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Relationship between level of physical activity and body mass index among senior high school students

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ABSTRACT

Background: The development of the times causes technology to also experience development. As a result, many activities that previously required excess energy can now be easily done and also more practical. On the other hand, the development of this technology has a bad impact, where a person becomes less active in carrying out his daily activities, which can affect his lifestyle. Low physical activity can have an impact on body mass index that becomes not ideal. The purpose of this study was to analyze the relationship between physical activity level and body mass index in students of senior high school.

Methods: This study used the cross-sectional design. The research was conducted offline or directly in the field.

Results: The results of *Spearman's rho* correlation test showed a value of $p = 0.000$ ($p < 0.05$) and a correlation coefficient value of -0.502.

Conclusion: There is a significant relationship between physical activity level and body mass index in students of senior high school with sufficient correlation strength. The value of the correlation coefficient shows negative results which indicate a unidirectional relationship between the two variables, where the lower the level of physical activity, the higher the value of a person's body mass index and vice versa.

Keywords: body mass index, senior high school, lifestyle, physical activity, technology.

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INTRODUCTION

The development of the times causes technology to also experience development. As a result, many activities that were previously carried out using large energy can now be done easily and more practically. Technological advances can accelerate the work done and of course activities that require human physical contribution are decreasing. World Health Organization (WHO) explains the definition of physical activity as any movement of the body, especially coming from muscles and skeletons that release energy, for example walking, doing housework, exercising and so on. There are several groupings of physical activity, namely light physical activity such as walking and watching, moderate physical activity such as brisk walking and playing music, and heavy physical activity such as exercise or aerobics.[1]

Doing activities regularly can have a positive impact on one's health which is able to launch blood circulation and metabolism, so that sleep quality is better.[2] Doing physical activity will certainly require energy that is not the same between activities. This adjusts to the length of intensity and muscle performance. Body Mass Index (BMI) and physical activity are two things that are related. Less physical activity can encourage the accumulation of energy in the form of fat in the body. Quoted from WHO, exercise or physical activity should be done at least 30 minutes in one day or 150 minutes in one week. Low physical activity on an ongoing basis will of course cause an increase in BMI.[3]

BMI which is also known as Body Mass Index is a benchmark in determining a person's weight status. BMI can be measured through weight and height measurements.[4] According to data from the Rikesdas in 2018 shows that as many as 21.8% of the Indonesian population aged >18 years is obese. Bali Province recorded an obesity incidence of around 23.3% which occurred at the age of >18 years. The average >18 year old in Bali is higher obese than the average >18 year old who is obese in Indonesia.[5]

According to several studies, physical activity categories are quite common in the Indonesian population at the age of 16-18 years, which is 9.0%, while minimal physical activity in Indonesian residents is stated to be 48.2% aged around 16-18 years or high school students. Teenagers both in big cities and villages have actively used the use of technology. This progress of course makes it very easy for them to do activities such as visiting friends' houses or going to school where in the past people were still walking or cycling, now it has been facilitated by going by using a vehicle. In addition, technological advances such as the use of smartphones also greatly affect a person's activity level, where teenagers now prefer to play games,

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watch videos on their electronic devices rather than having to go outside the house to just take a walk. These technological advances certainly result in a person becoming lazy and lacking in physical activity such as walking, exercising, or doing daily activities. This of course can lead to the emergence of the risk of non-communicable diseases in the future.[6]

Bali is one of 15 provinces with an obese population aged 16-18 years above the national average of 11.6% and the mortality category of 3%.[7] Lack of physical activity followed by unbalanced nutrition certainly results in energy that accumulates in the form. This certainly has the potential to cause abnormal BMI. Seeing this, it is known that if less physical activity will cause body fat deposits to accumulate, so that if someone who is lazy to move will lead to obesity.[8] So it can be known that physical activity has an important role in maintaining normal BMI.

The selection of samples at senior high school was carried out because according to data from Riskesdas in 2018 in Karangasem, the prevalence of obesity reached 8.1% and obesity as much as 5.2%.[5] In addition, the population is heterogeneous, that is, open and receptive to information. The location of this school is at the eastern end of Karangasem and is in one of the villages in Karangasem, and the school has never carried out similar research, so this can be one of the advantages and reasons for this research. The purpose of this study was to analyze the relationship between physical activity level and BMI in students of senior high school.

METHODS

This study is an analytical observational study using cross-sectional studies. The study was conducted in September 2022 at senior high school. Sample selection using *purposive sampling* method. The inclusion criteria for this study are students of senior high school 3 Amlapura, Bali, Indonesia aged 15-18 years and willing to complete *informed consent* as proof of willingness to be a research sample. The exclusion criteria are using a walker and being an athlete. The number of samples obtained was 47 people. The independent variable of this study is physical activity and the dependent variable is BMI. The variable controlled is age. The age range of the sample is 15 to 18 years known from the student card.

