION

Novel Coronavirus (Covid-19) causes respiratory infections, leading to an increase in the number of cases of illness and death; therefore, it was declared a pandemic by WHO.[1] In Indonesia, the pandemic has caused many changes in various sectors of life, one of which is education. About 45 million students study from home, and around 7.5 million are already affected by the virus.[2] Undeniably, the online learning model with various implementations also leaves various negative impacts, such as lack of understanding of learning materials, lack of signal, neglected character education, and giving more assignments. This causes students to improve further their abilities and aligns with the current education system.[3]

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Nutritional status is the leading indicator of a country to determine community health,[7] and one group that are vulnerable to nutritional problems is the adolescent group. In 2014, more than 1.9 billion people aged ≥ 18 years experienced overweight, and more than 600 million worldwide were obese.[8] Based on the results of Riskesdas in 2013, the prevalence of obesity in adolescents aged 13-15 years was 10.8%, consisting of 8.3% overweight and 2.5% obese. Meanwhile, the prevalence in adolescents aged 16-18 years was 7.3% consisting of 5.7% overweight and 1.6% obese.[9] Therefore, the problem of overweight and obesity aged ≥ 18 years has increased, with 8.6%–13.6% for overweight and 10.5%–21.8% for obesity since 2007–2018. In 20–24 years, 8.4% experienced overweight, and 12.1% were obese.[10] Meanwhile, in Palangka Raya, obesity cases increased in 2016 compared to 2015. The increase in men and women occurred ten and twelve times compared to 2015, respectively.[11] Based on the exposure to the problems, this study aimed to describe adolescents' nutritional status and physical activity during the Covid-19 pandemic in Palangka Raya City.

MATERIALS AND METHODS

This survey method was conducted in Palangka Raya City, Central Kalimantan, in September 2021. The population used was adolescents aged 18-20 years who are conducting lecture studies in any college of Palangka Raya City. Furthermore, about 114 adolescents referring to the Lemeshow formula using non-probability and Incidental Sampling techniques were obtained. This technique was carried out by distributing questionnaires to students used as data sources according to the criteria: aged 18-20 years, ready to be a participant, and not suffering from chronic diseases. In addition, the recruitment of participants was conducted using several campus side such as lecturers and staff to provide information about this study.

Data collection was conducted using a questionnaire and interview methods, including basic information on respondents, nutritional status based on anthropometric data (Body Mass Index), and physical activity using the IPAQ (International Physical Activity Questionnaire). It was mostly done with online questionnaires (basic information of participants and physical activity) by *Zoho Form* while still providing assistance and information on the procedure for filling out the questionnaire. This method was conducted since the Covid-19 pandemic caused limited meetings, and participants felt safe and comfortable answering the questions. Meanwhile, the measurement of nutritional status was carried out by personnel trained previously using validated measurements of weight (digital scales) and height (microtoise). Finally, quantitative (univariate) analysis using the SPSS program (IBM SPSS statistics version 22.0) was presented in a frequency distribution table and then explained in the form of a narrative.

RESULT

About 56.2% of the total sample were malnourished (undernutrition 25.5% and overnutrition 30.7%) compared with normal nutritional status (43.9%) (Table 1).

Table 1. Frequency Distribution of Nutritional Status among Adolescents in Palangkaraya City 2021

Nutritional Status	n = (114)	%
Very thin (<17,0)	14	12,30
Skinny (17,0-18,4)	15	13,20
Normal (18,5-25,0)	50	43,90
Overweight (25,1-27,0)	26	22,80
Obese (>27,0)	9	7,90

Table 2 showed that most of the samples were female (73.7%), while 26.3% were male. At the age of the sample, most were at the age of 19 (45.6%), while the least was at 18 years (26.3%). Based on the semester of lectures, most of the samples were in the first semester (48.2%) and the least in the fifth semester (18.4%). Finally, based on place of residence, most of them lived with their parents (73.7%), and a small proportion lived with other families (7.0%) (Table 2).

Table 2. Frequency Distribution of General Characteristics of Adolescents in Palangka Raya City 2021

Characteristics	n = (114)	%
Gender		
Man	30	26,30
Woman	84	73,70
Age (year)		
18	30	26,30
19	52	45,60
20	32	28,10
Semester		
1	55	48,20
3	38	33,30
5	21	18,40
Residence		
Parent	84	73,70
Cost/contract	22	19,30
Another family	8	7,00

In the general characteristics of the sample by gender, most of the women had 61.9% undernutrition and overnutrition compared to men with 40.0%. Based on age, most of the samples had undernutrition and overnutrition at 19 years (57.7%). Based on the semester level, most of them with 48.8% had undernutrition and overnutrition in semester 1. Finally, based on the place of residence, most of the students with 59.5% who lived with their parents had abnormal nutritional status (Table 3).

