THE RELATIONSHIP BETWEEN PHYSICAL ACTIVITY AND OBESITY BASED ON BODY FAT PERCENTAGE IN BANJAROYO VILLAGE, KALIBAWANG, KULON PROGO, D.I. YOGYAKARTA

HUBUNGAN AKTIVITAS FISIK TERHADAP KEJADIAN OBESITAS BERDASARKAN BODY FAT PERCENTAGE DI DESA BANJAROYO, KALIBAWANG, KULON PROGO, D.I. YOGYAKARTA

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ABSTRACT

Obesity, a metabolic disorder characterized by the accumulation of excessive body fat, which is closely associated with metabolic derangement-related disease. Obesity can be caused by low physical activity that can be assessed using body fat percentage. The purpose of this study was to identify the relationship between physical activity and obesity based on body fat percentage in Banjaroyo village, Kalibawang, Kulon Progo, Special Region of Yogyakarta. This study was an observational-analytical study with cross sectional design and conducted in January-June 2017. Total samples were 243 people (86 males and 157 females) with age range between 18-65 years old. Physical activity data were collected using a structured interview based on International Physical Activity Questionnaire (IPAQ), while body fat percentage was taken using Bioelectrical Impedance Analysis (BIA). The data were analyzed using comparative Chi-square test with the level of significance of 95%. The prevalence of obesity based on body fat percentage was 78.2% and 21.8% in men and women, respectively. Results of the study showed that there is no significant relationship between physical activity and obesity based on body fat percentage (p=0.419; CI 95%: 0.66-2.689). In conclusion, there is no significant relationship between physical activity and incidence of obesity.

Keywords: *body fat percentage, physical activity, obesity*

ABSTRAK

Obesitas merupakan penyakit metabolik yang ditandai dengan akumulasi lemak yang berlebihan. Aktivitas fisik yang rendah menjadi salah satu penyebab terjadinya obesitas. Keadaan obesitas dapat diukur dengan menggunakan persentase lemak tubuh yang didefinisikan sebagai proporsi dari massa lemak tubuh seseorang. Tujuan dari penelitian ini adalah untuk mengidentifikasi hubungan antara aktivitas fisik dengan kejadian obesitas berdasarkan Body Fat Percentage (BFP) pada warga di Desa Banjaroyo, Kalibawang, Kulon Progo, D.I.Yogyakarta. Jenis penelitian yang dilakukan adalah observasional analitik dengan rancangan penelitian potong lintang dan dilakukan pada bulan Januari- Juni 2017. Jumlah sampel penelitian sebanyak 243 responden yang terdiri dari 86 pria dan 157 wanita dewasa dengan rentang usia 18 – 65 tahun. Aktivitas fisik dinilai melalui panduan wawancara International Physical Activity

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Questionnaire (IPAQ) dan body fat percentage dinilai dengan instrumen Bioelectrical Impedance Analysis (BIA). Analisis statistik dilakukan dengan uji komparatif Chi-square dengan taraf kepercayan 95%. Prevalensi obesitas berdasarkan body fat percentage adalah 78,2% pada wanita dan 21,8% pada pria. Hasil penelitian menunjukkan tidak terdapat hubungan yang bermakna antara aktivitas fisik terhadap obesitas berdasarkan body fat percentage (p=0,419; CI 95%: 0,66-2,689). Kesimpulan penelitian ini adalah tidak ada hubungan bermakna antara aktivitas fisik dan kejadian obesitas.

Kata kunci: *body fat percentage, aktivitas fisik, obesitas*

INTRODUCTION

Obesity is a metabolic disease characterized by excessive accumulation of fat that can lead to some diseases; cardiovascular, diabetes, and joint disease (Zeng et al., 2012). As many as 600 million people around the world (13%) suffer from obesity in 2014. Obesity causes more deaths than underweight (WHO, 2016). In Indonesia, the prevalence of obesity among adults is 14.76%. In 2013, prevalence of obesity was 19.7% in men and 32.9% in women. Prevalence of obesity of men and women in 2013 has increased, compared to 2007 (13.9% in men and 13.9% in women) and 2010 (7.8% in men and 15.5% in women). Prevalence of obesity among women has increased from 2007 (18.1%) and from 2010 (15.5%) (Kementrian Kesehatan Republik Indonesia, 2013). The Province of Special Region of Yogyakarta is one of the 16 provinces with the highest prevalence of obesity in the national scale (Kementrian Kesehatan Republik Indonesia, 2016).