Physical activity can be measured by the *International Physical Activity Questionnaire* (IPAQ). IPAQ classifies physical activity into heavy category (≥3000 MET minutes/week), moderate category (≥600 MET minutes/week), and low category (<600 MET minutes/week).[9]

BMI is measured by the formula of body weight (kg) divided by height squared (m 2) so that then the results use units of kg / m^2. The measuring instruments used are scales and microtoise. How to measure through measuring weight with a scale and height measured with microtoise.[10] Then the BMI is searched according to the formula and matched with the BMI classification table based on the Ministry of Health of the Republic of Indonesia 2018. There are 5 BMI categories consisting of BMI < 17 which is underweight (underweight), BMI 17.0-18.4 which is mild underweight (underweight), BMI 18.5-25.0 which is normal, BMI 25.1-27.0 which is light overweight (fat), and BMI >27.0 which is overweight (fat).[11]

There are 3 types of data analysis in this study, namely univariate analysis, normality test, and bivariate analysis. Variables with univariate analysis include physical activity, BMI, and age which aims to determine the distribution and percentage of each variable. Furthermore, a normality test is carried out to determine whether the data is normally distributed or not, where the distribution of normal data is one of the requirements in using parametric tests. The test used is the *Shapiro-Wilk* test. After knowing the data is normally distributed or not, bivariate analysis is then carried out using the *spearman* correlative test because the results show the data is abnormally distributed. The purpose of bivariate analysis is to know and identify the relationship between independent as well as dependent variables.

RESULTS

From a total of 47 respondents, the descriptive characteristics of the respondents in this study were obtained, namely age, gender, BMI, and physical activity can be seen in the following table.

Table 1 explained that of the 47 samples, the majority had the age of 16 years, which was 16 people (34%) and was dominated by samples with female sex, namely 27 people (57.4%). Then, the majority of physical activity in the sample was in the moderate physical activity category (≥600) as many as 23 people (48.9%) and if differentiated according to sex still the majority of the sample had moderate physical activity (≥600). Judging from the Body Mass Index, the majority of the study sample was in the normal category with BMI values of 18.5-25 as many as 31 students (66.4%) and if distinguished based on male and female gender, the normal category BMI still dominates.

Based on Table 2. It is known that the *p-value*<0.05 (0.000) in the physical activity variable and the BMI

variable with a *p-value*<0.05 (0.037), which means that the two variables are abnormally distributed.

Based on Table 3. obtained a value of p= 0.000 (p< 0.05) and a correlation coefficient value of -0.502 which indicates that the level of physical activity is related to BMI with sufficient strength. The value of the correlation coefficient shows a negative result where there is an undirected relationship between the two variables. The lower the level of physical activity possessed, the higher the value of a person's BMI, and vice versa.

Table 1. Characteristics of Research Samples

Characteristic	Frequency (n)	Percentage (%)
Age		
15	11	23,4%
16	16	34%
17	14	29,8%
18	6	12,8%
Gender		
Man	20	42,6%
Woman	27	57,4%
Physical activity (total)		
≥3000	9	19,2%
≥600	23	48,9%
<600	15	31,9%
Physical activity (male)		
≥3000	7	35%
≥600	9	45%
<600	4	20%
Physical activity (female)		
≥3000	2	7,4%
≥600	14	51,9%
<600	11	40,7%
Body Mass Index (total)		
<17	3	6,3%
17,1-18,4	4	8,4%
18,5-25	31	66,4%
25,1-27	5	10,5%
>27	4	8,4%
Body Mass Index (male)		
<17	-	-
17,1-18,4	2	10%
18,5-25	14	70%
25,1-27	2	10%
>27	2	10%

Table 2. *Shapiro-Wilk* Normality Test

Variable	Sig
Physical Activity	0,000
Body Mass Indeks	0,037

Table 3. *Spearman's rho* Correlation Test of Physical Activity Level with Body Mass Index

Variable Correlation	p
Physical Activity Level with Body Mass Index	0,000
Physical Activity Level with Body Mass Index	

DISCUSSION

The total number of student participants in this study was 47 people with 27 female students (57.4%) and 20 male students (42.6%) from grades 10-12. In this study, the students who attended were taken initial measurements in order to meet the criteria for exclusion and inclusion. Participants in this study were dominated by 16 years old as many as 16 people and had a percentage of 34%. The age of 17 years is 14 students (29.8%), 15 years old is 11 students (23.4%), and the age of 18 years is the least among other ages, which is 6 students (12.8%). In this study, 9 students with heavy physical activity ≥3000 (19.2%) were obtained. The students who did moderate physical activity ≥600 were 23 students (48.9%). As well as students with low physical activity <600 as many as 15 students (31.9%). Based on these results, it was obtained if the highest percentage were students with moderate physical activity levels. The number of normal BMI categories is more dominant than other BMI values, namely 31 people (66.4%), followed by mild overweight which is 5 people (10.5%), the BMI category is light underweight and the BMI category is overweight weight has the same frequency, which is as many as 4 people each and the same percentage value, each of which has a value of 8.4%, For the least category, namely underweight, the level of weight was 3 students (6.3%).

