RELATIONSHIP BETWEEN BODY MASS INDEX AND WAIST TO HIP RATIO IN PATIENTS WITH CORONARY HEART DISEASE

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ABSTRACT

Background: Body mass index (BMI) is a measure of body fat based on height and weight that applies to adult men and women. As the highest BMI category, obesity is known to be one of the risk factors for coronary heart disease (CHD). Obesity increases the accumulation of excess body fat which in turn increases waist to hip ratio (WHR). Several studies have reported that WHR is associated with an increased risk of CHD. This study aimed to determine the relationship between BMI and WHR in patients with CHD.
Subjects and Method: This was a cross-sectional study conducted at Gatot Soebroto Army Hospital, in January to May 2015. A random sample of 90 patients with CHD were selected for this study. The dependent variable was WHR. The cutoff value for high risk of CHD is 85 cm (0.90) for Asian men and 75–80 cm (0.79–0.85) for Asian women. This study used 80 cm WHR cutoff point to make dichotomous variable for women. The independent variable was BMI. According to the Asian-Pacific, BMI are categorized into four groups: underweight (<18.5 kg/m^2), normal weight (18.5–22.9 kg/m^2), overweight (23–24.9 kg/m^2), and obese (≥25 kg/m^2). This study used overweight cutoff points to make dichotomous variable. The data were analyzed by chi-square with odd ratio (OR) has the measure of association.
Results: There was a positive relationship between WHR and BMI, and it was statistically significant (OR= 8.25; CI 95%= 2.89 to 23.48; p <0.001).
Conclusion: WHR is positively associated with BMI patients with CHD.

Keywords: waist-to-hip ratio, body mass index, patients with coronary heart disease.

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BACKGROUND

Coronary Heart Disease (CHD) is estimated to be around 30% as the main cause of death worldwide. According to WHO 2013, out of 17 million deaths, 37% were caused by cardiovascular disease (especially CHD, stroke, and rheumatic heart disease (WHO, 2013). The American Heart Association (AHA) in 2008 estimated the prevalence of CHD in the United States to be around 13.2 million. (American Heart Association 2008) and CHD are the biggest cause of death in adults, one third of whom are over 35 years old (Hadaegh et al., 2010). In Indonesia heart disease is also the biggest cause of death, according to the Ministry of Health (Kemenkes) of the Republic of Indonesia 2014 it is estimated that CHD will continue to increase to reach 23.3 million deaths in 2030 (Ministry of Health, 2014).

However, until now, CHD is still a disease which is a big problem, there is a classification of CHD risk factors

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that can be modified to reduce the risk of CHD. Many known risk factors for heart disease such as smoking, metabolic syndrome, hypertension, high cholesterol levels and obesity (Despres, 2012).

The basic problem that is generally known to be heart disease is caused by atherosclerosis of the coronary arteries, one of which can be caused by obesity which can cause an increased risk of ischemia or myocardial infarction (IM) or CHD (Price and Wilson 2013).

Obesity is the accumulation of fat in the body. Low physical activity followed by excessive eating patterns can lead to obesity and excess fat deposits. According to WHO (2013), 1.6 billion adults in the world are classified as overweight and 400 million people are classified as obese, and in America more than 60% are in the category of overweight and obese BMI. In 2015, it is estimated in America that 2 in 5 adults and 1 in 4 children will be obese. Being overweight/ obese has risks associated with excess adiposity or body fatness (Zeller et al., 2008).

In the diagnosis of obesity, BMI can be measured to determine the presence of excess body weight and the Waist to Hip Ratio (WHR) is measured to determine the distribution of abdominal fat/ subcutaneous fat (Whitlach et al., 2015). BMI, which is measured by weight in kilograms divided by height in meters squared (kg/m2), is often used to measure fat deposits in the whole body (Mawi, 2003). Because there are many varying results in measuring visceral fat on the resulting BMI values, starting in 1997 waist circumference measurements could represent a simple and inexpensive marker for measuring visceral fat (Despres 2012).

Technically, fat deposits in the abdominal cavity can be determined by looking at the WHR, namely by calculating the results for the measurement of the waist circumference and the measurement of the hip circumference. A high WHR reflects the amount of fat deposited in the abdominal cavity and can indicate obesity which is at risk for heart disease (Haryati et al., 2013).

