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Short notice
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Relationship of Physical Activity With Obesity

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Abstract: *Physical activity is one way to prevent obesity in the community. Physical activity can be done by anyone, both people who live in urban and rural areas. Paying attention to the physical activity of people in rural areas can help avoid various kinds of diseases even that cause death. The purpose of this study was to determine the relationship between physical activity and obesity seen based on body fat, visceral fat and body mass index. The research method used in this study is associative quantitative method with correlational study. Data collection was preceded by measurements of height, weight, and body fat then continued by filling out the Baecke Physical Activity Questionnaire. The hypothesis testing technique carried out in this study uses simple correlation statistical analysis techniques and multiple correlations followed by t-tests at a significant level of α = 0.05. The results showed: First, there was a meaningful relationship between physical activity and body fat of -0.751, second, there was a meaningful relationship between physical activity and visceral fat of -0.608, and third, there was a meaningful relationship between physical activity and body mass index of -0.72. Bottom Line: Moderate to vigorous intensity physical activity is associated with decreased body fat, visceral fat, and BMI. Light activity or sedentary activity can lead to excessive accumulation of fat which can lead to obesity. This occurred in both male and female genders in this study.*
Keywords: *Physical activity, Obesity, Body fat, Visceral Fat, BMI.*

INTRODUCTION

The development of science and technology in several fields can have a positive or negative impact. One of the negative impacts that occur is a decrease in mobility of movement and physical fitness levels (Woessner et al., 2021) Reduced mobility of movement means reduced physical activity performed, this can improve health (Woessner et al., 2021)

Health is one measure of the level of welfare of a nation. The higher the level of health, the higher the level of welfare of the nation (WHO, 2023). The importance of health is stated in the strategic plan of the Ministry of Health (Renstra Kemenkes) for 2020-2024, that in Presidential Regulation Number 18 of 2020 concerning RPJMN for 2020-2024, mandated nine national development missions, one of which is to improve the quality of Indonesian people. To realize this mission, every Indonesian citizen needs to improve the quality of life by maintaining health.

Health can be reviewed one of them through a person's body composition, body composition is the relative proportion of fat tissue and fat-free tissue contained in the body (Holmes & Racette, 2021). Body composition consists of four main components, namely Total Body Fat, Fat-Free Mass, Bone Minerals and Body Water. Through measuring body composition we can find out whether there is excess fat in the body or not (Duren et al., 2008). The two most commonly measured components of body composition are total body fat tissue and fat-free tissue (Rahayu et al., 2019). Good body composition has an important role in maintaining health and vice versa if the body composition is not good it will bring various diseases (Holmes & Racette, 2021). Good body composition is necessary for a person to increase work capacity and maintain physical fitness in order to complete his daily responsibilities well (Dhankhar, 2022).

In simple terms, body composition can be seen through body mass index (BMI) which has a close relationship with health, this is because BMI is one way to measure and monitor a person's nutritional status simply (Astuti et al., 2021). BMI is categorized into 5 categories, namely, underweight < 18.5, normal 18.5 - 22.9, overweight 23 - 24.9, obesity I 25 - 29.9, and obesity II ≥ 30.0. The main factors that affect BMI are age, sex, lifestyle, genetics, diet, and physical activity (Prameswari et al. 2022).

Changes in BMI can have an impact on a person's health status which can significantly affect his quality of life (Apple et al., 2018). An imbalance between food intake and energy that comes out will cause a person to be malnourished (underweight, overweight, and obesity) (Viasus et al., 2022). Being overweight is an excessive level of nutritional status that will depend on health so that it can reduce a person's quality of life Changes in BMI can have an impact on a person's health status which can significantly affect his quality of life. An imbalance between food intake and energy that comes out will cause a person to be malnourished (underweight, overweight, and obesity) (Lin

& Li, 2021). verweight is a condition where a person weighs more than 120% and has a body mass index above 27. Being overweight is an excessive level of nutritional status that will depend on health so that it can reduce a person's quality of life (Wang et al., 2018).

