

# Level of physical activity, body mass index (BMI), and sleep patterns among school students

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**Submission date:** 27-Apr-2022 09:07AM (UTC+0700)

**Submission ID:** 1821440723

**File name:** 13.\_M.\_Akbar\_Husein\_Allsabah\_OK.docx (234.45K)

**Word count:** 7589

**Character count:** 43356

# Level of physical activity, body mass index (BMI), and sleep patterns among school students

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Received: 27 November 2021; Accepted 07 April 2022; Published 27 April 2022  
Ed 2022; 7(1): 134-147

## ABSTRACT

During the current pandemic, the pattern of activity, lifestyle, and sleep quality of students at the school level has changed due to the Covid 19 outbreak which required students to reduce their activities outside the home. The purpose of this study was to find out the level of physical activity, body mass index (BMI), and sleep patterns Junior High School (SMP) and Senior High School (SMA) students of Kediri City and District. This study uses quantitative qualitatively described methods. The subjects of this study are 548 participants of the Junior High School (SMP) and Senior High School (SMA) in Kediri City and District. Instruments in this study for physical activity levels use IPAQ (International Physical Activity Questionnaire) questionnaires, body mass indexes using BMI questionnaires, and sleep patterns using the Pittsburgh Sleep Quality Index (PSQI) questionnaire. The results of this study show that physical activity levels of 81% fall into the Moderate category, Body Mass Index by 63% falls into the Normal category, and sleep patterns by 83% fall into the bad category. The results of this study have limitations on certain levels of education and a limited number of samples who perform new habits due to the Covid-19 pandemic. The results of this study show the real impact of the Covid-19 pandemic for school students, so in the future there needs to be a research study that can overcome the impact of the pandemic on students, namely regarding health and lifestyle.

**Keywords:** Physical activity; body mass index; sleep patterns; covid-19



[https://doi.org/10.25299/sportarea.2022.vol7\(1\).8188](https://doi.org/10.25299/sportarea.2022.vol7(1).8188)

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**How to Cite:** Sugito., Allsabab, M. A. H., & Kurniawan, B. T. (2022). Level of physical activity, body mass index (BMI), and sleep patterns among school students. *Journal Sport Area*, 7(1), 134-147. [https://doi.org/10.25299/sportarea.2022.vol7\(1\).8188](https://doi.org/10.25299/sportarea.2022.vol7(1).8188)

**Authors' Contribution:** a – Study Design; b – Data Collection; c – Statistical Analysis; d – Manuscript Preparation; e – Funds Collection

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## INTRODUCTION

Coronavirus disease 2019 (Covid-19) is a terrible disaster that has ever experienced by mankind. Covid-19 is a number of viruses originating from the subfamily Orthocoronavirinae in the family coronaviridae and the order Nidovirales (Britton & Marais, 2020). Covid-19 is a new type of disease that has never been identified before in humans. Covid-19 comes from the genus betacoronavirus, which is the same genus as the causative agents Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS) (Trindade et al., 2020). This Covid-19 outbreak can attack animals and humans whose symptoms are in the form of infections similar to SARS and MERS disease and in humans the symptoms are in the form of infections that are more massive in development. Covid-19 is an outbreak that affects almost

all countries, many victims who contracted this virus. The Covid-19 virus has resulted in 250,000 deaths while in hospital in countries around the world such as Asia, the Americas, Europe, Australia, and Africa. Calculated according to de Souza et al. (2020) the Covid-19 pandemic has recorded up to 25 million cases and the death toll reached 850 thousand in 213 countries. Covid-19 outbreak began in China, Covid-19 outbreak began in China, Wuhan (Rothan & Byrareddy, 2020). Initially Covid-19 which was previously known as 2019-nCoV has attracted worldwide attention, recorded on January 30, 2020 World Health Organization (2020) declared COVID-19 as a public health emergency of international concern.