In Christina's study (2010), it was said that adults with high WHR have risk factors for cardiovascular disease. According to Krotkiewski, men with a ratio > 0.90 and women with a ratio > 0.85 in the South Pacific population have high risk factors (Christina, 2010).

According to the results of research on Turkish people, BMI has a strong relationship with WHR as an anthropometry of obesity which is at risk of CHD. In contrast to the research by Wang and Hoy (2004), it states that the WHR measurement is more accurate because it describes the accumulation of intra-abdominal fat and visceral fat specifically compared to BMI as an anthropometry of obesity which is at risk for CHD (Wang and Hoy, 2004).

Judging from the high morbidity of CHD in increasing BMI and WHR, there has been no previous research that specifically discusses the relationship between the two. As well as many previous studies examining the many variables related to body composition, namely BMI, waist and hip circumference on blood lipid profiles, namely HDL, LDL, triglycerides, and total cholesterol. So, from the background above, researchers are interested in conducting research to determine the

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relationship between BMI and WHR in patients with CHD.

SUBJECTS AND METHOD

1. Design Study

The research design that will be carried out is to use a cross-sectional design, that is, during the interview, the researcher observes and measures variables at a certain moment, with this method the subject is only observed once and the subject variable is measured. The researchers obtained informed consent and took direct measurements of the patients to find out and assess how much influence the BMI (Primary Data) had on the WHR (Primary Data) in CHD patients at the Gatot Soebroto Army Hospital Jakarta Cardiac Polyclinic for the period January - March 2015 (Sastromoro et al., 2011).

2. Population and Sample

This research was conducted at the Heart Polyclinic of Gatot Soebroto Army Hospital, January - March 2015. The target population for this study were heart disease patients who came to the Gatot Soebroto Army Hospital Cardiology Clinic for the period January to March 2015. The reachable population for this study were CHD patients who came to the Cardiac polyclinic. Gatot Soebroto Army Hospital for the period January to March 2015. The sampling method used was consecutive sampling, meaning that the criteria were included in the study until the required number of subjects was met according to all subjects who came sequentially.

3. Study Variable

The dependent variable is the waist-to-hip ratio (WHR). The independent variable is body mass index (BMI).

4. Definition Operasional of Variable

The waist-to-hip ratio was an anthropometry/ simple method for differentiating between obesity in the lower body (hips and buttocks) and obesity in the upper body (waist and abdominal area) (Gibson, 2005). The measuring instrument is the Meterline/ Measuring tape (ABN).

Body mass index (BMI) was one of the simple parameters of body anthropometric examination to monitor the nutritional status of adults especially related (Seidell, 2009). Weighing scales and height measuring devices (microtoise staturemeter smic ZT 120) and calculating with the formula: (body weight (kg)/ height squared (m^2) (WHO, 2004) The measurement results include: underweight (<18.5); normoweight: (18.5–22.9); overweight (23.0–24.9); obese: (≥25). The measurement scale is categorical. The measurement results are divided for: Female: No risk: <0.80; Medium risk: 0.81 – 0.85; High risk: > 0.85, while for men: No risk: <0.90, Medium risk: 0.90 – 1.00, High risk: >1.00 (Oviyanti, 2010) The measurement scale is categorical.

5. Study Instrument

Instruments in this study included body weight scales/microtoise staturemeter (smic ZT 120), height measurement/ microtoise staturemeter (smic ZT 120), and meterline (ABN).

6. Data Analysis

The data were analyzed by chi-square with odd ratio (OR) has the measure of association.

RESULTS

The results of the study were obtained from an analysis of primary data on 90

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subjects regarding the relationship between body mass index (BMI) and waist-to-hip ratio (WHR) in CHD patients at the Gatot Soebroto Cardiology Hospital for the period January to March 2015 consisting of univariate data analysis and bivariate data analysis.

This data is obtained from measurements directly to the subject. The study was conducted by looking at the patient's medical records, to assess the subject's inclusion and exclusion criteria. After that, giving informed consent to the subject, by explaining the research procedure, the benefits of the research and making informed consent after explanation. This research is voluntary without coercion to related subjects.

After obtaining informed consent, the researchers intervened directly with the patient by measuring their weight and height to get BMI results, then measuring waist and hip circumference to get the WHR value.