Table 3. Distribution of Nutritional Status Based on General Characteristics of Adolescents in Palangka Raya City 2021

Characteristics	Nutritional Status						Total	
	Undernutrition		Normal		Overnutrition			
	n	%	n	%	n	%	n	%
Gender								
Man	6	20,0	18	60,0	6	20,0	30	100,0
Woman	23	27,4	32	38,1	29	34,5	84	100,0
Age (year)								
18	8	26,7	12	40,0	10	33,3	30	100,0
19	16	30,8	22	42,3	14	26,9	52	100,0
20	5	15,6	16	50,0	11	34,4	32	100,0
Semester								
1	13	23,6	28	50,9	14	25,5	55	100,0
2	10	26,3	16	42,1	12	31,6	38	100,0
3	6	28,6	6	28,6	9	42,9	21	100,0
Residence								
Parent	21	25,0	34	40,5	29	34,5	84	100,0
Boarding house	5	22,7	14	63,6	3	13,6	22	100,0
Another family	3	37,5	2	25,0	3	37,5	8	100,0

Based on the proportion of physical activity of the sample, more respondents had moderate activity than those with less and excess activities with 42.1%, 36.0% and 21.9%, respectively (Table 4).

Table 4. Frequency Distribution of Adolescent Physical Activity in Palangka Raya City 2021

Physical Activity	n = (114)	%
Less	41	36,00
Moderate	48	42,10
Excess	25	21,90

The results of the crosstabulation of physical activity with nutritional status in the sample (Table 5) showed that those with less activity had a more significant susceptibility to being overweight/obesity with a percentage of 58.5%. In comparison, 62.5% of the samples with moderate activity had normal nutritional status.

Table 5. Crosstabulation of Physical Activity with Nutritional Status in Adolescents in Palangka Raya City 2021

Physical Activity	Nutritional Status						Total	
	Undernutrition		Normal		Overnutrition			
	n	%	n	%	n	%	n	%
Less	11	26,8	6	14,6	24	58,5	41	100,0
Moderate	12	25,0	30	62,5	6	12,5	48	100,0
Excess	16	24,0	14	56,0	5	20,0	25	100,0

DISCUSSION

1. Overview of Nutritional Status in Adolescent

The results showed that most of the samples with a 56.2% were malnourished, specifically 25.5% of undernutrition and 30.7% of overnutrition than those of 43.9% with normal nutritional status. Confinement due to the Covid-19 pandemic can influence dietary profiles, especially adolescents highly susceptible to acquiring bad eating habits. Social isolation during the pandemic-included lockdown/quarantine resulted in more severe effects on nutritional status. In a Dutch study, overeating, primarily through snacking, was reported in 20-32% of respondents during the pandemic, whereas 7-15% reported behavior predisposed to undernutrition by skipping warm meals. These dietary habits have important implications for the health impact of the pandemic.[12]

This study also showed an increase in nutritional status problems in the sample where overweight/obesity (30.7%) had a more significant proportion than undernutrition (25.5%). The study by Jia et al. (2020) [13] conducted a national online survey in China with a sample of adolescents, where their average BMI increased significantly from 21.8 to 22.1 kg/m2 with the increasing prevalence of overweight and obesity at 21.4% and 10.5%, respectively, as well as increased sedentary activity during the pandemic. Nutritional problems negatively impact the level of public health, for example, a decrease in learning concentration, the risk of giving birth to a baby with low birth weight, and a decrease in physical fitness.[14] People with poor nutritional status are exposed to infectious disease, while those with overnutrition are exposed to degenerative disease.[15]

Based on the distribution of the general characteristics, the results showed that most of the females had nutritional problems, specifically 27.4% undernutrition and 34.5% overnutrition compared to males. According to Putra[16] (2017), female students tend to have

nutritional problems than males. Based on age, most respondents had nutritional problems at the age of 19 years with undernutrition and overnutrition at 30.8% and 26.9%, respectively. This study is in line with the study in Botswana, which revealed that nutritional status changes with age and level of study. This is because of several lifestyle habits, such as spending a long time in front of the computer to do tasks and stress, which can increase or decrease appetite.[17]

Most of the students who had nutritional problems were in the first semester with 23.6% undernutrition and overnutrition 25.5%. First-year students are faced with a significant change in their lives, where there is a transition process from senior in high school to a new person in college that can be a stressful time for individuals entering early adulthood.[181] The stressor for new students in the 2020/2021 academic year has increased with the Covid-19 pandemic, which requires lecture activities to be carried out online. Sari19 (2020) conducted a study on 70 first-year nursing students at a Health Sciences College (STIKES) in Kediri, where most experienced moderate stress during online lectures. The impact of this stress will affect a person's nutritional status.