The Covid-19 outbreak is getting bigger as the number of Covid-19 cases is rapidly infecting people and the outbreak is spreading throughout the country. Recorded until March 25, 2020, it was recorded that the number of cases detected infected with the outbreak amounted to 414,179 with 18,440 deaths (CFR4.4%) where the cases originated in 192 countries / regions. These cases included several health workers who were reportedly infected (Kementerian Kesehatan Republik Indonesia, 2020). Covid-19 also hit the country of Indonesia, on March 2, 2020 in the country of Indonesia recorded the first case of the Covid-19 outbreak with the discovery of 2 patients infected with the Covid-19 virus with symptoms that correspond to the signs of the Covid-19 outbreak such as fever, cough, and shortness of breath (Djalante et al., 2020). The Covid-19 virus is transmitted from animals that transmit humans, followed by human-to-human spread (Wu et al., 2020). Furthermore, from some patients who have been tested for radiography, it can be known that the patient was detected to have changes in his lungs, the average number of lymphocyte cells and platelets of patients showed lower results and accompanied hypoxemia (Huang et al., 2020). According to Kementerian Kesehatan Republik Indonesia (2020), Covid-19 is spread from person to person through coughing and sneezing (droplets). People who are in close contact with Covid-19 patients are most at risk of catching the disease. Symptoms of acute respiratory diseases such as fever, cough, and shortness of breath are common after a Covid-19 infection. The average incubation period is 5-6 days, with fever, cough, and shortness of breath occurring throughout this time. Pneumonia, acute respiratory syndrome, kidney failure, and even death have been reported in patients who have been exposed to Covid-19 (Rothan & Byrareddy, 2020). Prevention of transmission of this virus can be done through the use of several steps that can be done, including by covering the nose with elbows when sneezing and the use of masks and doing physical distancing (Ivbijaro et al., 2021). The use of masks in this pandemic is considered very important to be done as a preventive measure to prevent contracting the Covid-19 outbreak. The Government of Indonesia in tackling the covid-19 virus outbreak is handling social restrictions (social distancing) (Setiati & Azwar, 2020).

Furthermore, the Government instructs each school through the local government to replace teaching and learning activities in the classroom with online learning activities, including universities and other educational institutions (Setiati & Azwar, 2020). This is in the background with government rules that implement physical distancing policies or maintain distance and strict health protocols require a person to better calculate his activities at home and do all his activities from home. Physical distancing enacted by the Government of Indonesia has the aim to break the chain of transmission of the Covid-19 pandemic because the move requires the public to maintain a safe distance with other humans at least 2 meters, not make direct contact with others and avoid mass gatherings (Sobana, 2020). Physical distancing and Work From Home (WFH) that has been recommended by the Government of Indonesia, especially students, tend to be less mobile, so they tend to stay silent rather than actively (Al-Nakeeb et al., 2015; Fernström et al., 2020). This is based on previously doing face-to-face learning before the Covid-19 pandemic students actively do their activities to study in school to learn or play with friends as if to change with activities that are only in front of the laptop or gadgets to do distance learning through the internet and activities are limited to limit contact with others.

A study stated that during the Covid-19 pandemic, the average person experienced a decrease in the frequency of physical activity, especially sports activities during quarantine at home only (Castañeda-Babarro et al., 2020; Hemphill et al., 2020). In addition to learning patterns that change student activities to be more passive. This will be risky to students because they can experience sedentary lifestyle so that it makes a negative impact on him (Rodríguez-Larrad et al., 2021; Spencer et al., 2020). Not doing motion or

not doing activities can be bad for a person's health because with lack of movement makes the risk factor of contracting cardiovascular disease (Mekonen et al., 2021). Other problems exist in overeating causing obesity or making the body not ideal and causing non-communicable diseases such as diabetes, high blood pressure, heart disease, stroke, and cancer (González et al., 2017; Lavie et al., 2019; Park et al., 2020). Learning activities carried out at home make students become less in doing physical activity and increasing food consumption (Coughenour et al., 2021). Studies conducted Jalal et al. (2021) students who do independent learning at home with guidance by teachers through online learning increase the consuming of food so that the student's weight becomes uncontrolled. Another study Srivastav et al. (2021) by doing online learning found a disproportionate increase in BMI in students, this is due to students doing monotonous activities without doing physical activity and controlling the food consumed. The purpose of regulating food consumption is to maintain the ideal proportion of the body it can be seen from the weight and height that a person has. Research conducted Bertrand et al., (2021) and Romero-Blanco et al. (2020a) it stated that during the Covid-19 pandemic the ideal proportion of student bodies in the school sphere decreased in category compared to before the COVID-19 pandemic.

