

## Among BMI, Physical Activity, and Dietary Habit Students in SMPN 1 Karangploso

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### Abstract

This study aims to determine the relationship Among body mass index (BMI), physical activity, and dietary habit of students at SMPN 1 Karangploso. This study is a quantitative study using linear regression, with population of 32 students at Junior High School 1 Karangploso which was selected using simple random sampling method. The instrument of this study used questionnaire related to physical activity and dietary habit. The questionnaire that related to physical activity used the modified of Physical Activity Questionnaire Adolescents (PAQ-A) method according to conditions and habits in Indonesia. In the other hand, in the other hand questionnaire for dietary habit used 24-hour food recall method. This study used several analysis' such as shapiro wilk normality test, linearity test, multicollinearity test, heteroscedasticity test, bivariate analysis using simple regression test, and multivariate analysis using multiple regression test. The simple linear regression resulted 2 models that showed how strong the relationship between physical activity on BMI and dietary habit on BMI. The model results were respectively  $Y = 30,221 - 1,129X_1$  and  $Y = 23,045 + 2,204X_2$ . Those models indicated a negative relationship between physical activity on BMI and a positive relationship between dietary habit on BMI. While resulted a model  $Y = 25,985 - 0,61X_1 + 1,509X_2$ , in which it means that physical activity has a negative relationship towards BMI value along with a positive relationship between dietary habit and BMI value. Since it got an R value of 0,754, this result is accurate enough. In conclusion, according to the regression methods used in this study, there is a real relationship among physical activity, dietary habit, and BMI values. Thus, it means that physical activity and dietary habits have an influence on determining overweight status in 13-15 years old boys and girls.

Keywords: Dietary Habit, *Overweight* and Physical Activity

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### INTRODUCTION

The period of development from children to adolescence is a change in psychological and sexual maturity. Significant changes such as the metabolic system, hormonal regulation, physical changes, and fat content in the body, therefore need to be supported by consuming substances that are in accordance with the needs of the body. In the change of children towards adolescence, there is an increase in food and drink consumption, which is caused by more and more activities carried out. Adolescents generally consume food without paying attention to the long-term effects of these foods that can lead to several nutritional problems, one of which is overweight (Kurdanti, Suryani, Syamsiatun, Siwi, Adityanti, Mustikaningsih, dan Sholihah. 2015). Physiological and psychological factors of a person become the cause of overweight. Physiological factors such as heredity, diet, nutritional intake levels, and physical activity, while psychological factors such as changes in lifestyle, because it is related to a person's nutritional status, it is important to know in order to maintain a healthy lifestyle.

Basic Health Research in 2018 estimates that one in three adults, 1 from 7 adolescents aged 13-18 years in Indonesia are overweight or obese. Based on this percentage, it can be seen if the ratio of overweight and obese patients is quite high in East Java Province and nationally. Overweight has a negative impact on health, such as heart disease, shortness of breath and complications in the joints and others. The influence of overweight in terms of the social environment, overweight adolescents sometimes experience discrimination from the surrounding environment which can cause depression and lack of confidence. In addition to diet, overweight is also caused by a relatively light level of activity.

Previous research related to physical activity affecting overweight has been carried out by Mutia, Kusdalinah & Jumiayati, (2022) states that physical activity affects overweight because adolescents who do not do physical activity have a greater risk of being overweight than those who do physical activity. The results of a study similar to Kumala, Margawat, & Rahadiyanti, (2019) state that diet affects overweight because teenagers rarely eat healthy foods, such as high fiber, protein, vitamins and so on, most teenagers like to eat foods high in sugar. Similar research results were also obtained by Putra, Ermawati, & Amir, (2016) who stated that a person's body mass index will increase along with the higher the level of his diet.

In adolescence, the type of physical activity performed is classified as light activity, the usual activities are learning, playing, sports and so on. Light activity will release low energy, therefore the incoming energy is greater than the outgoing energy (Tandean, Mewo, & Wowor, 2015). Energy stored in the body will turn into fat and can trigger the occurrence of overweight. The relationship between overweight with physical activity and diet in adolescents is still very limited research, so the need for research in order to determine the relationship and strength between overweight with physical activity and diet. Research in January to March 2023 at SMP Negeri 1 Karangploso, entitled "The relationship between Overweight and physical activity and diet of adolescents aged 13-15 years in SMP Negeri 1 Karangploso".

