RESEARCH ARTICLE

Correlation between Abdominal Circumference and Serum High-Sensitivity C-Reactive Protein Concentration at Age 35–64 Years

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Abstract

The prevalence of central obesity in Indonesia is increasing every year. Based on data released by *Riskesdas* in 2018, there were 31% of the population aged 15 years and over suffer from central obesity, where the highest was found in the 45–54 years group (42.3%), followed by 44 years (39.2%) and 55–64 years group (39.1%). Central obesity can be measured by waist circumference or abdominal circumference, and it plays an important role in the occurrence of cardiovascular disease. Examining C-reactive protein (CRP) at low levels using high-sensitivity CRP (hs-CRP) methods will help to predict the risk of coronary heart disease. This study aimed to find the correlation between waist circumference and hs-CRP serum levels between the ages of 35 and 64. The study was an analytical observational with a cross-sectional approach attended by 25 respondents at Bhayangkara Hospital Tingkat I Raden Said Sukanto, Kramat Jati, East Jakarta, from October to November 2019. The waist circumference was measured with a metlin roll, and Prodia Laboratory took the blood to measure hs-CRP serum levels using ELISA methods. The data were analyzed using the Pearson correlation test. The results showed a correlation between waist circumference and hs-CRP serum levels with Sig. (2-tailed)=0.000 (p<0.05). There was a correlation between waist circumference and hs-CRP serum levels, which indicated that the greater the waist circumference, the higher levels of serum hsCRP would be.

Keywords: Abdominal circumference, central obesity, hs-CRP

Introduction

Central obesity is an accumulation of fat in the abdomen that may impair health. This accumulation is caused by excessive subcutaneous and visceral fat, caused by an energy imbalance between nutritional intake and lack of physical activities.[1] World Health Organization guidelines that alternative measures that reflect abdominal obesity, such as waist circumference, waist-hip ratio, and waist-to-height ratio, are superior to body mass index.[2] Waist circumferences are a method used to determine central obesity in Asian men who are more than 90 cm, and women who are more than 80 cm are declared to have central obesity.[3–5] Recently, obesity has increased in Asia, along with rapid economic growth.[6] In Indonesia, according to *Riskesdas* in 2018, there were 31% of the population aged 15 years and over suffering central obesity, where the highest was in the aged group 45–54 years old (42.3%), followed by 44 years old (39.2%) and in the aged group 55–64 years old (39.1%).[7] This prevalence is higher if we compare it to 2013.[8] Some studies showed that central obesity is essential to cardiovascular disease.[9] In Indonesia, data showed that stroke (21.1%) and coronary heart diseases (12.9%) were the most significant morbidity caused by obesity.[10] C-reactive protein (CRP) is an acute-phase protein molecule produced by the liver in the acute phase. CRP production is affected by inflammatory cytokines, particularly IL-6. High-sensitivity C-reactive protein (hs-CRP) is a test capable of measuring elevated levels of low CRP, so it is more sensitive to measure the range between 0.1–2 mg/L. Several studies have shown that hs-CRP is used to predict the risk of coronary heart disease and can indicate recurrences.[11,12] Research by Bennet et al.[12] showed a positive correlation between central obesity and hs-CRP examination. However, research by Kollathody et al.[13] in India showed no correlation between central obesity and increased levels of hs-CRP.

The article analyses the correlation between waist circumference and hs-CRP serum levels between the age of 35 and 64 years.

Methods

This study is an observational analytic study using cross-sectional methods and was conducted

in Bhayangkara Hospital Tingkat I Raden Said Sukanto, Kramat Jati, East Jakarta. The population in this study were all patients aged 35–64 who visited the hospital from October to November 2019 and were sampled using a consecutive sampling method. The inclusion criteria were patients aged 35–64 agreeing to be examined for waist circumference and hs-CRP serum level. The exclusion criteria were patients suffering infections such as fever, urinary tract infection, respiratory infection, gastroenteritis, pregnant or breastfeeding women, and smokers. The questionnaire in this study compiled sociodemographic data (age, gender, education level, and work) and anthropometry using metlin roll. The waist circumference for males >90 cm and females >80 cm are declared to have central obesity.[2–4] The waist circumference was measured to the nearest 0.5 cm at the superior border of the iliac crest.[14] Blood samples were taken to measure hs-CRP serum level and analyzed by Prodia Laboratory using ELISA methods. They were divided into three risk categories: low risk (<1.0 mg/L), average risk (1.0–3.0 mg/L), and high risk (>3.0 mg/L).[8,10] This study was attended by 25 respondents who calculated using the relation coefficient with $\alpha=5\%$, $Z\alpha=1.96$, $\beta=20\%$, $Z\beta=0.842$, with $r=0.552$.[15] Analysis used the Pearson correlation test with differences at $p<0.05$ that were considered significant.