Based on the residence condition, most respondents with nutritional problems live with their parents, where 25.0% suffering from undernutrition and 34.5% from overnutrition. Sulistyoningsih[20] (2011) stated that the role of parents is related to the nutritional status of children. This role is directly proportional to the nutritional status of children (standard). In this case, parents can be role models about good eating habits to impact their children's eating patterns.

2. Overview of Physical Activity in Adolescent

The results showed that most samples had a moderate physical activity of 42.1%. Although according to the American College of Sports Medicine21 (ACSM) (2015), physical activity is a positive behavior as a controller of energy balance since every body movement can cause an increase, expenditure, or burning of energy. Therefore, less activity in adolescence will tend to be less active in later life, causing obesity[22] and this study, 36.0% of the samples had less activity. Unicef[23] (2021) reported that during the Covid-19 period, there was a 52.0% decrease in physical activity in adolescents compared to the pre-pandemic period. On the other hand, only 7% of teens engage in more than 6 hours of physical activity per week. A study in the UK conducted by Robinson et al[24] (2021) predicts that the lifestyle during the pandemic is overeating and low physical activity. This decrease in physical

activity is due to the implementation of distancing/lockdown, which limited movement to prevent transmission of the virus.

This study also found that 58.5% of samples with less activity had a more significant susceptibility to being overweight/obese. This is because much energy is accumulated in the body without burning calories due to insufficient activity.[25] According to Condello et al. [26] (2016), the combination of insufficient physical activity and high energy intake is responsible for overweight and obesity. The more active a person is in physical activity, the more energy is expended. Meanwhile, when the energy intake is excessive without being balanced by physical activity, adolescents will quickly become overweight/obese.

Al-Hourani et al. [27] (2021) revealed that during the lockdown, the mean weight and body mass index in children and adolescents showed a significant increase ($p<0.001$). In addition, more than 50% of subjects spent more than 3 hours in front of the screen and a significant increase in food consumption compared to before lockdown. Philipouet al[28] (2020) found that weight gain was highly correlated with exercise, boredom caused by isolation, anxiety/depression, increased eating, consumption of snacks, and unhealthy foods such as cereals and sweets.

Results of a study in Turkey by Yilmaz et al. [29] (2020) on students affected by Covid-19 stated that there were significant changes in terms of limitations in activities and behavior in buying food. Most of the students admitted that they had increased the amount of food and snacks consumed compared to their pre-pandemic habits. The findings in Poland (2018) stated that the risk of obesity or overweight in adolescents active in physical activity can increase two times ($p<0.01$).[30] This is under the theory of Nhantumbo et al. [31] (2013), where people with excessive body weight and good activity are very likely to have a normal nutritional status than someone who has normal nutritional status but is not healthy due to low physical activity.

CONCLUSION

Currently, the Covid-19 pandemic is becoming a significant topic of conversation worldwide because of its impact on changes in aspects of life, especially health. The direct result was that the decline of physical activity has a significant impact on the nutritional status of adolescents. This also showed that most samples with poor activity have a more significant susceptibility to being overweight/obese. In contrast, most samples with moderate activity have normal nutritional status.

This study is expected to be a forum for increasing information and constant motivation to improve public health, especially during this Covid-19 pandemic. It is recommended as a reference in responding to the presence of the Covid-19 pandemic through an effective and efficient approach in handling health nutrition problems, especially for adolescents. Furthermore, it can contribute or become a reference material in further study, such as by analyzing other factors that trigger changes in a person's nutritional status.

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Word count: 3688
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First page

Nutritional Status and Physical Activity of Adolescents During Covid-19 Pandemic in Palangka Raya City

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Second page

Acknowledgment:

Acknowledgments are primarily addressed to research funders or donors. Thanks can also be conveyed to those who helped carry out the research.

Conflict of interest:

The authors declare that they have no conflict of interest.