## **METHOD**

This sampling using random sampling technique for population of adolescents aged 13-15 years who are overweight in SMP Negeri 1 Karangploso. This technique method by mixing subjects in the population that is considered the same. Prospective respondents get the same right to be selected into the research sample. The sample was determined using anthropometric measurements that can determine the size of the height and weight of prospective respondents in order to see the BMI value. Respondents obtained 32 adolescents from 224 sample. The gender of the respondents is presented as in Table 1 below:

Chart 1. Gender of respondents Research relationship between Overweight with physical activity and diet of adolescents aged 13-15 years in SMP Negeri 1 Karangploso

Gender Of Respondent	Amount
Female	15
Male	17
<b>Total</b>	<b>32</b>



Figure 1. Analyzing Anthropometry



Figure 2. Giving a Questionnaire

Physical activity Data obtained from the processed results of the journal The Physical Activity Questionnaire for Older Children (PAQ-C) and Adolescents (PAQ-A) (Ristina, 2019). Instruments that have been changed according to the circumstances and habits of carrying out physical activities in Indonesia. Questionnaire diet using instruments 24 hour food recall which was held for three days, namely school days and holidays with interviews. 24-hour food recall method to obtain information such as the type of food or drink, the number of dishes in household size (URT), and food ingredients used (Sirajuddin, Surmita, & Trina, 2018). Explanation of research variables the relationship between overweight with physical activity and diet is presented as in Table 2 and the flow of research is presented as in Figure 3 below

Table 2. Variable Research relationship between Overweight with physical activity and diet of adolescents aged 13-15 years in SMP Negeri 1 Karangploso

Variable	Sub Variables	Indicators	Instruments	Scale
<b>Dependen (y)</b>	Overweight	Height Weight	Formula= $\frac{IMT}{Weight (pound)} / [Height (inci)]^2$	Ordinal
	Physical Activity	Exercise Volume	Physical Activity Questionnaire Adolescents (PAQ-A)	Ordinal
<b>Independen (x)</b>	Diet	Meal time, groceries, processing method, URT, number of feedings	24-hour food recall	Ordinal