Regular physical activity is useful to control weight and prevent chronic diseases that can occur due to the obesity (Kementrian Kesehatan Republik Indonesia, 2011). Adequate physical activity for adults can reduce the risk of hypertension, coronary heart disease, stroke, diabetes and cancer (Widiantini and Tafal, 2014). Percentage of the lack of physical activity in rural area is 54.03%. This can cause obesity which is 13.36% higher than society with adequate physical activity (Sudikno et al., 2010). According to research conducted by Sunu et al. (2017), 42.2% of communities in Cangkringan, Sleman Regency, Yogyakarta, are obese. The obesity percentage is higher in women (32.4%) than in men (9.8%). Transportation and informatics technology in rural area has influenced most of the communities less engaged in physical activty (Lita, 2016).

Anthropometric measurement can be used to measure body fat percentage. Body fat percentage is the proportion of fat mass in human's body. Body fat percentage (BFP) has a direct significant relationship to the increase of risk factor for cardiovascular disease, such as total cholesterol, triglyceride, low-density lipoprotein cholesterol, and fasting plasma glucose. The research also shows that BFP is a predictor of more closely related cardiovascular disease than body mass index (BMI) (Zeng et al., 2012).

Method that is used to determine someone's obesity status is body mass index (BMI), bioelectrical impedance analysis (BIA), waist to hip ratio (WHR), and waist circumference (WC). Among these methods, BIA used to measure percentage of body fat is a method that has a significant relationship with the body fat composition of a person compared to other methods (Duncan and Nevill, 2010). Bioelectrical Impedance Analysis (BIA) is used to predict the total of body fat by running the technique of weak electrical current through the body (Hoeger and Hoeger, 2013). The Bioelectrical Impedance Analysis (BIA) has a principle that lean mass contains ion which is in aqueous solution can deliver electrical signal compared to fat mass (Goonasegaran et al., 2012). The use of BIA is relatively safe because it applies low electrical current with low frequency (Ramadhan and Billy, 2017).

According to the above description, this research aims to identify the relationship of physical activity toward obesity according to body fat percentage in Banjaroyo Village, Kalibawang, Kulon Progo, Special Region of Yogyakarta.

METHODS
Research Design and Subject
This research was analytical observational research with cross-sectional design. The research respondents were the community of Banjaroyo Village, Kalibawang, Kulon Progo, aged 18-65 years and had been willing to sign informed consent. The type of purposive sampling with non-random technique was used as the sampling technique. The inclusion criteria of this research were healthy adults, aged 18-65 years old, male and female, who did not do vigorous physical activity 12 hours before the measurement, did not consume alcohol 48 hours before the measurement and who were willing to sign the informed consent. Meanwhile, the exclusion criteria were people with physical disabilities who cannot perform physical activity, are pregnant, consume alcohol, are absent in the data collection, and are not willing to sign the informed consent. The procedures used in this research had been approved by the Medical and Health Research Ethics Committee of Medicine Faculty of *Universitas Gadjah Mada,* number: KE/FK/0837/EC/2017.

Data Collection
The data collection was conducted by measuring height, fat percentage and physical activity using an interview method which refers to IPAQ structured interview guide. Height measurement was conducted by using stature meter with Height® which is validated in *UPT Metrology Legal* of Yogyakarta. The fat percentage measurement tool of this research was body fat scale with Omron®. The body fat scale had been validated using the secondary validation by comparing body fat percentage measured using Bioelectrical Impedance Analysis with Omron® with skinfold thickness. Skinfold thickness used to validate BIA with *pzi dou fi* brand, has been

calibrated at the Calibration Laboratory of Testing Center and Goods Quality Certification of Surakarta.

Body Fat Percentage Measurement
The data used in Bioelectrical Impedance Analysis for measuring the value of Body Fat Percentage (BFP) were age, gender, and height. The measurement was Bioelectrical Impedance Analysis scale with upright position, facing straight forward and using no footwear and accessories (Gonzalez-Correa and Caicedo-Eraso, 2012; Citra, 2015). The respondents could go up to the scale and step on the foot electrode after the respondents' data had been entered to Bioelectrical Impedance Analysis. The respondents were required not to move until the measurement was complete (OMRON Healthcare Asia, 2016). The result of body fat percentage would be classified based on American Council on Exercise. According to American Council on Exercise (2010), someone is said to be obese if the value of body fat percentage in woman >32% while in man >25%.

Physical Activity Assessment
There are three categories of physical activity namely vigorous, moderate, and low. The physical activity with low intensity keeps the heart rate normal, such as walking and sweeping. The physical activity with moderate intensity increases the heart rate and produces less sweat, such as walking fast, cycling, dancing and gardening. Meanwhile, the physical activity with vigorous intensity requires energy, increases the heart rate, produces more sweat when much energy is released, such as exercising, hoeing and running (Befort et al., 2012; Intercollegiate & Network, 2010; WHO, 2017).