This study was accorded to the Helsinki Declaration and approved by the Research Ethics Committee of the Faculty of Medicine, Universitas Trisakti, number 67/KER-FK/VII/2019.

Results

Univariate analysis was used to determine the frequency distribution of subject characteristics in the form of age, gender, education level, and work. The subject characteristics can be seen in Table 1.

Table 1 shows that most of the subjects were females, the mean subject's age was 47.56±6.63 years old, and most of the subjects had central obesity. Based on the level of education, the majority of the subjects were with higher education and still work.

Table 2 shows that the hs-CRP serum levels mean was 3.85±2.39 mg/L and waist circumference means were 90.19±9.96 cm.

The Kolmogorov test of normality of the data

Table 1 Characteristics of Research Subjects

Characteristics	n=25
Gender	
Male	6
Female	19
Age (years)	
Average±s.b.	47.56±6.63
Waist circumference	
Normal	5
Central obesity	20
Level of education	
Low (elementary–junior high)	2
Mid (senior/vocational)	7
High (D1–D3/college)	16
Work	
No work	8
Work	17

Table 2 High-Sensitivity CRP (hs-CRP) and Waist Circumference

	n	Mean±SD
hs-CRP serum levels	25	3.85±2.39
Waist circumference	25	90.19±9.96

distribution showed that the data were normally distributed, so this study was analyzed by the Pearson correlation test.

Based on bivariate analysis using the Pearson correlation test, there was a significant correlation between waist circumference with serum level of hs-CRP with Sig. (2-tailed)=0.000 (p<0.05) between ages 35 and 64 years old (Table 3).

Discussion

Being overweight and obese are commonly known as risk of cardiovascular risk factors. Central obesity can occur due the multifactor influence such as smoking habits, high consumption of fatty foods, low consumption of fruits and vegetables, lack of physical activity, lifestyle change, age increases, gender, ethnic and socioeconomic status.[1,5,16,17] In this study, most subjects had central obesity with an average of 90.19±9.96 cm, which showed an increased incidence of central obesity compared to *Riskesdas* 2018 data which showed only 31% had central obesity. This can be

Table 3 Pearson Correlation Test

		Waist Circumference (Central Obesity)	hs-CRP
Waist circumference (central obesity)	Pearson correlation	1	0.714[*]
	Sig. (2-tailed)		0.000
	n	25	25
hs-CRP	Pearson correlation	0.714[*]	1
	Sig. (2-tailed)	0.000	
	n	25	25

Note: [*]correlation is significant at the 0.01 level (2-tailed)

caused because, in the big cities, there has been a change from a traditional diet to a western diet which contains high calories, fats, sugar, and low fiber, which causes energy imbalance to trigger obesity.[1,5,18]

This study result showed that the average hs-CRP serum level at age 35–64 years old was 3.85 ± 2.39 mg/L. Based on the America Heart Association recommendation regarding the cut-off value of hs-CRP serum level against the risk of cardiovascular disease, the average value in this study included high risk.[9]

This study shows a significant correlation between waist circumference and serum level of hs-CRP with Sig. (2-tailed)=0.000 (p<0.05) at 35–64 years old. This finding indicated that the greater the waist circumference, the higher levels of serum hs-CRP would be.[19]

The mechanisms in the obese are excessive visceral fat accumulation, which causes adipose tissue dysfunction. Adipocyte hypertrophy and hyperplasia exacerbated inflammation, impaired extracellular matrix remodeling and fibrosis, and altered secretion of adipokines. Adipose tissue influences many other organs by releasing pro-inflammatory and anti-inflammatory bioactive molecules, known as adipokines. Adipose tissue can produce a huge variety of adipokines, pro-inflammatory factors (leptin), cytokines (TNF-α, IL-6, IL-10), acute-phase reactants like C-reactive protein, chemokines, damage-associated molecular pattern molecules, and anti-inflammatory (adiponectin, ghrelin). It is associated with impaired mitochondrial function, membrane protein changes, and higher cell death and inflammation.[19,20] Intra-abdominal fat cells are more active than other elsewhere fat cells, so they are more atherogenic and easily cause inflammation in the blood vessels. Also, the IL-6 secretion induces the liver to produce acute-

phase reactants such as C-reactive protein.[13] This similar finding was also found in some studies which said that is a positive correlation between central obesity and hs-CRP serum level.[12,15,21]

The limitation of this study was the lack of possibility of subjects suffering from metabolic syndrome and cancer disease. Furthermore, no analysis was done to know the relationship between IMT and hs-CRP research.

Conclusion

There was a correlation between waist circumference with hs-CRP serum levels, which showed that the greater the waist circumference, the higher the hs-CRP serum levels would be.

Conflict of Interest

The authors do not have any conflict of interest to declare.

Acknowledgments

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