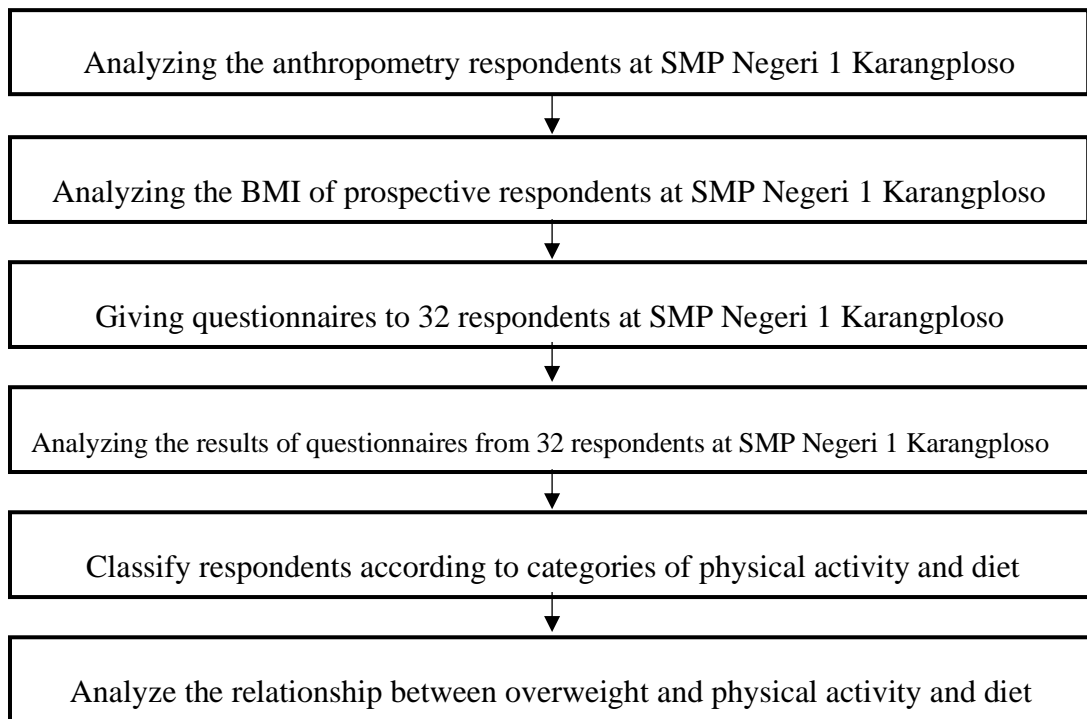


Figure 3. Flow of research and data collection in SMP Negeri 1 Karangploso

This study used bivariate analysis and multivariate analysis, namely simple linear regression analysis, multiple regression and correlation coefficient.

## RESULTS

The number of respondents studied amounted to 32 students who have been selected through anthropometric test methods and questionnaires or questionnaires. Respondents were 32 students with 15 female respondents and 17 male respondents. The study continued by providing questionnaires or questionnaires about physical activity and diet to respondents. Furthermore, the results of the questionnaire were analyzed and categorized according to the characteristics of the variables. After that, an analysis was conducted using microsoft excel to determine the relationship and strength of the relationship between overweight and physical activity and diet. The Data used in this study were the results of a questionnaire containing the value of the dependent variable (y) for overweight and the independent variable (x) for physical activity and diet. In the physical activity variable, the data is in the form of exercise frequency in the last 7 days. While the variable diet, the data is the result of the calculation of the RDA with indicators such as meal time, food ingredients, processing, URT, and the amount of food. BMI variable, calculated with the unit  $\text{kg}/\text{m}^2$  which is the result of body weight divided by

height. By using the help of SPSS Software, linear regression analysis with the following analysis results.

Table 3. Description of Research Variables

Statistical Value	N	Average	SD	Min	Max
BMI	32	27,29	1,473	25	29,8
Physical Activity	32	2,38	0,793	1	4
Diet	32	1,89	0,5342	1	2,91

Based on the output table above, it can be seen that the three variables studied have the same data size, namely 32 respondents. The three variables studied have a fairly small standard deviation which means that the respondents have values that are not much different from each other. The overall average of respondents was 27.29, so it can be proven that the respondents are classified as overweight. On average, the study respondents did physical activity in the last 7 days. The average nutritional adequacy rate of the respondents was 1.89 kcal.

Table 4. Shapiro Wilk Normality Test

No	Variable Name	Statistics	df	Sig.
1.	Body Mass Index (BMI)	0.947	32	0,117
2.	Physical Activity	0.836	32	0,000
3.	Diet	0.938	32	0,068

Based on the results of table 2 of the normality test, the significance value of the dietary variable ( $X_2$ ) on the shapiro wilk test is 0.068 ( $p > 0.05$ ), so that based on the shapiro wilk normality test, the data is normally distributed. The value of the physical activity variable ( $X_1$ ) on the shapiro wilk test is 0.000 ( $p < 0.05$ ), so based on the shapiro wilk normality test the data is abnormally distributed. The variable value of body mass index ( $Y$ ) on the shapiro wilk test is 0.117 ( $p > 0.05$ ), so based on the shapiro wilk normality test the data is normally distributed.

Table 5. Linearity Test  
Physical Activity

			Sum of Squares	df	Mean Square	F	Sig.
BMI*	Between	(Combined)	38,305	3	12,768	12,340	0,000
Physical Activity	Group	Linearity	37,720	1	37,720	36,453	0,000
		Deviation from Linearity	0,585	2	0,293	0,283	0,756
	Within Groups		28,973	28	1,035		
	Total		67,279	31			

Dietary Habit

			Sum of Squares	df	Mean Square	F	Sig.
BMI*	Between	(Combined)	65,745	25	2,630	10,291	0,004
Diet	Group	Linearity	43,876	1	43,876	171,688	0,000
		Deviation from Linearity	21,870	24	0,911	3,566	0,059
	Within Groups		1,533	6	0,256		
	Total		67,279	31			

Based on the significance value of the Deviation from Linearity column:

$H_0$ : there is a significantly linear relationship between the dependent variable and the independent variable

$H_1$ : there is no significantly linear relationship between the dependent variable and the independent variable

The significance value of Deviation from Linearity was obtained in the relationship between variable Y and  $X_1$  of 0.756. Then in the relationship of variables Y with  $X_2$  a significance value of 0.059 was obtained. The decision on the linearity test is to accept  $H_0$ . This decision means that there is a significantly linear relationship between variables Y with  $X_1$  and Y with  $X_2$ .