The problem of obesity is one of the main risk factors for various non-communicable diseases such as cardiovascular disease, cancer, and diabetes militus (Swinburn et al., 2011). Noncommunicable diseases are responsible for > 70% of deaths worldwide, making obesity a major risk factor for morbidity and mortality worldwide as a major risk factor for dangerous diseases, obesity also has a high prevalence with an average prevalence of obesity in adults worldwide of 19.5% (Hidayat & Karjadidjaja, 2022)

The implementation of a healthy lifestyle is still a serious challenge in Indonesia. This is marked by one of them the low participation in sports in Indonesia. According to the results of the Socio-Cultural Education Module (MBPS) survey in 2018, it shows that the participation rate of people exercising nationally is 31.9%. Of the 34 provinces, 12 provinces (35.29%) with scores above the national average and 22 provinces (64.70%) with average scores below the national average (Komisi X DPR, 2018). The decline in sports participation in the community is partly due to the development of technology, this causes someone to be less active. Excessive use of gadgets has a negative side (Alotaibi et al., 2020). High sedentary time in front of layers, lack of physical activity, and poor diet can affect people's nutritional status (Kumala et al., 2019).

Based on data from the Central Statistics Agency (BPS) on the prevalence of obesity in the population aged > 18 years by sex, there was an increase from 2013-2018. In 2013 the prevalence of obesity was 19.6% of men and women 32.9%, in 2016 the prevalence of obesity was 24% of men and women 41.6%, in 2018 the prevalence of obesity was 26.6% of men and women 44.4% (BPS, 2018). Meanwhile, according to data from the Indonesian Ministry of Health (Kemenkes RI) on the obesity epidemic in Indonesia that 13.5% of adults aged 18 years and over are overweight, while 28.7% have obesity (BMI ≥ 25), and based on the 2015-2019 RPJMN indicators as many as 15.4% are obese (BMI ≥ 27) (Ministry of Health, n,d). The problem of obesity does not only occur in urban areas, but the trend of increasing obesity problems in rural areas needs to be considered as a form of input in determining nutrition and health program policies and planning (Effendy et al., 2018).

Looking at the high prevalence of obesity in Indonesia is a serious problem, so obesity prevention is very important. To prevent obesity problems, one of them is by improving lifestyle, Lifestyle plays a very important role for health. In sociology, lifestyle is life for a person (Kumar, 2017). Lifestyle is a long-term choice. There are various efforts to implement a healthy lifestyle, namely by maintaining a healthy food intake pattern with diet and nutrition, exercising regularly, choosing the right supporting nutrition and joining the community to get support from the same people. By making these various efforts and attitudes, a healthy quality of life can be obtained and can create a positive environment (Tiara & Lasnawati, 2022). The application of a healthy lifestyle needs to be applied to all groups ranging from young children, adolescents, adults, and the elderly.

In addition to participating in regular exercise, the application of a healthy lifestyle also needs to be accompanied by maintaining a pattern of healthy and nutritious food intake (Joo et al., 2018). Pineda et al. (2019) showed that changes in the school food environment, such as a ban on drinking overly sweetened beverages and an increase in the availability of fruits and vegetables led to a significant decrease in the prevalence of obesity (Pineda et al. 2019). Salam et al. (2020) showed that a combination of diet along with exercise can reduce BMI z-scores in adolescents (Salam et al. 2020). The application of a healthy lifestyle such as physical activity is one way to maintain physical health and maintain quality of life to stay healthy and fit throughout the day (Kemenkes, 2021). Physical activity is intended to reduce sedentary lifestyle, can increase caloric expenditure, and control weight. However, physical activity needs to be done regularly to get good results (Jeki & Isnaini, 2022).