Third page

ABSTRACT

~~**Please add some background for this study**~~

~~**Objective**~~**Background**: The presence of Covid-19 pandemic has brought changes in various life sectors, such as unhealthy life style behaviors in adolescents due to the negative impact of online learning. Several studies have shown that stress and lack of physical activity are factors that influence nutritional status. This study aimed to describe nutritional status and physical activity in adolescents during Covid-19 pandemic in Palangka Raya City.

Methods: This study is survey research method that conducted in Palangka Raya city. The sample was 114 adolescents with incidental sampling technique.

Results: The basic result of this study was the decline of physical activity has major impact on nutritional status of adolescents. The results also showed that majority of samples with poor activity have a bigger susceptibility~~risk~~ to being overweight/obesity, while majority of samples with moderate activity have normal nutritional status.

Conclusions: We recommended to the government to implementing and promoting policies of nutrition improvement and health awareness on weight maintenance to deal with the health crises as impacts of Covid-19 pandemic.

Keywords: Nutritional status, Pphysical activity, Aadolescent, Covid-19 pandemic, LLifes style~~Adolescent, physical activity, nutritional status~~

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Fourth page

INTRODUCTION

Novel Coronavirus (Covid-19) is a type of virus that causes respiratory infections which has led to an increase in the number of cases of illness and death, so that it ~~was first discovered in the city of Wuhan at the end of 2019, then spread to various countries so that it~~ was declared a pandemic by WHO.[1] ~~In Indonesia, the spread of Covid-19 occurred in early 2020, which has led to an increase in the number of cases of illness and death. The President of the Republic of Indonesia took steps to accelerate the handling of Covid-19 by declaring an emergency response status and establishing a public health emergency status through Presidential Decree No. 11 of 2020 and PP No. 21 of 2020 concerning Large-Scale Social Restrictions (PSBB).~~[2]

In Indonesia, ~~T~~the ~~COVID~~Covid-19 pandemic has caused many changes in various sectors of life, ~~daily life and activities in society,~~ one of that is in sector of education. There are about 7.5 million college students and 45 million students who are affected and who have to do learning from home.[23] Undeniably, the online learning model with various implementations, it also leaves various negative impacts on students such as lack of understanding of learning materials, ~~students outside the region who are constrained by access to information due~~ to lack of signal, neglected character education, and giving more assignments. This impact causes students to further improve their own abilities and efforts to be able to align with the current education system.[3]~~(reference)?~~

Physical activity is very influential in maintaining a person's physical and mental health. According to WHO (2017), physical activity is defined as the burning of calories as a result of the work of skeletal muscles in every movement of the body.[44] An adolescent who regularly does physical activity has good self-confidence, self-concept, as well as less stress and feelings of anxiety.[55] Staying at home during the Covid-19 pandemic can have a negative impact on unhealthy lifestyle behaviors in society~~, including adolescents~~. The fact that occurred in the field, it was found that most adolescents did not know the benefits of physical activity, unhealthy living behavior and the existence of various facilities also affected the level of physical health in adolescents. Lifestyle changes to sedentary life ~~(lack of movement)~~ accompanied by excessive eating patterns increase the risk of overweight and obesity.[66] ~~The availability of food delivery (delivery services with applications) in the city of Palangka Raya is one of the triggers for a sedentary lifestyle among students. Based on the results of initial interviews with 32 students, information was obtained that 100% of them have food delivery~~

~~service applications (such as gojek, grab, maxim), 75% (24 students) often use the application to order food (2-3 times/week).~~

Nutritional status is the main indicator of a country to determine the health status of the community.[7,7] One of the groups that are vulnerable to nutritional problems is the adolescent group. ~~Adolescents are vulnerable to nutritional problems because their growth is very fast so that need for nutrients increases in children late teens.[8]~~ In 2014, more than 1.9 billion people aged ≥ 18 years experienced overweight and more than 600 million people in the world are obese.[8,9] Based on the results of Riskesdas in 2013, the prevalence of obese in adolescents aged 13-15 years was 10.8%, consisting of 8.3% overweight and 2.5% obese. Meanwhile, the prevalence of obesity in adolescents aged 16-18 years was 7.3% consisting of 5.7% overweight and 1.6% obese.[9,10] Based on the results of Riskesdas 2018, since 2007–2018, the problem of overweight and obesity aged ≥ 18 years has increased, with 8.6%–13.6% for overweight and 10.5%–21.8% for obesity. In the age range of 20–24 years, there are 8.4% of the overweight, and 12.1% were obese.[10,11] Meanwhile, in the city of Palangka Raya, obesity cases increased in 2016 compared to 2015. The increase in obesity cases in men occurred 10 times compared to 2015, while obesity cases in women increased by 12 times.[11,12] Based on the exposure to the problems that occurred, this study aimeds to describe~~determine the description of the~~nutritional status and physical activity of adolescents during the Covid-19 pandemic in Palangka Raya City.