Table 6. Multicollinearity Test

Model	Unstandardized Coefficients		Standardized Coefficients		Collinearity Statistics		
	B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1 (Constant)	25,9234	0,981		26,420	0,000		
Aktivitas Fisik	-0,608	0,177	-0,404	-3,442	0,002	0,618	1,618
Pola Makan	1,528	0,322	0,558	4,753	0,000	0,618	1,618

If the value of VIF <10 : no multicollinearity occurs in the regression model

If the value of VIF > 10 : multicollinearity occurs in the regression model

Based on the output above, it can be concluded that the independent variables ( $X_1$  and  $X_2$ ) in the model do not have a significant correlation with each other. This indicates the absence of multicollinearity in the model.

Table 7. Heteroscedasticity Test

Model	Unstandardized Coefficients		Standardized Coefficients		t	Sig.
	B	Std. Error	Beta			
1 (Constant)	-0,246	0,618			-0,398	0,694
Aktivitas Fisik	0,101	0,111	0,209		0,911	0,370
Pola Makan	0,275	0,203	0,311		1,360	0,184

The heteroscedasticity test aims to test whether in the regression model there is an inequality of variance (variation) from the residual value of one observation to another. If the variance from the residual value of one observation to another observation is fixed, then it is called homoscedasticity. However, if the variance from the residual value of one observation to another observation is different, then it is called heteroscedasticity. A good regression model should not occur symptoms of heteroscedasticity.

If the significance value > 0.05: no symptoms of heteroscedasticity occur in the regression model

If the significance value < 0.05: symptoms of heteroscedasticity occur in the regression model.

The significance value for  $X_1$  variable is 0.37. Meanwhile, the significance value for  $X_2$  variable is 0.184. Based on the significance value of the two variables, which is more than 0.05, it can be concluded that there are no symptoms of heteroscedasticity in the regression model.

### Simple Linear Regression Analysis Between Physical Activity Against BMI

Table 8. Analysis of Physical Activity on BMI

	Coefficient
Intercept	30,221
$X_1$	-1,129

Based on the model in the table above, a constant of 30.221 is obtained which shows the value obtained by variable Y without the influence of other variables or the amount of physical activity as much as 0. To facilitate interpretation, the table above can be formulated as follows.

$$Y = 30,221 - 1,129X_1$$

The equation above means that the BMI value has a negative relationship with physical activity, meaning that every increase in physical activity, BMI will decrease. Every increase of 1 unit of physical activity will affect a decrease of 1,129 times in the BMI value.

### Simple Linear Regression Analysis Between Dietary Habit Against BMI

Table 9. Analysis of Dietary Habit on BMI

	Coefficient
Intercept	23,045
$X_2$	2,204

Based on the table above, a constant of 23.045 is obtained which shows the value obtained by variable Y without the influence of other variables or Diet as much as 0. To facilitate interpretation, the table above can be formulated as follows.

$$Y = 23,045 + 2,204X_2$$

The equation above means that the BMI value has a positive relationship with diet, meaning that every increase in diet the BMI will increase. Every increase of 1 unit of diet will aff

**Multiple Regression Analysis (Multiple) Between Physical Activity and Diet on BMI**

Table 10. Analysis of Physical Activity and Dietary Habit on BMI

	Coefficient
Intercept	25,985
$X_1$	-0,61
$X_2$	1,509

Based on the table above, a constant of 25.985 is obtained which shows the value obtained by variable Y without the influence of other variables or the amount of physical activity and diet as much as 0. To facilitate interpretation, the table above can be formulated as follows.

$$Y = 25,985 - 0,61X_1 + 1,509X_2$$

The equation above means that the BMI value has a negative relationship with physical activity, meaning that every increase in physical activity, BMI will decrease. Every increase of 1 unit of physical activity will affect a decrease of 0.61 times in the BMI value. Then the BMI value has a positive relationship with diet, meaning that every increase in diet the BMI will increase. Every increase of 1 unit of diet will affect the addition of 1,509 times the BMI value.