Based on the above problems, the purpose of this study was to find out how much the relationship between physical activity and the incidence of obesity. Previous research explains that, In particular, rural residents have higher rates of chronic diseases and obesity, evidence supports the effectiveness of environmental policies and strategies to prevent obesity and promote health equity (Renée Umstattd Meyer et al., 2016).

METHODS

The study design used in this study was a cross-sectional observational study. The sample in this cross-sectional observation study was 35 male and 15 women with an age range of 24-65 years from Bojong Koneng village, Ba-

bakan Madang district, Bogor regency. We recruited samples and populations using accidental sampling techniques. Accidental sampling technique is a technique of collecting samples by chance. The sample criteria are as follows.

Physical activity is measured using a physical activity questionnaire, BPAQ (Beacke Physical Activity Questionnaire). This questionnaire contains 16 questions covering 3 categories, such as work activities, sports activities, and leisure activities The questionnaire consists of physical activity scores, namely the light physical activity category <5.6, the moderate physical activity category 5.6-7.9, and the heavy physical activity category >7.9 (Rahayuningsih & Muniroh, 2022).

Body composition is measured using Xiaomi Mi Body Scale 2/ BIA (Bioimpedance Analysis), which consists of weight, body mass index, body fat percentage, bone mass, protein percentage, total body water percentage, visceral fat, body age, muscle mass and BMR (basal metabolic rate).

The data analysis used in this study was univariate analysis, bivariate analysis using pearson product moment and spearman rank correlation tests, and multivariate analysis using simple linear regression equation techniques. To find the relationship between variables use the correlation coefficient and the t-test to find the meaningfulness of the relationship. The analysis of the coefficient of determination is used to determine the contribution of variable X to variable Y by multiplying the correlation coefficient that has been squared by 100%.

Double linear regression equations are used for 2 or more variables. To find a relationship consisting of more than 2 variables use multiple correlation coefficients and an F-test to find the meaningfulness of the relationship. The analysis of the coefficient of determination is used to determine the contribution of variable X to variable Y by multiplying the correlation coefficient that has been squared by 100%.

RESULTS

Below are the results of descriptive analysis of the data obtained, as follows.

Table 1. *Descriptive statistics*

Descriptive Statistics					
Variabel	**N**	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Physical Activity	50	4.75	11.00	7.6720	1.64917
Body Fat	50	5.00	47.80	26.8640	11.74735
Visceral Fat	50	1.00	14.00	6.5600	3.76970
BMI	50	15.30	31.40	23.6122	3.90382
Age	50	24	65	46.68	11.765

Table 2. *Sample participation*

Age (Years)	Men (N)	Women (N)	N=40	%
20-30	6	1	7	14
31-40	8	0	8	16
41-50	8	4	12	24
51-60	8	9	17	30
61-70	5	1	6	12

Based on the results of descriptive analysis, it can be seen that the number of data (N) is 50 people, the people of Bojong Koneng village have an average age of 46.68±11.76. In the results of the descriptive analysis, physical activity is known to have an average of 7.67±1.64 which means that physical activity carried out by the people of Bojong Koneng village is classified as moderate physical activity. In addition, it can be known that the average body fat of the people of Bojong Koneng village is 26.86±11.74 with the category of overfat in the male sex and obesity in the female sex. In the variable visceral fat has an average of 6.56±3.76 with normal categories in the male sex and obesity in the female sex. In the variable body mass index has an average of 23.61± 3.90 with normal categories in the male sex and obese in the female sex. In table 2. explain by gender. It can be known that the characteristics of respondents in this study are 70% male and 30% female. People who have the most ages of 51-60 years in this study amounted to 30%.