MATERIALS AND METHODS

This research is a survey method that conducted in Palangka Raya City, Central Kalimantan, in September 2021. The population in this study is adolescents aged 18-20 years who are conducting lecture studies in any college of Palangka Raya City ~~City~~. The sample was obtained as many as 114 adolescents referring to the Lemeshow formula and the sampling technique using non-probability sampling with Incidental Sampling technique. ~~The meaning of Incidental Sampling is anyone who coincidentally/incidentally meets with the researcher can be used as a sample, if it is deemed that the person who happened to be met is suitable as a data source.~~ This technique was carried out by distributing questionnaires to each student who is met and suitable as a data source according to the criteria: aged 18-20 years, ready to be a participant and not suffering from chronic diseases. In addition, the recruitment of participant was conducted with the help of several campus side such as lecturers and campus staff to provide information to students about this study.

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Collecting data using a questionnaire and interview methods which include basic information on respondents, nutritional status based on anthropometric data (Body Mass Index), and physical activity using the IPAQC ~~questionnaire~~ (International Physical Activity Questionnaire). The data collection was mostly done with online questionnaire (basic information of participants and physical activity) by *Zoho Form* while still providing assistance and giving information on the procedure for filling out the questionnaire. This method was conducted because the Covid-19 pandemic which caused some meetings to be limited and participants could feel safe and comfortable to answering the questions. Meanwhile, the measurement of nutritional status was carried out by personel who have been trained previously with using validated measurements of weight (digital scales) and height (microtoise). Furthermore, the ~~D~~data analysis used quantitative (univariate) analysis using the SPSS program (IBM SPSS statistics version 22.0) that presented in the form of a frequency distribution table and then explained in the form of a narrative. ~~The processed data was then analyzed using the SPSS program version?. Furthermore, the data is presented in the form of a frequency distribution table and explained in the form of a narrative.~~

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RESULT

~~Based on the research conducted, the results obtained can be seen in the following tables:~~ The results showed that from total sample of 114 ~~people~~adolescent, most of them were malnourished (undernutrition 25.5% and overnutrition 30.7%) as much as 56.2% than the sample with~~had~~ normal nutritional status (43.9%). ~~As for the sample with abnormal nutritional status, there are undernutrition (25.5%) and overweight/obesity (30.7%)~~ (Table 1).

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~~Fat~~ Overweight (25,1-27,0)	26	22,80
~~Very fat~~Obese (>27,0)	9	7,90

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From table 2, it can be seen that most of the samples are female (73.7%) while the male is only 26.3%. At the age of the sample, most were at the age of 19 years by 45.6%,

while the least was at the age of 18 years (26.3%). Then based on the semester of lectures, most of the samples were in first semester (48.2%) and the least was in fifth semester (18.4%). Based on place of residence, most of the samples lived with their parents at 73.7% and a small proportion lived with other families at 7.0% (Table 2).

Table 2. Frequency Distribution of General Characteristics of Adolescents in Palangka Raya City 2021

Characteristics	n = (114)	%
Gender		
Man	30	26,30
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Cost/contract	22	19,30
Another family	8	7,00

In the general characteristics of the sample by gender, most of the women had undernutrition and overnutrition~~an abnormal nutritional status~~ of 61.9% compared to 40.0% of men. Based on age, most of the samples had undernutrition and overnutrition~~abnormal nutritional status~~ at the age of 19 years by 57.7%. Based on the semester level, most of the samples had undernutrition and overnutrition~~abnormal nutritional status~~ in semester 1 of 48.8%. Based on place of residence, most of the students who lived with their parents had abnormal nutritional status as much as 59.5% (Table 3).