**Correlation of the relationship between physical activity and diet to body mass index**

In the range of -1 to 1, the correlation coefficient indicates the magnitude of the linear relationship between the variables studied. The correlation value -1 indicates that every increase of 1 unit of value of a variable, then other variables will decrease by 1 unit. While the correlation value of 1 indicates every increase of 1 unit of value of a variable, eating other variables will also increase by 1 unit. A correlation value of 0 means that the two variables under study have absolutely no relationship that affects each other.

Table 11. Correlation Coefficient

	Y	$X_1$	$X_2$
Y	1		
$X_1$	-0,752	1	
$X_2$	0,806	-0,61	1

In the table above, it can be seen that between each variable studied has a meaningful relationship or closeness. So it can be concluded that the data in this study already meets the requirements of regression analysis, namely the variables studied are mutually independent.

A positive correlation is obtained from pairs of variables Y and  $X_2$  , meaning that if the variable  $X_2$ , the other variables tend to decrease proportionally. Furthermore, variable Y with



$X_1$  and  $X_2$  with  $X_1$  negative correlation, meaning that if one variable increases, then the other variable tends to decrease proportionally.

Table 12. R Square Value

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>	<i>R Square</i>
Regression	2	50,566	25,283	44,535	1,44092E-09	0,754387153
Residual	29	16,463	0,567			
Total	31	67,029				

Based on the results of data analysis, it is known that the value of Sig. F Change is  $1,44 \times 10^{-9}$ , because the value of Sig. F Change is  $1,44 \times 10^{-9} < 0,05$ , it can be concluded that there is a significant relationship between physical activity, food patterns and body mass index, while R-Square or coefficient of determination shows the proportion of variation in variable Y that can be explained by independent variables in regression models. The range of R-square values is 0 to 1, where 1 indicates all variations in the dependent variable can be explained by the independent variable, while 0 indicates that the independent variable cannot explain the variation in the dependent variable. The higher the R-square value, the better the regression model produced because it can explain the variance of variable Y. R Square value (Coefficient of Determination) = 0.754 which means the influence of physical activity variables, food patterns on body mass index has a high contribution of 75.4%.

## DISCUSSION

### The Effect Of Each Physical Activity And Diet On Body Mass Index (BMI)

Based on the results obtained, it can be seen that physical activity has a negative influence on BMI values in overweight adolescents. That is, in every increase in the frequency of physical activity carried out by overweight adolescents, the BMI value is even greater. In detail, every increase of 1 unit of physical activity will be followed by a 1,129-fold decrease in BMI value. This relationship has a negative direction, which can be concluded that the lighter the physical activity carried out, the increase in BMI and vice versa. The results of this study are similar to Mutia, Kusdalinah & Jumiyati (2022) stating that physical activity affects overweight because adolescents who do not do physical activity have a greater risk of overweight than those who do physical activity. This is because burning calories does not occur in accordance with the energy that enters the body and most of it can be stored as fat in the body which causes overweight. The relationship obtained from this single regression model has a constant value of 30.221 which indicates the BMI value where the physical activity variable is 0.

Based on the results obtained, it can be seen that diet has a positive influence on the BMI value of overweight adolescents. That is, in every increase in the frequency of eating patterns carried out by overweight adolescents, the BMI value is even greater. In detail, every increase of 1 unit of physical activity will be followed by a 2,204-fold decrease in BMI value. This relationship has a positive direction, so it can be concluded that the higher the total consumption of energy, carbohydrates, proteins and fats excessively, the BMI will increase. The results of a similar study with Kumala, Margawat, & Rahadiyanti (2019) stated that diet affects overweight because adolescents rarely eat healthy foods, such as high in fiber, protein, Vitamins and so on, most teenagers like to eat foods that are high in sugar. Similar research results were also obtained by Putra, Ermawati, & Amir, (2016) which stated that a person's body mass index will increase along with the higher the level of his diet. The relationship obtained from this single regression model has a constant value of 23.045 which indicates the BMI value where the dietary variable is 0.