Table 3. *Characteristics of Respondents*

Characteristics of Respondents	Gender			
	Men		Women	
	Frequency			
	N	%	N	%
Physical Activity				
Light	3	6	8	16
Keep	10	20	6	12
Heavy	22	44	1	2
Average±SD	7,67±1,65			
Body Mass Indeks				
Thin	2	4	0	0
Normal	28	56	4	8
Fat	2	4	3	6
Obesity	3	6	8	16
Average±SD	23,61±3,90			
Body Fat				
Underfat	2	4	0	0
Health	25	50	2	4
Overfat	4	8	2	4
Obese	4	8	11	22
Average±SD	26,86±11,74			
Visceral Fat				
Low	19	38	0	0
Normal	6	12	2	4
High	9	18	3	6
Very High	2	4	9	18
Average±SD	6,56±3,77			
Average weight	60,70±8,67		63,66±10,17	
Average±SD	62,00±9,22			

In table 3. Explaining the characteristics of respondents, it can be seen that in the variable of physical activity, men in rural areas do more heavy physical activity by 44%, while women do more light physical activity by 16%. The mean and standard deviation in the body weight of males was 60.70±8.67 and females was 63.66±10.17. In the variable Body mass index it is known that men who are obese by 6% and women by 16%. Age, sex, and ethnicity were found to have an influence on body fat and BMI in the community of Bojong Koneng Village. Gender can influence the extent to which BMI can predict body fat in the community of Bojong Koneng Village. Women have more total body fat than men (Carpenter et al., 2013).

Body fat in obese men by 8% and women by 22%. A study explains, that light activity has no link with body fat (Winters-VAN Eekelen et al. 2021). The difference in average body fat percentage between men and women was found in this study. Women have a higher body fat average than men. This is in line with research that explains that women's body fat percentage is higher than men's (Goodman-Gruen & Barrett-Connor, 1996).

Visceral fat that falls into the high and very high categories in men by 18% and 4%, while in women by 6% and 18%. . This is in contrast to previous studies that found that the difference in visceral fat in men is higher than in women, besides that there is no difference between visceral fat in men and women (Staiano & Katzmarzyk, 2012). In this study it is known that physical activity carried out by men is classified as heavy physical activity, while in women it is classified as light physical activity. This is what causes differences in visceral fat in men and women. A study says that physical activity for 30 minutes with moderate to strong intensity is associated with a decrease in visceral fat, while light activity is not related (Winters-VAN Eekelen et al., 2021).

Next, it is described in table 4. Related to the relationship between physical activity, body fat, and visceral fat on the body mass index of people in rural areas. To find the correlation value between variables, spearman correlation analysis is used.

Table 4. *Correlation of physical activity, body fat, visceral fat with BMI*

Variabel		Physical Activity	Body Fat	Visceral Fat	BMI
Physical Acativity	R		-0.751	-0.608	-0.725
	Sig. (2-tailed)		0.000	0.000	0.000
Body Fat	R	-0.751		0.672	0.821
	Sig. (2-tailed)	0.000		0.000	0.000
Visceral Fat	R	-0.608	0.672		0.951
	Sig. (2-tailed)	0.000	0.000		0.000
BMI	R	-0.725	0.821	0.951	
	Sig. (2-tailed)	0.000	0.000	0.000	

DISCUSSION

This study discusses the interaction between physical activity, body fat, visceral fat and BMI in rural communities. The results found that obesity that occurs in rural communities is associated with low levels of physical activity as well as high body fat, visceral fat and BMI found in women. Strenuous activity levels are associated with lower body fat, visceral fat and BMI found in males.

Based on the results of the correlation calculation above, it can be explained that, the variable relationship of physical activity with body fat ($R = -0.751$; $\rho = 0.000$) means that physical activity has a strong and significant negative relationship with body fat. A negative sign indicates the direction of the relationship between variables, this can be explained that the higher the physical activity carried out, the less body fat. . This is supported by a study conducted, that someone who has more sedentary activity will have high body fat (DiFrancisco-Donoghue et al., 2022). Other studies report that someone who does more frequent physical activity has low body fat (Zou et al., 2020). Physical activity of moderate to vigorous intensity had a negative association with some body fat and belly fat, while light physical activity had no association with body fat. This is important to prevent abdominal obesity and cardiometabolic disease (Winters-VAN Eekelen et al., 2021).