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Table 3. Distribution of Nutritional Status Based on General Characteristics of Adolescents in Palangka Raya City 2021

Characteristics	Nutritional Status						Total	
	Undernutrion		Normal		Overnutrition			
	n	%	n	%	n	%	n	%
Gender								
Man	6	20,0	18	60,0	6	20,0	30	100,0
Woman	23	27,4	32	38,1	29	34,5	84	100,0
Age (year)								
18	8	26,7	12	40,0	10	33,3	30	100,0
19	16	30,8	22	42,3	14	26,9	52	100,0
20	5	15,6	16	50,0	11	34,4	32	100,0
Semester								
1	13	23,6	28	50,9	14	25,5	55	100,0
2	10	26,3	16	42,1	12	31,6	38	100,0
3	6	28,6	6	28,6	9	42,9	21	100,0
Residence								
Parent	21	25,0	34	40,5	29	34,5	84	100,0
Boarding house~~Cost/contract~~	5	22,7	14	63,6	3	13,6	22	100,0
Another family	3	37,5	2	25,0	3	37,5	8	100,0

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Based on the proportion of physical activity of the sample, there were more respondents had moderate activity~~most of the samples have moderate activity~~ of 42.1%. ~~Meanwhile,~~ than the sample with less activity was 36.0% and excess~~over~~ activity was 21.9% (Table 4).

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Table 4. Frequency Distribution of Adolescent Physical Activity in Palangka Raya City 2021

Physical Activity	n = (114)	%
Less	41	36,00
Moderate	48	42,10
~~Over~~Excess	25	21,90

The results of the crosstabulation of physical activity with nutritional status in the sample (Table 5) show that the sample who has less activity has a bigger ~~risk of experiencing~~ susceptibility to being overweight/obesity (58.5%), while most of the samples with moderate activity had normal nutritional status (62.5%).

Table 5. Crosstabulation of Physical Activity with Nutritional Status in Adolescents in Palangka Raya City 2021

Physical Activity	Nutritionl Status						Total	
	Undernutrition		Normal		Overnutrition			
	n	%	n	%	n	%	n	%
Less	11	26,8	6	14,6	24	58,5	41	100,0
Moderate	12	25,0	30	62,5	6	12,5	48	100,0
~~Over~~Excess	16	24,0	14	56,0	5	20,0	25	100,0

DISCUSSION

1. Overview of Nutritional Status in Adolescent

Based on the results ~~of measurements of Body Mass Index (BMI) conducted on 114 students as research samples~~, it was found that most of the samples were malnourished (undernutrition 25.5% and overnutrition 30.7%) as much as 56.2% than the sample with normal nutritional status (43.9%). ~~had normal nutritional status of 43.9%.~~ Confinement due to the Covid-19 pandemic can influence dietary profiles especially those of adolescents, who are highly susceptible to acquiring bad eating habits. Social isolation during the pandemic-included lockdown/quarantine resulted in more severe effects on nutritional status. In a Dutch study, overeating, primarily through snacking, was reported in 20-32% of respondents during the pandemic whereas 7-15% reported behaviour predisposed to undernutrition by skipping warm meals. These changes in dietary habits have important implications for the health impact of the pandemic.[12] ~~This is in line with the research in Saudi Arabia conducted by Jalal et al (2021) where there are 46.0% of students who are able to maintain their weight (BMI) during their term lockdown Covid-19, while others students experienced weight gain (32.0%) and weight loss (22.0%).[13] Normal nutritional status can occur if the body gets enough nutrients that are used efficiently, so that the possibility of physical growth, brain development, and work ability reaches optimal levels.[14]~~

~~According to Irianto (2014), the factors that influence nutritional status include the level of education, family knowledge and skills. The higher the education, knowledge and~~

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~~skills of the family, the better the level of one's food security.[15] Students are defined as individuals who are studying at the tertiary level where they are considered to have a high level of intelligence, brilliance in thinking and planning in action.[16] Therefore, the number of respondents with normal nutritional status can be due to the better level of formal education of respondents which is a factor in determining whether or not someone easily absorbs and understands the nutritional information obtained, so that it affects the attitudes and behavior of respondents in meeting their nutritional needs.~~

This study also showed that there was an increase in nutritional status problems in the sample where ~~overweight~~overweight/obesity~~-~~ (30.7%) had a ~~greater~~ bigger proportion than undernutrition (25.5%). The research by Jia et al[13] (2020) conducted a national online survey in China with a sample of adolescents ~~with an average age range of 19.8 ± 2.3 years~~, it was found that the average BMI of adolescents increased significantly from 21.8 to 22.1 kg/m2 with the increasing prevalence of overweight (21.4%) and obesity (10.5%) as well as increased sedentary activity during the Covid-19 pandemic.[17] Nutritional problems in adolescents will have a negative impact on the level of public health, for example, a decrease in learning concentration, the risk of giving birth to a baby with low birth weight, and a decrease in physical fitness.[14,18] Meanwhile, a~~A~~ person who has poor nutritional status has a risk of infectious disease, ~~while someone who is~~whereas someone with overnutrition~~above normal weight~~ has a risk of degenerative disease.[15,19] ~~Students as late teens are the stage of the period that occurs the growth spurt, there are peak growth, body weight (peak weight velocity) and bone mass (peak bone mass/ PBM) where these changes will affect changes in body composition, rapid growth and physical activity so that it affects the nutritional needs of late adolescents.[20] Nutritional problems in adolescents arise due to poor nutritional intake, that is an imbalance between nutritional intake and the recommended nutritional adequacy.~~