Based on the calculation of multiple regression analysis, it was found that physical activity had a negative influence on the BMI value of overweight adolescents. That is, in every increase in the frequency of physical activity carried out by overweight adolescents, the BMI value is even greater. In detail, every increase of 1 unit of physical activity will be followed by a 0.61-fold decrease in BMI value. While on diet, the BMI value has a positive relationship with each increase in diet, followed by the BMI value which also increases. Every increase of 1 unit of diet will affect the addition of 1,509 times the BMI value.

### **The Effect Of Physical Activity And Simultaneous Diet On Body Mass Index (BMI)**

Based on the calculation of multiple regression analysis, it was found that physical activity had a negative influence on the BMI value of overweight adolescents. That is, in every increase in the frequency of physical activity carried out by overweight adolescents, the BMI value is even greater. In detail, every increase of 1 unit of physical activity will be followed by a 0.61-fold decrease in BMI value. While on diet, the BMI value has a positive relationship with each increase in diet, followed by the BMI value which also increases. Every increase of 1 unit of diet will affect the addition of 1,509 times the BMI value.

Research conducted by Suyasmi, Citrawathi, & Sutajaya, (2018) shows a significant relationship between diet and physical activity with body mass index. The importance of maintaining a healthy body, especially for junior high school students, is to pay attention to and improve the health of the body which can be done by doing regular exercise with a frequency of exercise 3-5 times a week with a minimum exercise duration of 20-60 minutes.

With an exercise intensity of 60-90% maximum heart rate (Pranata & Kumaat, 2022). Physical activity that is done regularly will affect a person's body mass index. Meanwhile, a diet that is in accordance with the portion of food and type of food in one food is useful for maintaining a healthy body, good nutritional status for a person, and preventing disease (Astuti, Bayu & Destriana, 2022).

Research that has been carried out has advantages in terms of methods, namely, research with the PAQ-A method can be used in longitudinal research. In addition, the PAQ-A method has more assessment category values than the IPAQ method. Another advantage of this research method is that it uses the 24 hours food recall method which can be used for illiterate respondents, because the questionnaire not only contains writing, but contains pictures of types of food and drinks. There are also disadvantages of this study such as, it requires a long time for sampling, because some respondents need to remember what was done and consumed during the study. In addition, the questionnaire given is difficult for respondents to understand, due to the age factor of respondents who are not yet mature to understand this, and there are also some discrepancies between the questionnaire and the respondent's physical activity and diet.

The reason this study used BMI variables is because BMI is the easiest way to estimate overweight related to body fat mass and height is important to identify whether respondents fall into underweight, overweight and obesity. Underweight if  $BMI < 20 \text{ kg/m}^2$ , overweight if  $BMI$  between 25 and  $29.9 \text{ kg/m}^2$  and obesity if  $BMI \geq 30 \text{ kg/m}^2$  (Tandean, Mewo, & Wowor 2015). In this article, all respondents are overweight teenagers. Overall, both simple and multiple regression analyses show relationships between each dependent and independent variable with results in the same direction. In physical activity and BMI, a negative relationship was obtained. Meanwhile, in diet and BMI, a positive relationship was obtained. The models have been tested for accuracy and each has considerable value. That is, the results obtained in this study are quite accurate.

## CONCLUSION

Based on calculations using simple linear regression analysis and multiple regression analysis, it was concluded that there was a relationship between physical activity and diet on the overweight status of adolescents aged 13-15 years at SMP Negeri 1 Karangploso. The models produced by both analyses have a fairly high accuracy value, with an accuracy value of 75.4%