International Physical Activity Questionnaire (IPAQ) short form can be used to categorize physical activity of adult population aged 15-65 years (IPAQ Researcher Committee, 2005). Unit of measurement for the value of physical activity is kcal/kg/hour or MET (Metabolic Equivalents). IPAQ short form consists of seven questions used to measure someone's

physical activity during the last seven days. There are three categories based on the classification of physical activity; low physical activity <600 MET-minute/week, moderate physical activity ≥600 MET-minute/week and vigorous physical activity ≥3000 MET-minute/week (IPAQ Research Committee, 2005). Physical activity data obtained from interview result then processed by using IPAQ protocol.

The interview guide used in this research had been given to the professional judgment in order to ensure that IPAQ questionnaire is a proper translation from English into Indonesian. The language comprehension test was conducted to ensure that the language used was well understood by the respondents and was conducted on 12 respondents aged 18-65 years from Duren Sawit sub-village, Banjaroyo village, Kalibawang, Kulon Progo, Special Region of Yogyakarta, who have similar characteristic with the residents of Banjaroyo village (Notoatmodjo, 2012). Interview guideline of physical activity used by the researcher was not examined for its validity and reliability because the interview guideline IPAQ-SF questionnaire has been used by other institutions (Marcelia, 2014; Wibowo, 2014).

Statistical Analysis

The data collection was conducted in the Research Center of Clinical Epidemiology and Biostatistic Unit of *Universitas Gadjah Mada Yogyakarta* by using IBM SPSS 22 program. Comparative test using Chi-square was conducted on physical activity and body fat percentage. Significant test between the observed data and the expected data was conducted by using 95% of trust level (Dahlan, 2014).

Table I. Demographic Characteristics of Research Respondents (N=243)

Variable		Female (n=157) n (%)	Male (n=86) n (%)	Total (n=243) n (%)	*p-value*
Age	41-65	113(46.5)	62 (25.5)	175 (72.0)	0.984*
	18-40	44 (18.1)	24 (9.9)	68 (28.0)	
Physical Activity	Low-moderate	31 (12.8)	8 (3.3)	39 (16.0)	0.034*
	Vigorous	126 (51.9)	78 (32.1)	204 (84.0)	
BFP	Obesity	83 (34.2)	25 (10.3)	108 (44.4)	<0.001*
	Non-obesity	74 (30.5)	61 (25.1)	135 (55.6)	
Smoking habit	Not Smoking	157 (64.6)	53 (21.8)	210 (86.4)	<0.001**
	Smoking	0 (0)	33 (13.6)	33 (13.6)	
Occupation	Unemployed	58 (23.9)	7 (2.9)	65 (26.7)	<0.001*
	Underemployed	99 (40.7)	79 (32.5)	178 (73.3)	
Dietary Habits	Less	1 (0.4)	1 (0.4)	2 (0.8)	1.000**
	Enough	156 (64.6)	85 (35.0)	241 (99.2)	
Education Level	≤ Middle School	131 (53.9)	63 (25.9)	194 (79.8)	0.058*
	≥ High School	26 (10.7)	23 (9.5)	49 (20.2)	
Income	Low	116 (47.7)	42 (17.3)	158 (65.0)	<0.001*
	High	41 (16.9)	44 (18.1)	85 (35.0)	

* Chi-square Test; ** Fisher Test

Table I. The Relationship of Physical Activity toward Obesity based on BFP in Research Respondents in Banjaroyo Village

Variable	Obesity		Non-obesity		*p*	OR	95% CI
	n	%	n	%			
Physical Acitivity							0.66-2.689
Low-Moderate	19	17.30	18	13.5	0.419ᵉ	1.33	
Vigorous	91	82.70	115	86.5			

Note:
ᵉ Comparative Test of *Chi-Square* p >0.05 = does not significantly influence

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Table III. Others Factors influencing Obesity in Banjaroyo Village (N=243)

Variable	Obesity		Non-Obesity		*p-value*	OR (95% CI)
	n	%	n	%		
Gender						
Female	83	34.2	74	30.5	<0.001[f*]	2.737 (1.562-4.769)
Male	25	10.3	61	25.1		
Age						
41-65 years old	84	34.6	91	37.4	0.074[*]	1.692(0.948-3.020)
18-40 years old	24	9.9	44	18.1		
Dietary Habits						
Less	1	0.4	1	0.4	1.000**	1.252 (0.077-20.256)
Enough	107	44	134	55		
Smoking Habits						
Not Smoking	99	40.7	111	45.7	0.033[f**]	2.378(1.055-5.360)
Smoking	9	3.7	24	9.9		

Note:
[f] Comparative Test of *Chi-Square* p <0.05 = does significantly influence
*Uji *Chi-square*; **Uji *Fisher*

RESULTS AND DISCUSSION

There were 243 respondents consisting of 157 female respondents and 86 male respondents fulfilling the inclusion criteria. The demographic characteristics of research respondents in Village Banjaroyo covered age, physical activity, BFP, smoking habit, occupation, dietary habits, education, and income levels as presented in Table I.

