

Abdominal Obesity is Associated with Physical Activity Index in Indonesian Middle-Aged Adult Rural Population: A Cross-Sectional Study

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Abstract

Background: Obesity is one of the significant health problems. Physical activity includes a potential modifier in the development of abdominal obesity. **Objective:** The objective of the study is to analyze the association between physical activity and abdominal obesity in middle-aged adults in the Indonesian rural population. **Methods:** A community-based study was conducted in a rural area of Malang, Indonesia. Data were collected using interviews to obtain sociodemographic and physical activity index (PAI). Waist circumference was measured using a tape measure. Data were analyzed using one-way ANOVA and logistic regression. **Results:** A total of 75 adults (62.7% were female) was included in this study. Mean waist circumference was 88.18 ± 9.21 cm. Total prevalence of abdominal obesity was 69.3%. Among the total of participants, 29.3% were inactive. A significant association was found between physical activity and abdominal obesity. Participants with inactive PAI have a higher risk of suffering from abdominal obesity than those with active PAI with odds ratio = 7.04; 95% confidence interval: 1.55–31.99. **Conclusion:** In middle-aged adults living in a rural area of Indonesia, physical activity was associated with a lower risk of abdominal obesity. Strategies for preventing and reducing abdominal obesity in rural areas should consider improving physical activity.

Keywords: Abdominal obesity, middle-aged adult, physical activity, rural population

INTRODUCTION

The double burden of malnutrition has been widely documented in developing nations, including Indonesia. In addition to the undernutrition problem, Indonesia also faces the problem of an increasing prevalence of overnutrition (overweight and obesity, or diet-related noncommunicable disease [NCD]).^[1] Overweight and obesity are important modifiable risk factors for chronic NCD and were attributed to 3.4 million deaths worldwide in 2010.^[2]

Obesity is generally referred to as general obesity and abdominal obesity. Obese individuals have higher mortality and morbidity rates compared to nonobese individuals.^[3] The measurement of abdominal fat is one of the best predictors of visceral fat relative to other anthropometric indicators.^[4] Abdominal fat is reported to strongly correlates with most metabolic diseases such as diabetes mellitus and dyslipidemia. Abdominal fat is also regarded as an independent risk factor in cardiovascular diseases such as hypertension.^[5] Physical

activity may be a crucial protective factor for the development of obesity. Moreover, it appears that physical activity that is at least moderate-intensity may be necessary to enhance long-term weight loss and minimize weight regain following weight loss.^[6]

Although obesity was often associated with higher income and urbanization, little is known about the situation in rural area. Rural areas vary in demographic, cultural, and socioeconomic characteristics from urban areas, which are considered to be significant in determining obesity at the population level.^[7] Rural populations have low education, low revenues, and

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inadequate access to health care services, leading to disparities with the urban population.^[5] However, little is known about the association of physical activity and abdominal obesity, including the prevalence of abdominal obesity in the rural population. In the present study, we aimed to estimate the prevalence of abdominal obesity and its association with physical activity in middle-aged adults living in rural areas in Indonesia.

MATERIALS AND METHODS

Design

This was a cross-sectional study conducted at Randuagung Village, Singosari District, Malang Regency, East Java, Indonesia, in 2013.

Population and sample

Sample was enrolled using consecutive sampling. The sample size was determined using Lemeshow formula with 95% degree confidence level, anticipated population proportion of 0.6 degrees 0.1. Inclusion criteria were the adult population aged 49–59 years. Exclusion criteria were pregnant women, having a severe physical or mental illness that was unable to give a response or causing waist circumference measurements cannot be performed, and not willing to be a participant.

Ethical consideration

This study was conducted according to the Helsinki Declaration of 1975 as revised in 2000. Written informed consent was obtained from study participants who agreed to participate in the study. This study was approved by the Faculty of Medicine, Universitas Airlangga (approval date: April 21, 2013; number: 214). Data that show patient personal information were omitted.