A person's low physical activity will encourage the increase in BMI value owned. Someone with low exercise, less activity, and low physical activity has the potential to be obese or with *an overweight* BMI.[12] The results of research from Krismawati in 2019 targeting adolescents aged 16-18 years found that physical activity affects BMI.[6]

In addition to physical activity, other factors that affect BMI include genetic factors and diet. History of obesity can be passed down in the next turn, but actually the family environment, especially through lifestyle, is very influential on a person's BMI status. This is because a person can be more exposed to family styles and habits at home compared to outside, especially to family members who spend more time at home. Parents in the family are role models that will certainly be imitated by their children, especially in carrying out a healthy lifestyle at home. Eating habits outside the home such as at school are also very influential, where the habit of snacking instant food without parental supervision is certainly a bad eating habit.[13] The fundamental principle of weight imbalance is

that it is the result of an imbalance in the energy component, namely the expenditure and storage of energy. Unbalanced energy between the entry and exit process can potentially cause a buildup of fat tissue in the body.[14]

The prevalence of obesity will increase significantly in groups with low activity. Gender is one of the factors in a person doing physical activity, where in this study it was found that heavy physical activity is more done by students with male gender. This is also supported by Agustina's research in 2020 said that before puberty, male and female physical activity will not be much different, but after puberty usually male physical activity will be better than females.[15] Men use more calories than women even when resting. This can be caused by more male muscle mass than women and this results in burning more calories. So that women are easier to gain weight.[16]

Physical activity is also defined as all body movements that come from skeletal muscle movements and produce energy, such as household chores, playing badminton, basketball, table tennis, swimming, volleyball, running, and doing other *fitness* exercises.[17] Some physical activities are considered as sports, where exercise can be defined as an activity that has a purpose for fitness or exercise, in other words exercise is an activity that is usually planned, structured, and repetitive.[18] Physical activity is an important aspect that can control adolescent weight, increase energy use, and help reduce fat. Obesity has a negative impact on the physical and mental health of adolescents, such as anxiety, depression to eating disorders, substance abuse such as drug use, even to cause suicide in adolescents.[19]

Many advantages are offered if you do physical activity, one of which is the benefits in terms of health.[20] The benefits obtained are in the form of a slow metabolism due to increased myocardial efficiency through increased blood flow and oxygen.[21] Other advantages can be a reduced risk of insulin resistance that can result in diabetes, elevated blood sugar levels, and other conditions that lead to diabetes risk. The distribution of body fat use is also influenced by physical activity, so low activity increases fat deposits in certain areas of the body.[22]

The advantages of physical activity can also be related to the balance between energy in and out of the body so that weight becomes controlled. This can have an impact on the visual of the body that is increasingly attractive, muscles are more flexible, and bone strength improves. This affects a person's self-confidence, but it also causes more fit, excited, and energetic. A person's ability to adapt physical activity to prevent negative reactions caused by internal or external disturbances is very important to maintain the state of the body. So attention is needed not to do too heavy physical activity and balanced with a balanced food intake.

CONCLUCION

Based on the results of research and analytical tests conducted, it can be concluded that there is a significant relationship between the level of physical activity and BMI and has a sufficient correlation value. The value of the correlation coefficient shows negative results where there is a unidirectional relationship between the two variables, where the lower the level of physical activity possessed, the higher the value of body mass index owned and vice versa.

ETHICAL CLEARANCE

This research has been approved by the Research Ethics Commission of the Faculty of Medicine, Udayana University. *Ethical clearance* with letter number 2215/UN14.2.2.VII.14/LT/2022 and protocol number 2022.01.1.1058.

CONFLICT OF INTEREST

This study has no conflicts of interest.

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AUTHOR CONTRIBUTIONS

IGPHD is preparing study designs, collecting data, processing data, and writing manuscripts. IWS, NLNA, and LPRS are directing data collection and revising the manuscript.