The impact of the Covid-19 pandemic also resulted in sleep patterns being disrupted, with the need to do activities at home making students become busy with learning activities at home. Especially the Covid-19 pandemic makes students become stressed, feeling scared because the virus is lurking at any time (Dunton et al., 2020; Durankuş & Aksu, 2020; Schmidt et al., 2021; Zengin et al., 2021). Uncertain circumstances, fear, and reduced interaction and entertainment make increased levels of stress, anxiety, or depression. Research reveals that in Canada, it was found that more than 50% of the 5000 people with study subjects had experienced significant sleep problems since the pandemic began to strike (Best et al., 2021). Research from Şengül, and Bulut (2020) 16% of the 1005 people involved in the study, and in the study 41% were users of new sleeping pills since the lockdown began (Beck et al., 2021). In France, the problem of sleep disorders peaked after 2 weeks of lockdown, the disruption detected was initially 49% in the period before the pandemic in 2017, and at the time of the pandemic to 74% (Niela-Vilen et al., 2021). Disruption in sleep patterns can be caused also through exposure to news that comes from the mass media or comes from social media makes one of the causes of a person experiencing sleep disorders. During the Covid-19 pandemic there was a lot of news in various mass media that focused on the news of Covid-19 (King et al., 2020; Lokhandwala et al., 2021). The existence of the news makes sleep problems and depression will be higher, especially in adults (Facer-Childs et al., 2021; Lokhandwala et al., 2021; Smirnova et al., 2021). Disruption of sleep patterns in addition to the pandemic there are several other factors such as reduced physical activity and changes in daily schedule (Sadeh et al., 2000; Tikotzky & Sadeh, 2001). Lifestyle in students is very important and can determine the development of health levels. Physical activity that should be done at a moderate intensity for 30 minutes/day and done as much as 3 x a week will have a positive impact on health significantly (Rodríguez-Larrad et al., 2021). According by Castañeda-Babarro et al. (2020), lack of physical activity is in the top four causes of death after hypertension, diabetes, and smoking. In addition, almost half of the population in Indonesia with the age group over 10 years, 42% are classified as still having behavior lacking in physical activity or sedentary behavior (Risikesdas, 2018).

So far, many previous researchers have conducted the research about description of the effect of COVID-19 pandemic, however, there have not been other researchers who have discussed about effect of the pandemic on students toward physical activity, Body Mass Index, and sleep pattern in Junior High School and Senior High School. So for that the research that will be carried out will measure physical activity, Body Mass Index, and sleep patterns in students of Junior High School and Senior High School in Kediri City and District, where from the data taken can describe the level of physical activity, body mass index, and sleep patterns owned by students of Junior High School and Senior High School in Kediri City and District.

## METHOD

The methods used in this research are case studies and field research. The research design aims to know intensively about the background of a current situation regarding lifestyle and its relationship to the environment in a social unit be it individually, group, or society. The results of the research conducted are a

complete and organized picture based on data that can be directly in the field. The research subjects in this study are Junior High School and Senior High School students located in Kediri City and District with the overall sample number were 548. The criteria that do not qualify (exclusion criteria) are in addition to junior and Senior High School students in Kediri City and District.

The study volunteers measured their physical activity by filling out an online paper-based questionnaire, the short form International Physical Activity Questionnaire (IPAQ), which has been validated. Furthermore, body mass index (BMI) is computed using the formula of weight in kilograms divided by height in square meters (kg/m<sup>2</sup>), and this measurement is carried out utilizing an online questionnaire. These figures fill in the gaps in their weight and height measurements in their separate homes. Obesity II, Obesity I, Overweight, Normal, and Underweight are the five categories of BMI. The Pittsburgh Sleep Quality Index (PSQI) questionnaire is used to assess sleep quality. PSQI is a sleep quality questionnaire that categorizes excellent and unsatisfactory sleep quality over the previous month. The study was conducted from October to November 2021. Analysis of the data collected is done using SPSS 25.