Definitions

Abdominal obesity was defined using cutoff points for Asians as waist circumference for males >90 cm and females >80 cm.^[8] Physical activity was defined as daily activities conducted by participants as measured by general practice physical activity queries, which divided into four physical activity index (PAI) categories: Inactive (sedentary job and no physical exercise or cycling); moderately inactive (sedentary job and some but <1-h physical exercise and/or cycling per week, or standing job and no physical exercise or cycling); moderately active (sedentary job and 1–2.9 h physical exercise and/or cycling per week, or standing job and some but <1-h physical exercise and/or cycling per week, or physical job and no physical exercise or cycling); and active (sedentary job and ≥3 h physical exercise and/or cycling per week, or standing job and 1–2.9 h physical exercise and/or cycling per week, or physical job and some but <1-h physical exercise and/or cycling per week, or heavy manual job).^[9]

Data collection

Data were collected from auto-history taking recorded in the form of a questionnaire, consist of participants' identity, background characteristics, physical activity. Measurements

of waist circumference performed using a tape measure in an upright and calm position. Clothing or measurement barriers were removed. The measuring tape was placed on the crista iliaca. Measuring tape was not allowed to press the skin too tight and must be looped parallel to the floor. Measurements were taken at the end of normal expiration.^[8,10]

Data analysis

Analysis of data was conducted using the SPSS for Windows, v25.0 (IBM Corp., Armonk, N.Y., USA). Fisher's exact test was used to identify the association between the categorical variables. One-way ANOVA was used in the bivariate analysis to identify the association between physical activity and waist circumference. Logistic regression was used to calculate the odds ratio (OR) of PAI and abdominal obesity. $P < 0.05$ was considered significant.

RESULTS

A total of 75 study participants were enrolled in the study. Nearly 62.67% of participants were female. The mean age of all participants was 53.81 ± 3.78 years. Most study participants were housewives (50.67%), merchants (18.16%), and farmers (10.67%). Nearly 66.67% of participants had family members ≤4. Dyslipidemia was found in 18.67%. Hypertension and diabetes mellitus were found in 58.67% and 13% of participants, respectively. Nearly 29.3% of the total participants were in the inactive category of PAI, 28% were moderately inactive, 17.3% were moderately active, and 25.3% were active.

Mean waist circumference, according to PAI and gender, is shown in Table 1. Mean waist circumference of all participants was 88.18 ± 9.21 cm. Total prevalence of abdominal obesity was 69.33% (95% confidence interval [CI]: 0.57–0.79). A total of 42.86% of male participants and 85.11% of female participants were suffered from abdominal obesity.

A significant association was found between waist circumference and physical activity ($P = 0.006$). Table 2 shows the relationship between physical activity and abdominal obesity after considering the confounding factors. The proportion of participants with PAI inactive and moderately inactive and suffered from abdominal obesity (88.37%) was higher

Table 1: Mean of waist circumference of study participants

PAI	n = 75	Waist circumference (mean ± SD)		
		Male	Female	Total
Inactive	22	90.50±11.84	92.09±9.19	91.73±9.57
Moderately inactive	21	95.33±6.51	89.61±8.25	90.43±8.14
Moderately active	13	89.75±6.92	81.60±8.33	86.62±8.25
Active	19	81.25±9.01	85.10±6.66	82.67±8.25
Total	75	86.84±9.81	88.98±8.85	88.18±9.21
<i>p</i> *		0.01	0.05	0.002
<i>r</i>		-0.478	-0.288	-0.352

*Correlation was analyzed by Spearman with the significant cut-off <0.05. SD: Standard deviation, PAI: Physical activity index

Table 2: Relationship between physical activity and abdominal obesity

PAI	n=75	Abdominal obesity, n (%)	Nonobesity, n (%)	OR (95% CI)	P
Inactive	22	19 (86.36)	3 (13.64)	7.04 (1.5531.99)	0.012
Moderately inactive	21	19 (90.48)	2 (9.52)	6.67 (1.4630.43)	0.014
Moderately active	13	6 (46.15)	7 (53.85)	0.95 (0.233.92)	0.946
Active	19	8 (42.10)	11 (57.90)	1.00 (reference)	

PAI: Physical activity index, OR: Odds ratio, CI: Confidence interval

compared to participants with PAI active and moderately active (43.75%). Participants with inactive PAI have a higher risk of suffering from abdominal obesity than those with active PAI (OR = 7.04; 95% CI: 1.55–31.99).

Abdominal obesity was associated with the risk of metabolic diseases. Our results showed that abdominal obesity is significantly associated with hypertension [Table 3]. The proportion of hypertensive patients with abdominal obesity is significantly higher than nonobese.