REFERENCES

1. Chennaoui M, Arnal PJ, Sauvet F, Leger D. Sleep and exercise: a reciprocal issue? *Sleep Medicine Reviews*. 2015;20(1):59-72.
2. Nina N, Kalesaran AFC., Langi FLFG. Hubungan antara aktivitas fisik dengan kualitas tidur pada masyarakat pesisir kota manado. *Jurnal Kesehatan Masyarakat*. 2018;7(4):3-8.
3. Ariyani NL, Masluhiya SM. Keterkaitan aktivitas fisik dengan indeks massa tubuh (imt) siswa sd kota malang. *Medicine Reviews*. 2017;6(1): 1-10
4. Arini LA, Wijana IK. Korelasi antara body mass index (bmi) dengan blood pressure (bp) berdasarkan ukuran antropometri pada atlet. *Jurnal Kesehatan Perintis (Perintis's Heal Journal)*. 2020;7(1):32-40.
5. Riset Kesehatan Dasar. Laporan_nasional_rkd2018_final.pdf. *Badan Penelitian dan Pengembangan Kesehatan*. 2018:3(2) 221-222.

6. Krismawati LDE, Andayani NLN, Wahyuni N. Hubungan antara aktivitas fisik dengan indeks massa tubuh (imt) pada remaja usia 16-18 tahun di sma negeri 2 denpasar. *Majalah Ilmiah Fisioterapi Indonesia*. 2019;7(1):29-32.
7. Riskesdas. Risk factors and prevalence of abdominal obesity. *Badan Penelitian dan Pengembangan Kesehatan*. 2013;7(5):803-809.
8. Habut M, Nurmawan I, Wiryanthini, I. Relationship of body mass index and physical activity for dynamic balance. *Majalah Ilmiah Fisioterapi Indonesia*. 2015;2(1):45-51.
9. Widiyatmoko F, Hadi H. Tingkat aktivitas fisik siswa di kota semarang. *Journal Sport Area*. 2018;3(2):140.
10. Dicky. Hubungan indeks massa tubuh dengan prestasi belajar anak usia sekolah dasar. *Majalah Ilmiah Fisioterapi Indonesia*. 2018;4(1):5-10
11. Kementerian Kesehatan RI. Klasifikasi obesitas setelah pengukuran imt. *Badan Penelitian dan Pengembangan Kesehatan*. 2018: 5(2):200-215.
12. Restuastuti T, Jihadi M, Ernalia Y. Hubungan pola makan dan aktivitas fisik terhadap obesitas pada remaja di sma negeri 5 pekanbaru. *Jom FK*. 2016;3(1):1-20.
13. Yaumil F. Hubungan antara aktivitas fisik dengan status nutrisi anak usia sekolah di sd bopkri gondolayu kota yogyakarta. *Journal of Chemical Information and Model*. 2017;21(2):1689-1699.
14. Siburian YN. Korelasi lingkar pinggang dengan tekanan darah pada remaja di smp negeri 1 labuhan deli tahun 2018. *Jurnal Kesehatan Perintis (Perintis's Heal Journal)*.2018;4(1):10-14.
15. Agustina M. Hubungan antara aktivitas fisik dengan keseimbangan dinamis pada lansia di komunitas sasana arjosari malang. *Jurnal Kesehatan Perintis (Perintis's Heal Journal)*.2020;5(1):6-10.
16. Saraswati NLPGK, Wibawa A, Adiputra LMISH. Correlation body mass index (bmi) with static balance. *Majalah Ilmiah Fisioterapi Indonesia*. 2015;2:29-33.
17. Kementerian Kesehatan RI. Mengenal jenis aktivitas fisik. *Badan Penelitian dan Pengembangan Kesehatan*.2018;6(1)10-15.
18. Darmayanti NL. Hubungan lama duduk dan indeks massa tubuh (imt) terhadap keluhan muskuloskeletal pada mahasiswa program studi sarjana kedokteran gigi dan profesi dokter gigi universitas udayana angkatan tahun 2013 dan 2014. *E-Jurnal Medika Udayana*. 2020 18;9(10):25-30.
19. Prianthara IMD, Suadnyana IAA, Suparwati KTA, Marufa SA. Ergonomic intervention on physical therapy programs decrease pain and disability level on subject with myogenic low back pain: a case report. *Physical Therapy Journal of Indonesia* 2021; 2(1): 5–9.
20. Janrio Tandirerung F, Dwicky Male HC, Mutiarasari D. Hubungan indeks massa tubuh terhadap gangguan muskuloskeletal pada pasien pralansia dan lansia di Puskesmas Kamonji Palu. *Healthy Tadulako Journal (Jurnal Kesehatan Tadulako)* 2019; 5: 9–17
21. Purnawijaya MA, Adiatmika IPG. Hubungan indeks massa tubuh dengan gangguan muskuloskeletal dan distribusinya menggunakan NBM (Nordic body map) pada anggota Senam Satria Nusantara di Lapangan Nitimandala Renon. *E-Jurnal Medika Udayana* 2016; 5(2): 1–8
22. Wearing SC, Hennig EM, Byrne NM, Steele JR, Hills AP. Musculoskeletal disorders associated with obesity: a biomechanical perspective. *Obesity reviews*. 2006;7(3):239-50.