## REFERENCES

- Astuti, N. P. T., Bayu, W. I., & Destriana, D. (2022). Indeks massa tubuh, pola makan, dan aktivitas fisik: apakah saling berhubungan? *Jurnal Olahraga Pendidikan Indonesia (JOPI)*, 1(2), 154–167. <https://doi.org/10.54284/jopi.v1i2.99>
- Adi, S., Supriyadi, M. K., & Masgumelar, N. K. (2020). *Model- Model Exercise Dan Aktivitas Fisik Untuk Kebugaran Jasmani Anak Sd.*
- Akhriani, M., Fadhilah, E., & Kurniasari, F. N. (2016). Indonesian Journal of Human Nutrition. *Indonesian Journal of Human Nutrition*, 3(1), 29–40.
- Ariesta, M., Mitra, Desfitas, S., Nurlisis, & Harahap, H. (2021). Hubungan Keanekaragaman Konsumsi Pangan Dan Aktifitas Fisik Dengan Kegemukan Remaja Di SMPN Kampr Kiri Kabupaten Kampar. *Jurnal Ners*, 5(2), 45–47.
- Basri, N. I. R. (2020). *Hubungan Pola Makan Dan Aktivitas Fisik dengan Kejadian Obesitas Usia Produktif Di Posbindu PTM Melati Kelurahan Josenan Demangankota Madiun.* 21(1), 1–9. <http://journal.um-surabaya.ac.id/index.php/JKM/article/view/2203>
- BestBook. (2010). *A-Z Multivitamin untuk Anak & Remaja.* Penerbit Andi. [https://www.google.co.id/books/edition/A\\_Z\\_Multivitamin\\_untuk\\_Anak\\_Remaja/-ADUgG7OvU8C?hl=id&gbpv=0](https://www.google.co.id/books/edition/A_Z_Multivitamin_untuk_Anak_Remaja/-ADUgG7OvU8C?hl=id&gbpv=0)
- DAMAYANTI, A. E. (2016). Hubungan Citra Tubuh, Aktivitas Fisik, Dan Pengetahuan Gizi Seimbang Dengan Status Gizi Remaja Putri. In *Skripsi.* <http://repository.unair.ac.id/46573/>
- Flegal, K. M., Kit, B. K., & Graubard, B. I. (2014). Body mass index categories in observational studies of weight and risk of death. *American Journal of Epidemiology*, 180(3), 288–296. <https://doi.org/10.1093/aje/kwu111>
- Frisca Siahaan, R. (2017). Mengawal Kesehatan Keluarga Melalui Pemilihan Dan Pengolahan Pangan Yang Tepat. *Jurnal Keluarga Sehat Sejahtera*, 15(2), 57–64. <https://doi.org/10.24114/jkss.v15i2.8775>
- Ira Nurmala. (2020). *Mewujudkan Remaja Sehat Fisik, Mental dan Sosial: (Model Intervensi Health Educator for Youth).* Airlangga University Press. [https://www.google.co.id/books/edition/Mewujudkan\\_Remaja\\_Sehat\\_Fisik\\_Mental\\_dan/uOkJEAAAQBAJ?hl=id&gbpv=0](https://www.google.co.id/books/edition/Mewujudkan_Remaja_Sehat_Fisik_Mental_dan/uOkJEAAAQBAJ?hl=id&gbpv=0)
- Kowalski, K. C., Crocker, P. R. E., Columbia, B., & Donen, R. M. (2004). *The Physical Activity Questionnaire for Older Children ( PAQ-C ) and Adolescents ( PAQ-A ) Manual.* August.
- Kumala, A. M., Margawati, A., & Rahadiyanti, A. (2019). Hubungan Antara Durasi Penggunaan Alat Elektronik (Gadget), Aktivitas Fisik Dan Pola Makan Dengan Status Gizi Pada Remaja Usia 13-15 Tahun. *Journal of Nutrition College*, 8(2), 73. <https://doi.org/10.14710/jnc.v8i2.23816>
- Kurdanti, W., Suryani, I., Syamsiatun, N. H., Siwi, L. P., Adityanti, M. M., Mustikaningsih, D., & Sholihah, K. I. (2015). Faktor-faktor yang mempengaruhi kejadian obesitas pada remaja. *Nti, Dkk: Faktor-Faktor Yang Mempengaruhi Kejadian Obesitas Pada Remaja Jurnal Gizi Klinik Indonesia*, 11(4), 179–190. <https://doi.org/10.1016/j.gendis.2020.11.005>
- Loliana, N., Nadhiroh, S. R., Gizi, D., Fakultas, K., & Masyarakat, K. (2015). Asupan Dan Kecukupan Gizi Antara Remaja Obesitas Dengan Non Obesitas. *Media Gizi Indonesia*,