DISCUSSION

A high prevalence of abdominal obesity was found in our study. Our study also demonstrated that there was a relationship between physical activity and the incidence of central obesity in middle-aged people in rural populations. Moderately inactive and inactive PAI increased the risk of getting abdominal obesity in these populations. This finding is consistent with the study from Camões *et al.*, which stated that increased physical activity is associated with a decrease in the incidence of central obesity (RR = 0.47 [0.27–0.94]).^[11] A population-based study on adults living in a rural area with a total prevalence of abdominal obesity 37.8%, also demonstrated that rural activity was a protective factor for abdominal obesity in men.^[2] Findings from the ANIBES study in Spain also showed that vigorous physical activity reduced the risk of abdominal as well as general obesity.^[12] However, the discordant result was found in a study assessing evidence from Indonesia's national health survey, with a total prevalence of abdominal obesity 28%, which stated that no relationship was found between physical inactivity and abdominal obesity.^[13]

Abdominal obesity, or often termed visceral obesity, was closely related to clustering cardiometabolic risk factors. Hypertriglyceridemia, adipose tissue proinflammatory cytokines release; increased free fatty acid availability, liver insulin resistance, reduced clearance of triglyceride-rich lipoproteins, increased very low-density lipoprotein synthesis and secretion; the presence of small, dense low-density lipoprotein; and reduced high-density lipoprotein cholesterol levels are among the many metabolic changes closely associated with this condition.^[14]

Physical activity is inversely associated with abdominal obesity. Physical activity is an effort to prevent weight gain and significantly contributes to long-term weight loss, and reduces health risks associated with chronic disease. Physical activity also leads to moderate weight loss. Physical activity is also

Table 3: The history of metabolic disease among abdominal-obese participants

Diseases	Abdominal obesity (%)		P
	Nonobese	Obese	
Hypertension	8/23 (34.8)	36/52 (69.2)	0.006*
Diabetes melitus	1/23 (4.3)	13/52 (5.8)	0.641
Dislipidemia	1/23 (4.3)	1/52 (1.9)	0.522

*P value was obtained by the Fisher's exact test with the significant cut-off <0.05

associated with increased sustained weight loss and weight gain protection after initial weight loss.^[6] Existing evidence supports that physical activity intensity should be moderate to vigorous to affect body weight control.^[15,16]

There are also increasing reports that physical activity can be accrued over the day in shorter periods rather than in longer and structured periods, and as such physical activity can play an essential role in body weight control.^[6] In studies, even without statistically significant body weight changes, regular physical activity was associated with a marked decrease in waist circumference. In most studies, improvements in cardiometabolic risk variables have followed a significant decrease in waist circumference in the absence of weight loss.^[14,17]

A lack of physical activity will cause an energy imbalance (energy excess consumed relative to that used for basal body metabolism, physical activity, and the food's thermal effect) in the form of energy excess, stored as an energy reserve in the form of fat. The distribution of fat is mostly found in the abdominal area, causing an enlarged abdomen, which increases waist circumference.^[18,19]

In this study, we also investigated the association of abdominal obesity with hypertension, diabetes mellitus, and dyslipidemia as the known metabolic diseases. We showed that abdominal obesity has a significant association with hypertension. Previous studies also showed that waist circumference is positively correlated with hypertension.^[20] The mechanism linking abdominal obesity with hypertension might be explained by the activation of the renin-angiotensin-aldosterone system, which primarily leads to the activation of the sympathetic activity, promotion of leptin resistance by increased procoagulatory activity. The cumulative effect of this cascade is endothelial dysfunction and inflammatory changes. The additional mechanism includes the enhanced renal sodium reabsorption with a resultant increase in volume expansion usually observed in abdominally obese patients.^[21]

Our study presents some limitations. This was a cross-sectional study with small sample size. Thus, the documented associations can not be established, and/or only hypothetical causal relations can be interpreted. Primary data collection techniques in interviews are very subjective, and recall bias may happen because the information was just based on participants' self-report measures. Several other factors that might be related to abdominal obesity were not analyzed in this study.

CONCLUSION

Our study demonstrated that in middle-aged adults living in a rural area, physical activity was associated with a lower risk of abdominal obesity. Strategies for preventing and reducing abdominal obesity in rural areas should consider improving physical activity. Further study is needed to clarify the role of physical activity, including other risk factors in determining obesity in rural areas.

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Conflicts of interest

There are no conflicts of interest.

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