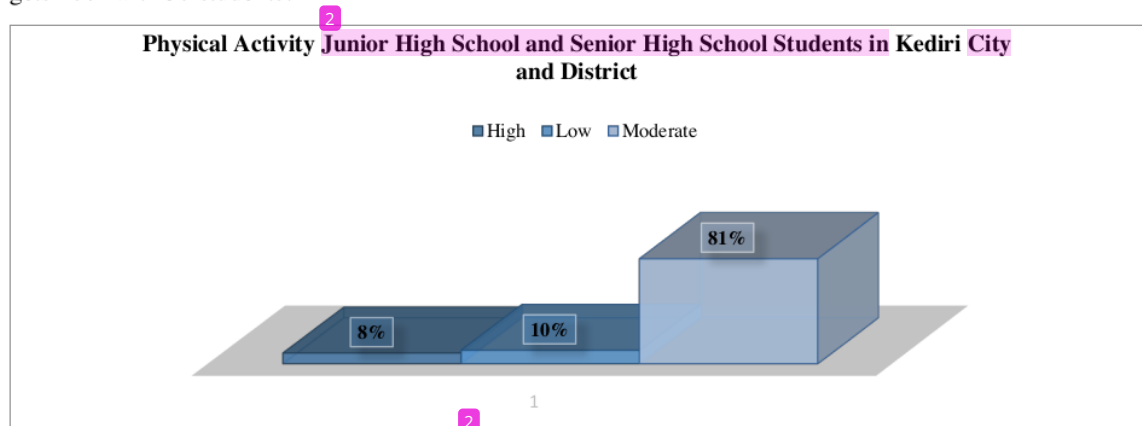
**RESULTS AND DISCUSSION**

Overall, the subjects in the study totaled 548 students, consisting of 319 students with a male gender or 58%, and 229 students with a female gender or 42%. The entire sample is Junior High School and Senior High School students in Kediri City and District. Here is a data on physical activity that has been done on the research subjects of Junior High School students and Senior High School in Kediri City and District numbering 548 using the International Physical Activity Questionnaire (IPAQ).

**Table 1. Description Of Physical Activity Data of Junior High School and Senior High School Students of Kediri City And District**

Variable	N	Minimum	Maximum	Mean	SD
Physical activity Student	548	386	3570,5	3624,7	5757,93

Physical activity data of Junior High School and Senior High School students in Kediri City and District obtained a minimum score of 386, a maximum score of 3570.5, a mean score of 3624.7, and an elementary school score of 5757.93. In figure 1 shows the overall level of physical activity obtained by middle school students and high school students with low, moderate, and high categories. The results obtained each is, the high category gets 8% with 45 students, the moderate category gets 81% with 446 students, the low category gets 10% with 57 students.



**Figure 1. Category of Physical Activity of Junior High School and Senior High School Students in Kediri City and District**

The results of this study show that the amount of physical activity carried out by students with a percentage of 81% falls into the category of moderate activity, which means that in Junior High School and Senior High School students in Kediri City and District are categorized as moderate. The findings in this study are in accordance with what is done by the ministry of health which said that 42% of the population over the age of 10 years have sedentary behavior (lack of physical activity) (Direito et al., 2015). On research of Hay et al. (2012), students spend 69.6% of their time sedentary, 22.9% do light physical activity, and 6.8% do normal physical activity, and 0.6% do physical activity vigorously. In addition to research Yaméogo et al. (2017) mentions the age of 12 years and above has a decrease in the intensity of doing physical activity compared to the age of 12 years and under. Decreased physical activity that afflicts children due to sedentary living behavior, dominant activities carried out in the room, use of motor vehicles, and excessive use of gadgets. If this is left alone, it can affect their health condition in the future.

The results of this study show the impact of the covid 19 pandemic makes a decrease in physical activity carried out by someone, because in this covid 19 pandemic students are busy with online learning that makes students reduce their physical activity. This is in line with the research Maugeri et al. (2020), stated that quarantine in Italy induces a significant reduction of total weekly physical activity energy expenditure in all age groups and especially in men, and this reduction negatively affects the psychological well-being. Similarly, it is conveyed Woods et al. (2020) stated that in the condition of the covid-19 pandemic requires people in a country to reduce their activities, so that the community lives a sedentary life so that the activity can harm itself. As a result of the COVID-19 pandemic, families expressed a shift toward unstructured play, loss of social opportunities, and anxieties related to adapting to safety protocols (Pelletier et al., 2021). In fact, physical activity has a very positive impact on psychological health, by increasing self-esteem and resilience to stress that triggers depression and anxiety. Given the spread of COVID-19, stay at home is a fundamental step to stop the pandemic. Doing physical activity every day can actually overcome the covid 19 virus, according to research (Füzéki et al., 2020; Stockwell et al., 2021) explained by doing physical activities can increase immunity in a person, by doing the right dose by doing physical activity can increase happiness, immunity, and of course health for each individual during the covid 19 pandemic.