Based on the distribution of the general characteristics of the sample, the results showed that most of the female respondents had ~~abnormal nutritional status~~nutritional problem (27.4% under~~mal~~nutrition and 34.5% overnutrition) compared to male respondents. ~~Genetic factors are the basic capital in achieving the results of the growth process.[21]~~ According to Putra[16] (2017) in his research shows that female students have 2 times the tendency to have ~~abnormal nutritional status~~nutritional problems than boys.[22] Based on age, ~~it was found that~~ the majority of respondents had ~~abnormal nutritional~~nutritional problems ~~status~~ at the age of 19 years (undernutrition 30.8% and overnutrition 26.9%). This study is in line with research in Botswana which revealed that nutritional status changes with age and

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level of study. This is because there are several lifestyle habits such as spending long time in front of the computer to do tasks, and the occurrence of stress that can increase or decrease a person's appetite.[17,23]

In addition, it was also found that most of the students who had ~~abnormal nutritional status~~ nutritional problems were at the first semester (23.6% ~~less~~ undernutrition and overnutrition 25.5%). ~~First year students are identified as students who have just felt the euphoria of the beginning of the lecture period.~~ First year students are faced with a big change in their lives, where there is a transition process from ~~a~~ senior in high school ~~(SMA)~~ to a new person in college~~.~~ that ~~This transition period~~ can be a stressful time for individuals entering early adulthood.[18]~~, where they experience a double transition, namely psychological and institutional development.[1,24] Therefore, stress is a vulnerable problem experienced by first year students.~~ The stressor for new students in the 2020/2021 academic year has increased with the Covid-19 pandemic situation which requires lecture activities to be carried out online. A study conducted by Sari[19] (2020) on 70 first-year nursing students at a Health Sciences College (STIKES) in Kediri showed that most students experienced moderate stress during online lectures. The impact of this stress will affect a person's nutritional status.[25]

Then based on the condition of residence, the majority of respondents who have ~~abnormal nutritional status~~nutritional problems are those who live with their parents (25.0% ~~less~~ undernutrition and overnutrition 34.5%). ~~The role of parents is needed to form good eating habits/ patterns for their children because parents have a very close role with them. In addition, parents also act as facilitators of good nutrition.~~ Sulistyoningsih[20] (2011) ~~states stated~~ that the role of parents is related to the nutritional status of children where the higher the role of parents, the better the nutritional status of children (normal), but on the other hand, if the role of parents is low, children tend to experience nutritional problems. In this case, parents can be role models about good eating habits so that it has an impact on their children's eating patterns.[26]

2. Overview of Physical Activity in Adolescent

The results showed that most of the samples had moderate physical activity ~~category~~ of 42.1%. ~~This research is in line with Delimasari (2017) which shows that the majority of students do moderate activities as much as 71.4%. In this study, respondents tend to do moderate activities such as sweeping, cooking, lifting light items, and walking.[27]~~ According to American College of Sports Medicine[21] (ACSM) (2015), physical activity is a positive behavior as a controller of energy balance, every body movement will cause an increase,

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expenditure, or burning of energy.[28] ~~High physical activity will break down energy in fat reserves to be used, but low activity will make fat reserves accumulate which causes an increase in a person's weight.~~[29]

Less activity in adolescence will tend to be less active in later life. This is one of the factors that cause obesity.[22][30] In this study, 36.0% of the samples had less~~mild~~ activity. This is in line as Unicef[23] (2021) reported that during the Covid-19 period there was 52.0% decrease in physical activity in adolescents compared to the pre-pandemic period. ~~Then it was reported that 33.0% did not do physical activity and another 25.0% were categorized as doing less than one hour of physical activity per week.~~ On the other hand, only 7% of teens engage in more than 6 hours of physical activity per week.[31] Study in UK conducted by Robinson et al[24] (2021) predicts that the lifestyle that occurs during the Covid-19 pandemic is overeating and low physical activity. This decrease in physical activity is due to the implementation of physical distancing/-lockdown thus limiting the movement of a person in order to prevent transmission of the virus.[32]