In this study, the results of the analysis presented and discussed were the results of univariate analysis and the results of bivariate analysis.

1. Univariate Analysis

This analysis was carried out to see the distribution of data for each variable prevalence studied. The variables that will be seen from the data distribution are the BMI and WHR of CHD patients. Because both BMI and WHR are ordinal data, the distribution of the data will be described in graphical form. The following is a univariate analysis procedure accompanied by a description of the univariate results carried out from the sample data taken.

Figure 1 shows that the majority of subjects were overweight as many as 44 (48.9%) subjects, followed by normoweight as many as 24 (26.7%) subjects, obese as many as 21 (23.3%) subjects, and underweight as many as 1 (1.1%) subjects.

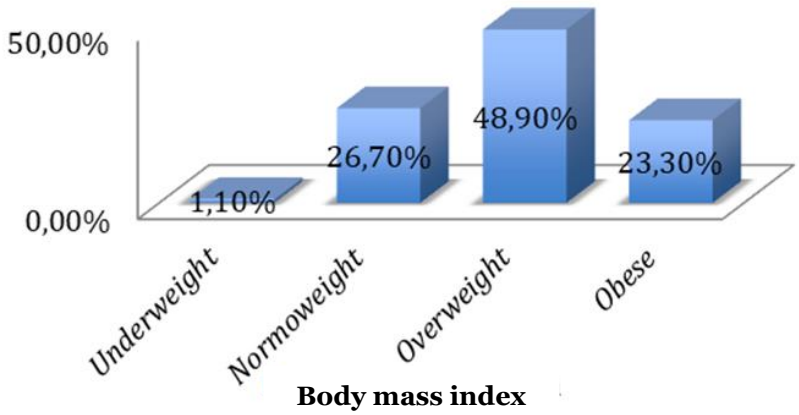

Figure 1. BMI in CHD Patients

Figure 2 shows that the distribution of research subjects is related to the presence of risk in the WHR measurement, consisting of 22 (23.3%) subjects having no risk, 21 (24.4%) subjects having moderate risk of WHR, and 47 (52.2%) subjects having high risk against the WHR.

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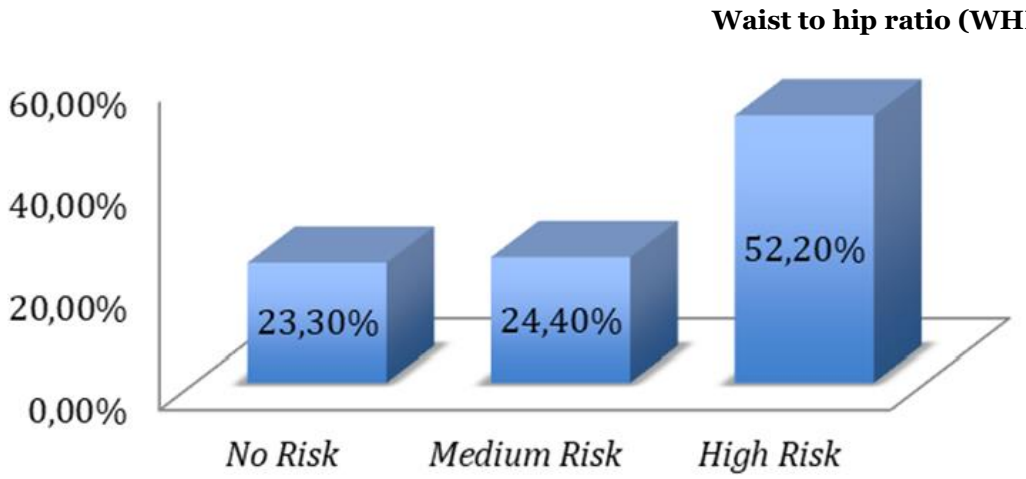

Figure 2. WHR in CHD Patients

2. Bivariate Analysis

Bivariate analysis was carried out to explain the relationship between BMI and WHR in CHD patients at the heart polyclinic at Gatot Soebroto Hospital from January to March 2015. The chi square test in this study used a 2 x 2 table, because the BMI variable was grouped into 2, namely underweight + normoweight and overweight + obese, and the WHR variable has 2 groups, namely no risk and risk (medium risk and high risk).