- 10(2), 141–145. <https://www.e-journal.unair.ac.id/MGI/article/view/3319>
- Mutia, A., Jumiyati, J., & Kusdalinah, K. (2022). Pola Makan Dan Aktivitas Fisik Terhadap Kejadian Obesitas Remaja Pada Masa Pandemi Covid-19. *Journal of Nutrition College*, 11(1), 26–34. <https://doi.org/10.14710/jnc.v11i1.32070>
- Narbuko, C. & Achmadi, A. (2001). *Metodologi Penelitian*.
- Nurul Yuda Putra, R., Ermawati, E., & Amir, A. (2016). Hubungan Indeks Massa Tubuh (IMT) dengan Usia Menarche pada Siswi SMP Negeri 1 Padang. *Jurnal Kesehatan Andalas*, 5(3), 551–557. <https://doi.org/10.25077/jka.v5i3.575>
- Octavia, S. A. (2020). *Motivasi belajar dalam perkembangan remaja*.
- Pranata, D., & Kumaat, N. (2022). Pengaruh Olahraga Dan Model Latihan Fisik Terhadap Kebugaran Jasmani Remaja: Literature Review. *Jurnal Universitas Negeri Surabaya*, 10(02), 107–116. <https://ejournal.unesa.ac.id/index.php/jurnal-kesehatan-olahraga/article/view/45189>
- Putra, Y. W., & Rizqi, A. S. (2018). Index Massa Tubuh (Imt) Mempengaruhi Aktivitas Remaja Putri Smp Negeri 1 Sumberlawang. *Gaster*, 16(1), 105. <https://doi.org/10.30787/gaster.v16i1.233>
- Ristina, E. (2019). *Hubungan Aktivitas Fisik Dengan Body Mass Index (Bmi) Pada Siswa Kelas Vii Sekolah Menengah Pertama Negeri 5 Kota Bandung*. <http://repository.bku.ac.id/xmlui/handle/123456789/1621>
- Sirajuddin, Surmita, Trina Astuti. (2018). *Survey-Konsumsi-Pangan\_SC.pdf*.
- Sudargo, T., Freitag, H., Kusmayanti, N. A., & Rosiyani, F. (2018). *Pola Makan dan Obesitas*. Gadjah Mada University Press.
- Suyasmi, N. M., Citrawathi, D. M., & Sutajaya, I. M. (2018). Hubungan Pola Makan Aktivitas Fisik Pengetahuan Gizi Dengan Indeks Massa Tubuh ( IMT). *Jurnal Pendidikan Biologi Undiksha*, 5(3), 156–165.
- Tandean, N., Mewo, Y., & Wowor, P. M. (2015). Gambaran Indeks Massa Tubuh Pada Anggota Senat Mahasiswa Fakultas Kedokteran Manado. *Jurnal E-Biomedik*, 3(3), 23–27. <https://doi.org/10.35790/ebm.3.3.2015.9628>
- Voss, C., Ogunleye, A. A., & Sandercock, G. R. H. (2013). Physical Activity Questionnaire for children and adolescents: English norms and cut-off points. *Pediatrics International*, 55(4), 498–507. <https://doi.org/10.1111/ped.12092>
- Wahyuningsih, R., & Pratiwi, I. G. (2019). Hubungan aktifitas fisik dengan kejadian kegemukan pada remaja di Jurusan Gizi Politeknik Kesehatan Mataram. *Action: Aceh Nutrition Journal*, 4(2), 163. <https://doi.org/10.30867/action.v4i2.180>
- Wati, D. K., & Sumarmi, S. (2017). *Citra Tubuh Pada Remaja Perempuan Gemuk Dan Tidak Gemuk : Studi Cross Sectional Body Image Among Overweight and Non overweight Adolescent Girls : A Cross Sectional Study*. 044, 398–405. <https://doi.org/10.20473/amnt.v1.i4.2017.398-405>