In this study, it was also found that 58.5% of samples with less activity had a bigger ~~risk of experiencing more nutritional status~~susceptibility to being overweight/obesity. ~~Physical activity is one of the causes that affect a person's nutritional status. Light physical activity will cause a decrease in fitness and the risk of obesity or obesityoverweight.~~ This is because a lot of energy is accumulated in the body and there is no burning of calories due to insufficient activity.[25][33] ~~Excess body weight is caused by an increase in energy stores in the form of fat tissue, usually in the abdominal cavity or hips, due to decreased energy use.~~[34] According to Condello et al[26] (2016), the combination of insufficient physical activity and high energy intake is responsible for overweight and obesity. The more active a person is in physical activity, the more energy is expended. Meanwhile, if the energy intake is excessive without being balanced by physical activity ~~balanced, it is easy for teenagers to be overweight~~adolescents will easily become overweight/obesity.[35] ~~Vertical (2012) suggests that low physical activity has a 3 times greater chance of causing overweight than heavy physical activity.~~[36]

According to ~~WHO (2016), physical activity is one of the determinants of a person's nutritional status.~~[37] ~~A Jordanian study by~~ Al-Hourani et al[27] (2021) revealed that during the period lockdown, the mean of weight and body mass index in children and adolescents showed a significant increase ($p<0.001$). In addition, it was also reported that more than 50% of subjects spent more than 3 hours in front of the screen and a significant increase in food

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consumption compared to before lockdown.[38] ~~Students as students now spend most of their time studying from home so they tend to spend hours sitting in front of the computer. In addition, the presence of lecture assignments is also a trigger for stress and poor food consumption patterns for students. This tends to lead to a lack of physical activity and increased stress. Research~~ Study by Philipouet al[28] (2020) found that weight gain during the Covid-19 pandemic was highly correlated with exercise, boredom caused by isolation, anxiety/depression, increased eating, consumption of snacks, and unhealthy foods such as cereals and sweets.[39]

Results of ~~research~~ study in Turkey by Yilmaz et al[29] (2020) on students affected by Covid-19 ~~stated~~ stated that there were significant changes both in terms of limitations in activities and behavior in buying food. Most of the students admitted that they had increased the amount of food and snacks they consumed during the pandemic compared to their pre-pandemic habits.[40] ~~According to Putra (2017), this indicates that light physical activity allows the energy consumed not to be expended through physical activity and the energy will form fat. Different results are found in respondents with strenuous physical activity which allows the energy that enters the body to be released through physical activity so that fat is not formed in the body.[22]~~ Based on the findings of ~~research results~~study in Poland ~~by Glinkowska & Glinkowski~~ (2018) stated that the risk of obesity or overweight in adolescents who are not active in physical activity can increase 2 times ($p<0.01$).[30][41] This is in accordance with the theory of Nhantumbo et al[31] (2013) which revealed that someone who has excessive body weight but has good activity is very likely to have a normal nutritional status than someone who has normal nutritional status but is not healthy due to low physical activity.[42]

CONCLUSION

Currently, the Covid-19 pandemic is becoming a major topic of conversation around the world because of its impact on changes in aspects of life, especially health. The basic result of this study was the decline of physical activity has major impact on nutritional status of adolescents. The results also showed that the majority of samples with poor activity have a bigger susceptibility to being overweight/obesity, while the majority of samples with moderate activity have normal nutritional status.

~~Currently, the Covid-19 pandemic is becoming a major topic of conversation around the world because of its impact on changes in aspects of life, especially health. The conclusion in this study was that 43.9% of adolescents were able to maintain their nutritional status. In addition, it was also found that there was an increase in nutritional status problems~~

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~~in adolescents, there are 30.7% experienced an increase in BMI and 25.5% experienced a decrease in BMI where both susceptible to various health problems. Based on physical activity, it was found that the majority of adolescents had moderate physical activity of 42.1%. But on the other hand, there are 36.0% of adolescents who experience an increase in light activity which can be one of the factors causing obesity in adolescents.~~

This research is expected to be a forum for increasing information and motivation to always make efforts to improve public health status, especially during this Covid-19 pandemic. For the government, it is hoped that this research will become a reference in its seriousness in responding to the presence of the Covid-19 pandemic so that it is able to intervene through an effective and efficient approach in handling health nutrition problems, especially for adolescents. It is also hoped that this research can contribute or become a reference material in the development of further research, such as by analyzing other factors that trigger changes in a person's nutritional status.

~~**It is highly recommended to ask for english editor/ proof reading of the paper before submission. please use correct terminology in nutrition field**~~

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