Table 1 shows that of the 25 subjects (27.8%) with underweight and normoweight BMI categories, 15 (16.7%) subjects had no risk WHR category, 1 (1.1%) subject had medium risk WHR category and 9 (10.0%) subjects had WHR High Risk category.

As many as 65 (67.7%) subjects with BMI in the category of overweight and obese, 6 (6.7%) subjects had no risk category WHR, 21 (23.3%) subjects had medium risk category WHR and 38 (42.2%) subjects had high risk WHR category.

The results of the chi-square analysis showed that there was a positive relationship between WHR (WHR) and BMI, and it was statistically significant (OR= 8.25; 95% CI= 2.89 to 23.48; p <0.001).

Table 1. Bivariate analisis relationship of WHR with BMI in CHD patients

BMI	WHR		Total (n/ %)	OR (95% CI)	p
	Medium & High Risk (n/ %)	No Risk (n/ %)			
Overweight + obese	55 (84.6)	10 (15.4)	65 (100)	8.25 (2.89 to 23.48)	<0.001
Underweight + normoweight	10 (40)	15 (60)	25 (100)		

DISCUSSION

1. Univariate Analysis

a. BMI of CHD Patients

The most common BMI category is overweight (48.9%) in CHD patients at the Gatot Subroto Army Hospital Cardiac Polyclinic for the period January - March 2015. This study is supported by

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research by Zeller et. al (2008) where out of a total of 2,229 patients who had CHD, half (46.8%, n=1,044) were included in the overweight category, some (n=660) were included in the normoweight category and the rest (n= 525) were included in the obese category, so around 70% of patients have a BMI exceeding 25kg/m2 (Zeller et al., 2008). The results of this study are supported by the statement put forward (Stampfer et al., 2000) stating that increasing BMI will increase the incidence of CHD by 8%. This is supported by the statement of Despres et al. (2012), stated that in general, excessive fat distribution can lead to CHD risk which is significantly associated with an increase in BMI. Thus, BMI is said to be an adequate index of body fat, and is significantly related to frequently reported diseases such as cardiovascular disease, hypertension, dyslipidemia, and type 2 DM (Despres et al., 2012).

In addition to obesity and overweight, fat deposits in the tissues that can increase body fat and body weight are also a risk for degenerative diseases. Obesity and overweight have harmful effects on cardiovascular health. In addition, obesity is also associated with increased mortality in cardiovascular disease. Therefore, weight loss and fat reduction can specifically improve CHD risk factors and other related comorbidities (Cornier et al., 2011). Statement by Stampfer et al. (2000) showed that prevention of overweight is a way out of public health problems. Prevention of excess body weight must be done through a healthy lifestyle, namely frequent exercise, reducing food intake that is high in energy and increasing fiber food intake. To prevent future weight gain, it is necessary to carry out early health education for children with the aim of preventing CHD in the future (Stampfer et al., 2000).

b. Waist to hip ratio (WHR) in CHD patients

The results showed that the WHR of CHD patients at the Gatot Soebroto Army Hospital for the period January to March 2015 included 21 (23.3%) subjects in the no-risk WHR category, 22 (24.4%) subjects in the medium risk WHR category, and high risk WHR (high risk) category 47 52.2% (subjects). This study illustrates that most CHD patients at the Gatot Soebroto Army Hospital have WHR in the high-risk category (high risk) even though interventions have been carried out to reduce the increase in their WHR. This is due to the low knowledge and awareness of CHD patients to maintain their WHR within normal limits or to prevent their body proportions from falling into the obesity category. This statement is in accordance with research conducted by Isnaini et al. (2012) on 50 samples, who argued that the better the knowledge one has about the importance of maintaining WHR or ideal body proportions, the lower the WHR category they have.

The results of this study are similar to the previous study by Nishtar et al. (2005), using the case control method with a total population of 200 people with a diagnosis of CHD stating a positive correlation with an increase in WHR, it was found that there was a relationship between WHR in CHD patients (95% CI= 1.01 to 1.08; p=

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0.010) (Nishtar et al., 2005). This study is supported by a statement from (Reis et al., 2009) which compared overall obesity (general obesity) and total abdominal adipose (central obesity) with the risk of death in cardiovascular disease in the National Health and Nutrition Examination Survey III found that in men and women those who died from cardiovascular disease had a large WHR value (high risk WHR category) (Reis et al., 2009).