Based on the results of the correlation calculation above, it can be explained that, the relationship of physical activity variables with visceral fat ($R = -0.608$; $\rho = 0.000$). This means that physical activity has a strong and significant negative association with visceral fat. A negative sign indicates the direction of the relationship between variables, this can be explained that the higher the physical activity carried out, the less visceral fat will be. This is supported by a study that explains that found a relationship between physical activity and abdominal body fat, broadly the same as the relationship between physical activity and total body fat (Bowen et al., 2015). Other studies report that increased visceral fat is a risk factor for metabolic syndrome in postmenopausal women, but high levels of regular physical activity above the threshold of 12,500 steps/day can reduce it substantially (Zając-Gawlak et al., 2017).

Based on the results of the correlation calculation above, it can be explained that, the relationship of physical activity variables with BMI ($R = -0.725$; $\rho = 0.000$). This means that physical activity has a strong and significant negative relationship with BMI. A negative sign indicates the direction of the relationship between variables, this can be explained that the higher the physical activity carried out, the less BMI. This is supported by a study that explains that increased physical activity for 3 three months along with diets carried out by people who are obese shows a decrease in BMI (Rodriguez et al., 2022). The behavior of daily physical activity affects the accumulation of visceral fat and body mass index (Ando et al., 2020). Doing physical activity, such as walking is one way to prevent cardiometabolic disease (Ando et al., 2020).

Based on the results of the correlation calculation above, it can be explained that the variable relationship between body fat and visceral fat ($R = 0.672$; $\rho = 0.000$) shows the direction of a strong and significant positive relationship. This means that, the higher the body fat, the visceral fat. This is supported by research that explains, that there is a positive correlation between body fat and visceral fat (Saraswati et al. 2014).

Based on the results of the correlation calculation above, it can be explained that the variable relationship of body fat with BMI (R = 0.821; ρ = 0.000) shows the direction of a strong and significant positive relationship. This means that, the higher the body fat, the BMI will increase. This is supported by research that explains, that body fat can be predicted well by BMI (Gurrici et al., 1998).

Based on the results of the correlation calculation above, it can be explained that the relationship between visceral fat variables and BMI (R = 0.951; ρ = 0.000) shows the direction of a strong and significant positive relationship. This means that, the higher the visceral fat, the BMI will increase. This is supported by research that explains, that there is a positive correlation between visceral fat and BMI. In addition, it was explained that the correlation between visceral fat and BMI was greater experienced in men (Gadekar et al., 2020). In another study, visceral fat has little to do with BMI. Visceral fat is considered very important for assessing cardiometabolic risk (Shah et al., 2014). The prevalence of abdominal obesity will tend to increase according to BMI and with age usia (Kim et al., 2019).

The study showed that physical activity had a negative association with obesity based on body fat, visceral fat and BMI. In this study, women had a higher average BMI value compared to men, this is because in this study women did more light physical activity, while men had an average BMI value of normal average value conditions due to heavy physical activity. Women with high obesity are associated with risk factors that can cause metabolic syndrome, but high regular physical activity above the threshold of 12,500 steps/day can reduce it substantially (Zając-Gawlak et al., 2017). The findings of this study explain that it is important to engage in moderate-to-vigorous intensity physical activity and is carried out regularly in rural communities. This is important to do to maintain their fitness and health, both physically and mentally. The need to plan government programs related to physical fitness and health in rural areas as an effort to prevent obesity in rural areas.

CONCLUSION AND SUGGESTION

Based on the discussion above, it can be concluded that, the importance of people to do physical activity with moderate to strong intensity, because it can be associated with a decrease in body fat, visceral fat, and BMI. Light activity or sedentary activity can lead to excessive fat accumulation that can lead to obesity. This occurred in both male and female genders in this study. In future studies, more populations and samples are needed to have a better level of accuracy.

Conflict of Interest

The authors declare that there are no confl icts of interest.

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