Based on the statistical analysis result of the characteristics and demography of the research respondents (Table I), the community of Banjaroyo village mostly performed vigorous physical activity. There were 126 women (51.9%) and 78 men (32.1%) who did vigorous physical activity. There were 31 women (12.8%) did a low-moderate physical activity, whereas only eight men (3.3%) did a low-moderate physical activity. Based on the chi-square test, there is a significant relationship between physical activity and gender (p=0.034). The result is in line with previous researchers suggesting that women tend to do lighter physical activity than men (Sudikno et al., 2010; Sunu et al., 2017). Low physical activity leads to a greater chance of being obese (Diana et al., 2013; Wanner et al., 2016; Sudikno et al., 2010; Sunu et al., 2017; Sidik and Rampal, 2009; Nurzakiah et al., 2010).

There were 83 women (34.2%) and 25 men (10.3%) who were obese in Banjaroyo village. Meanwhile, there were 74 women (30.5%) and 61 men (25.1%) who were not obese. Based on the chi-square test that has been conducted, there is a significant relationship between obesity and gender (p<0.001). The result is corroborated by previous researchers suggesting that the obesity proportion on women is greater than in men (Nurzakiah et al., 2010; Riebe, 20; Sudikno et al., 2010; Sidik and Rampal, 2009; Sunu et al., 2017; Fenty et al., 2016).

The respondents' dietary habits in Banjaroyo village are classified based on the consumption of vegetables and fruits, namely Less and Enough. There were 156 women (64.6%) and 85 men (35%) who had a habit of consuming vegetables and fruits. In average, the income level of the community of Banjaroyo village is in the middle level. It is proven by 116 women (47.7%) and 42 men (17.3%) who had low income (0-500,000 IDR). There were 41 women (16.9%) and 44 men (18.1%) who had high income (>500,000 IDR) (Sudikno et al., 2010). Based on the chi-square test that has been conducted, there is a significant relationship between income and gender (p<0.001).

Table II shows that there is an insignificant relationship between physical activity and body fat percentage (p=0.419; CI 95%=0.66-2.689). The result is in line with some researchers suggesting that there is an

insignificant relationship between physical activity and obesity (Dewi and Mahmudiono, 2012; Joh et al., 2013; Novitasary et al., 2013; Veghari et al., 2010; Tan and Yim, 2010). Meanwhile, the result is different from the research conducted by Rachmi and Allison (2017) which state that there is a significant relationship between less physical activity and obesity rate in Indonesia. The low level of physical activity is associated to have high risk in suffering obesity for men in Malaysia, but it does not apply to women (Chan et al., 2017).

Obesity is a complex problem caused by behavior, psychology, environment, and genetic factors (Chan et al., 2017). Obesity is not always associated with low physical activity. Energy that has been produced when doing physical activity shows that there is no difference for the subject who has a normal weight and is obese. Individual who is obese tends to be less physically active rather than the one who has normal weight (Westerterp, 2013). Obesity can happen because of the amount of energy in the form of food is greater than the amount of energy produced. The low energy production which is accompanied with excessive food consumption will increase the weight (Swift et al., 2014). The important consideration about the relationship between physical activity and obesity is the presence of hormones that can stimulate food entering the body. This will affect the balance of energy that is still not fully understood (Cook and Schoeller, 2011).

Others factors influencing obesity are gender, age, dietary habits, and smoking habits. Based on the table III, factor of gender and smoking habit have significant relationship to the obesity (p<0.05). This result is in accordance with the research conducted by Fenty et al. (2016), which states that in rural area of Yogyakarta, the prevalence of obesity among women is higher than men. Fat body can decrease when the physical activity is doing in high intensity. Meanwhile, women tend to compensate energy produced with increased food. Generally, women are not really losing body fat even though they do intensive exercise (Westerterp, 2013). In addition, smoking habit

also has a significant relationship to obesity (p<0.05). This is in line with the research conducted by Clair et al., (2011) who suggest that smoking habit at least one cigarette per day is positively associated with abdominal fat increase. Active smokers are more likely to have an unhealthy lifestyle such as less physical activity, high consumption of alcohol and less consumption of vegetables and fruits which easily cause fat accumulation in abdominal area.

CONCLUSION

Based on the research that had been done, it can be concluded that there is no significant relationship between physical activities and the incidence of obesity among the community in Banjaroyo Village, Kalibawang, Kulon Progo, Special Region of Yogyakarta (p=0.419). Women have 3.12 times greater of suffering obesity than men. It is also applied for the respondents who do not smoke in which they have 2.95 times greater risk of suffering obesity than the respondents who do smoke.

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