WHR is related to the basis of cardiovascular disease and the risk of cardiovascular disease, one of which is CHD. One of the risks of developing CHD is someone has a history of obesity/ overweight, due to the deposition of fat in the abdomen in someone who has a history of being overweight/ obese, this deposition can affect the WHR value. So thus, WHR can also be said to be a predictor of a history of obesity/ overweight as a CHD risk (Whitlach et al., 2015).

In this study, it can be clearly concluded that CHD patients obtained WHR values that were more than normal. population in Asia (Cornier et al., 2003). An increase in WHR in CHD patients was also stated by Despres et al. (2012) who argued that compared to BMI, WHR is more related to complications of metabolic disease and cardiovascular disease.

2. Bivariate Analysis

The results of the chi-square analysis showed that there was a positive relationship between WHR (WHR) and BMI, and it was statistically significant (OR= 8.25; 95% CI= 2.89 to 23.48; p <0.001). This means that CHD patients with BMI accompanied by an increased risk of WHR have a 8.25 times chance of developing CHD compared to someone with an underweight/ normoweight BMI accompanied by WHR who is not at risk.

In this study, most of the 90 subjects studied had received treatment, namely by changing the diet of CHD patients. The results of these treatment efforts found that most of the patients still had high BMI and WHR categories due to lack of knowledge, attitudes and concern for low-fat diet patterns. This statement is supported by research by Sari et al. (2011), of 84 CHD patients who were outpatients, 59.52% had insufficient knowledge of balanced nutritional patterns, and 40.48% had sufficient knowledge. Apart from the low level of knowledge, it turns out that the eating patterns of the 84 samples were also of low quality. The diet was assessed by 4 components. Based on the results of combining the four components based on the QDS (Quality Diet Score) assessment, 73.8% of the total subjects studied still had poor food quality (Sari et al., 2011).

Guyton and Hall (2007), argued that in obesity there can be ineffective mobilization of fat from adipose tissue by tissue lipases, while the formation and storage of fat runs normally. So that fat accumulation can be collected in the most important fat storage areas, one of which is the waist and abdomen. This can increase fat deposits at the waist and increase the difference in values between waist circumference and hip circumference values, with waist circumference values getting bigger as a result of being obese. The value of the waist circumference which is higher than the hip circumference

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can result in a greater waist-to-hip ratio, so that the end result is an increase in the value of the WHR (Guyton and Hall, 2007).

This research is also supported by research (Sonmez et al., 2003), with an observational study using a cross-sectional method that included 617 samples diagnosed with CHD, it was found that half of the population (50%) had BMI in the overweight category and around 15% had the category Obese BMI, including an increase in WHR in the high-risk category at 51% of the total number of samples (Sonmez et al., 2003). In this study the population used was CHD patients supported by the statement put forward by (Ghandi et al., 2010) about the involvement of BMI and WHR in CHD. The study (Gandhi et al., 2010) states that increased BMI and WHR are standard diagnoses for obesity which are none other than the main risk factors for CHD. Another supporting study conducted by Taylor et al. (1995), where they found a significant relationship between BMI, WHR and LP as risk factors for heart disease.

However, this study had a slight difference in the results with another study (Parsa et al., 2014), a study using a cross-sectional method which included 414 CHD patients with 250 male sex (60.4%) and the rest female, found that there was a significant relationship significant increase in WHR in CHD patients (p = 0.030), but in the BMI study it was said to have a negative correlation in CHD patients (Parsa et al., 2014). Research Parsa et al. (2015) is supported by statements from Cornier et al. (2011) stated that compared to BMI, WHR is the highest risk factor for increasing the incidence of heart disease, dyslipidemia, hypertension, or type 2 DM (Cornier et al., 2011).

AUTHOR CONTRIBUTION

Derby Febriani Sultany, Agus Harsoyol collected and analyzed data and prepared a manuscript. Citra Ayu Aprilia and Agus Harsoyo reviewed the first draft of the paper. All authors have read and approved the final version of the manuscript.

CONFLICT OF INTEREST

Tidak ada konflik kepentingan dalam penelitian ini.

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