The World Health Organization (WHO) warns that lack of physical activity increases health risks and lack of physical activity. The risk of lack of physical activity is a decrease in body capacity, with this decrease in body capacity makes the body stricken with dangerous diseases (Vernaza-Pinzón et al., 2017). Doing regular physical activity in one day at least doing for 30 minutes can improve the health and mood of someone who does physical activity (Kim & Lee, 2017). Currently, there are many cases of heart disease, respiratory, diabetes, hypertension, and others in addition to dietary factors, lack of physical activity, and many factors both from inside and outside the patient's body (Harada et al., 2018; Lowry et al., 2021; Yarb et al., 2006). Maintaining high levels of physical activity from children to adults on a regular basis is associated with a lower risk of obesity and is most at risk in women than men (Harada et al., 2018). Table 2 is a description of body mass index data in Junior High School and Senior High School students in Kediri City and District. A total of 548 students filled in data on height and weight as body mass index category scores.

Table 2. Description of Body Mass Index data of Junior High School Students and Senior High School Students of Kediri City and District

Variabel	N	Minimum	Maximum	Mean	SD
Body Mass Index Student	548	165	342	224,77	19,241

Figure 2 shows body mass index in all Junior High School students and Senior High School students with categories Obesity II, Obesity I, Overweight, Normal, Underweight. The results obtained by each subject were, the Obesity category II got 0% with 2 students, the Obesity category I got 4% with 23 students, the Overweight category got 30% with 166 students, the Normal category got 63% with 345 students, the Underweight category 2% with 12 students.

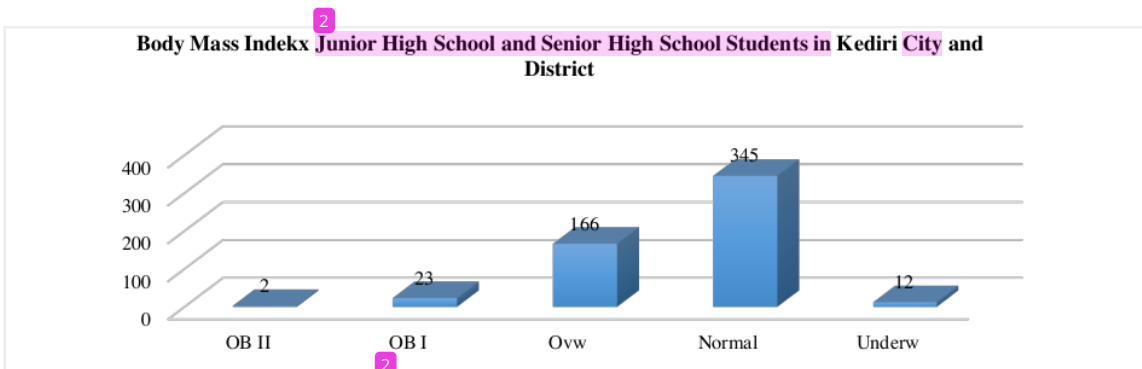


Figure 2. Body Mass Index Value Of Junior High School And Senior High School Students In Kediri City and District

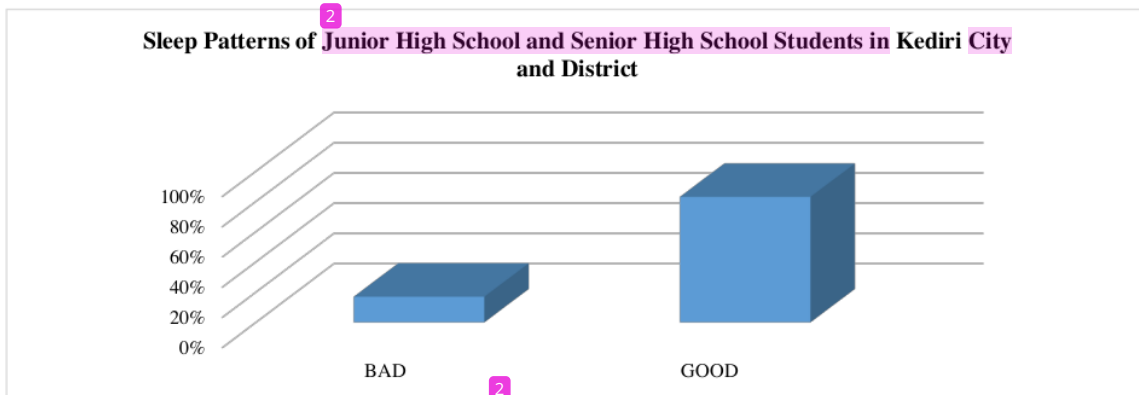
The body mass index shows results that the number of BMI performed by students with a percentage of 63% falls into the Normal category, which means that in Junior High School and Senior High School students in Kediri City and District are categorized as normal. In the results of this study on the body mass index at the time of the covid 19 pandemic in students is at a normal level, this is based on existing research in various countries that during covid 19 this has increased due to various things such as sedentary lifestyle, consuming food out of minimal proportion, and lack of physical activity at all times (Brooks et al., 2021). The results of this study are in line with Di Renzo et al, (2020) which states the perception of weight gain was observed in 48.6% of the population, whereas a slight increased physical activity has been reported in 38.3% of respondents, especially for bodyweight training. Interestingly, the population group aged 18–30 years resulted to have a higher adherence to the MD when compared to the younger and the elder population. Moreover, 15% of respondents turned to farmers or organic purchasing groups for fruit and vegetables, especially in the North and Center of Italy, where BMI values were lower. Another positive result is the percentage reduction in smokers by 3%. However, as the COVID-19 pandemic is still ongoing, our data need to be confirmed and investigated in future larger population studies. Auny et al. (2021) emphasize how important the role of physical activity and normal BMI status is to minimize the COVID-19-related psychological burden and suicidal behavior. As an exploratory study investigating the role of BMI status and physical activities, and their changes in psychological health, the findings may help facilitate further studies and help policy-makers establish appropriate strategies. It is very important in monitoring body mass index at the time of pandemic because body mass index is the most important thing in human development, besides body mass index is the most urgent thing in pandemic covid-19.

The findings in this study are in accordance Bhasin et al. (2020) patients with a young age who are hospitalized with covid-19 tend to have a higher BMI than older patients who are hospitalized with a diagnosis of Covid-19 virus infection. It is very clear that a high BMI is one of the factors a person can be exposed to the Covid-19 virus, this is reinforced by research Du et al, (2021) there is an interrelated relationship between someone who has a high BMI/ obesity rate is associated with a significantly increased risk of Covid-19, and significantly death from Covid-19. Another factor that may explain the link between the condition and the adverse outcomes of COVID-19 is that obesity has a negative effect on the immune system and the body's defense mechanisms (Frasca & McElhaney, 2019). Research by Khasawneh et al, (2020) patients who have an obese body shape and are exposed to the Covid-19 virus cause symptoms caused by the covid-19 virus longer than patients who have a normal body, and found the fact that the age of children vulnerable to early obesity. It is important to have a BMI in the normal category, because with it keeps the body awake in a fit state and easy to do activities without feeling fatigue (Breland et al., 2021). Table 3 is a description of sleep patterns data in Junior High School students and Senior High School in Kediri City and District. The students who participated are 548 students by filling out the Pittsburgh Sleep Quality Index (PSQI) questionnaire.

**Table 3. Description of Sleep Patterns of Junior High School and Senior High School Students of Kediri City and District**

Variabel	N	Minimum	Maximum	Mean	SD
Students Sleep Patterns	548	3	12	7,49	1,743

Figure 3 displays sleep patterns in junior school and Senior High School students by filling out a Pittsburgh Sleep Quality Index (PSQI) questionnaire that categorizes sleep quality into both good and bad categories. The results of the student sleep pattern category are, the good category got 17% with 93 students, the bad category got 83% with 455 students.



**Figure 3. Category Sleep Patterns of Junior High School and Senior High School Students of The City and Kediri Regency**

Student sleep patterns shows with a percentage of 83% fall into the bad category, which means that in Junior High School and Senior High School students in Kediri City and District are categorized as bad. The poor sleep pattern is caused by the covid-19 pandemic that is currently endemic in all countries. In the covid-19 pandemic by doing lockdown regulations for the community is closely related to sleep schedules and quantity with the quality of night sleep, this causes psychological pressure so that sleep patterns can be disrupted (Gupta et al., 2020). The current Covid-19 pandemic is causing psychosocial problems such as stress, worry, fear, anxiety, symptoms of depression, and sleep disorders (Romero-Blanco et al., 2020b). This happens because the public becomes anxious about the pandemic and the fear of contracting the Covid-19 virus is currently spreading. Many activities during the Covid-19 pandemic became disrupted such as irregular sleep patterns, screen time with very intense duration, and sedentary behavior (Ranjbar et al., 2021). When the covid-19 pandemic plagues people the duration of a person to sleep becomes less, this happens because they feel depressed about the state of the virus that spreads the disease has not stopped (Sañudo et al., 2020). Sleep or rest activities are needed by students to support their development with sufficient time, the time recommended by WHO states that children to adolescents need a break time in one day for 7-8 hours. Recommendations from WHO at the time of the Covid-19 pandemic could not be made, according to the study Becker et al, (2021) adolescents who get night sleep duration shifted to 57% from before covid-19 attacked by 64%. Sleep patterns must be considered for all of us to be able to regulate it during this pandemic, because if it lacks time to rest it results in the body not fit and difficult to get immunity (Dai et al., 2021).

## CONCLUSION

The results of this study are from 548 samples, physical activity carried out by students with a percentage of 81% falls into the category of moderate activity, which means that in Junior High School and Senior High School students in Kediri City and District are categorized as moderate. The body mass index shows results that the number of BMI performed by students with a percentage of 63% falls into the normal category,

which means that in Junior High School and Senior High School students in Kediri City and District are categorized as normal. Student sleep patterns showed with a percentage of 83% fall into the bad category, which means that in Junior High School and Senior High School students in Kediri City and District are categorized as bad. The results of this study have limitations on certain levels of education and a limited number of samples. So in the future it is necessary to pay attention to all levels in the unit of education organizers such as vocational schools or religious schools, because the impact of changes in learning habits in the covid-19 pandemic is felt by all students at the level of formal education held by the Indonesian country. The contribution of this study can find out the condition of students during the covid-19 pandemic with new habits, namely home study activities, so this study is a reference for the relevant education department to pay attention to the condition of students affected by new habits in the covid-19 pandemic.

The results and discussions on the research that have been explained can be concluded in the Covid-19 pandemic causing various impacts, such as on the education sector. The learning process is carried out independently through online learning conducted at the home of each student. Working from home makes student activities become disturbed students who used to be active become passive, do monotonous activities such as sitting with gadgets for a long time in addition to the student's body mass index becomes uncontrolled, and students' sleep patterns are disrupted during the Covid-19 pandemic. 3 factors that make the effects of the Covid-19 pandemic for students can be described these factors in Junior High School and Senior High School students in Kediri City and District in this study recorded physical activity in the moderate category of 81% (446 students), Body Mass Index falls into the normal category of 63% (345 students), and sleep patterns fall into the category of bad 83% (455 students). The results of this study should be of particular concern to each element in order to take action so that the effects of the Covid-19 pandemic do not enlarge.

#### ACKNOWLEDGMENT

The study used primary data from those obtained by field surveys using original data. We are grateful to the Education Office, and the Research Partner schools for their participation in being respondents who have provided free data access and answered surveys, and thank you to LPPM (Institute for Research and Community Service) Universitas Nusantara PGRI Kediri for the assistance in carrying out this research.

#### CONFLICT OF INTEREST

The author stated that there is no conflict of interest in this manuscript. We know of no conflicts of interest associated with this publication, and there has been no significant financial support for this work that could affect the outcome. As a suitable author, I confirm that the manuscript has been read and approved to be submitted by all the authors mentioned.

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