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The Relationship of Obesity Index and Lipid Profile in 25-65 Year-Old Adults in Bogor City (Baseline Data of Cohort Study on Non-Communicable Disease in Bogor City, West Java Province)

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Abstract

Obesity is associated with cardiovascular disease (CVD) risk factors (hypertension, dyslipidemia and diabetes) and metabolic syndrome (MetS), and it may be flawed that most studies only use one obesity index to predict these risk factors. The aim of this study was to analyze the relationship between obesity index (BMI and WC) and lipid profile in 25-65 year-old adults. This study used baseline data "Cohort Study of Non-Communicable Diseases" that was carried out in 2011-2012 in Bogor City, West Java Province. The study design was cross-sectional. A number of samples analyzed were 4554 subjects. Result of the analysis showed that the prevalence of obese (BMI≥30 kg/m^2) was found 6.3% in males and 16.8% in females. The prevalence of central obesity was found 46.7% in males and 53.8% in females. The results of linier regression analysis showed that obesity index (BMI and WC) strong associated with lipid profile WC and BMI can be used to predict lipid profile disorder.

Keywords: obesity index; lipid profile; adults.

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1. Introduction

In the last two decades obesity prevalence increases [1]. In 2030 approximately 2.16 billions people are obese and 1.12 billions people are going to be one [2]. In Indonesia central obesity prevalence on people aged ≥15 years old in 2013 was 26.6 % higher than the one in 2007 (18.8%) [3,4]. Basic Health Research 2013 data analysis showed that central obesity prevalence on people aged 25-65 years old was high (48.5%) [5].

Overweight is proven related to some conditions such as diabetes, cardiovascular diseases (CVD), dyslipidemia, hypertension, metabolic syndrome, inflammation, thrombosis and cancer [6-10]. Obesity increases the risk of cardiovascular through risk factor such as increasing fasting triglyceride, high low density lipoprotein (LDL) cholesterol, low high density lipoprotein (HDL) cholesterol, high blood sugar and insulin rate and hypertension [11]. Sudikno and his colleagues (2016) study showed that central obesity prevalence was 51.3%; total cholesterol (K-total) was high (16%), LDL cholesterol (K-LDL) was high (17.6%), HDL cholesterol (K-HDL) was low (16.2%) and triglyceride percentage was high (8.5%) [12].

According to WHO, Body Mass Index (BMI) (kg/m2) can be used to predict obesity prevalence and obesity in population [13]. The limitation of body mass index (BMI) is that it cannot differentiate body fat or non body fat such as muscle, edema and bones [14]. Meanwhile, waist circumference (WC) measurement is easy, simple and not related to height [15], it has strong correlation with BMI and waist hip ratio (WHR) [16]. It is also a strong indicator to indicate CVD compare to BMI [17].

Cohort study of non-communicable disease in 2011-2014 by National Institute of Health Research and Development provided data about lipid profile and central obesity without further analysis. The objective of this study was to analyze the relationship of obesity index (BMI and WC) and 25-65 year-old adults' lipid profile.

2. Materials and Methods

2.1. Design, location, and time of study

This study was further analysis using baseline data "Cohort Study of Non-Communicable Diseases" that was carried out in 2011-2012 in Bogor City, West Java Province stage by National Institute of Health Research and Development in 2011-2014. The Study design at baseline stage was cross-sectional.

2.2. Research subjects

The population was all household members aged 25-65 years old. The subject was all household members aged 25-65 years old who lived in study area (citizen with proven ID card), independent, not handicapped, not pregnant, and had complete data.

Verification process had already done to the data and variables that were going to be analyzed. A number of data at early stage were 5296 samples. While being sorted, outlier scores of BMI, WC, lipid profile and data completeness variables were taken out. So, a number of data being analyzed were 4554 samples which were

baseline data in 2011 and 2012.

2.3. Data type and collection methods

WC Subjects were measured by plastic (*Medline*) tape measure with o.1cm accuracy. WC was measured to the nearest 0.1 cm at the level of the iliac crest while the subject was at minimal respiration [18]. Abdominal circumference category: male >90 cm and female >80 cm [19]. BMI category, that is weight and square height ratio, was normal (18.5 – 24.9 kg/m^2), overweight (25.0 – 29.9 kg/m^2), and obese (≥ 30 kg/m^2) [13].

Lipid profile checking consisted of total cholesterol, triglyceride, LDL, and HDL, using enzymatic colorimeter method. The blood was taken from vein as many as 10 cc. The sample was taken and checked by laboratory. Profile lipid that was total cholesterol (K-total) level was categorized into two; normal (<160 mg/dl) and high (≥160 mg/dl). LDL cholesterol level consisted of two categories; normal (<160 mg/dl) and high (≥160 mg/dl), while for HDL cholesterol level; normal (≥40 mg/dl) and low (<40 mg/dl). Next, triglyceride level was categorized into normal (<200 mg/dl) and high (≥200 mg/dl) [20].

2.4. Data analysis

Data analysis were done in some stages, that are univariate and bivariate. Re-coding of some variables also were done during analysis. Student's t-test was used to analyze quantitative data of obesity index. Linier regression analysis was used to analyze the relationship between obesity index (BMI and WC) and lipid profile.

2.5. Ethical clearance

The study was approved by Ethical Committee of Health Research of National Institute of Health Research and Development, Ministry of Health numbers KE.01.05 / EC / 394/2012.

3. Results and Discussion

Result of this study showed that obese percentage according to BMI (>=30 kg/m^2) in females was 16.8% and in males was 6.3% (Table 1), while Saad et.al (2015) research in Malaysia showed that obese percentage (>=30 kg/m^2) was 24.1% in males and 13,5% in females [21].

The result also showed that central obese in females and males was 53.8% and 46.7% respectively. This percentage was higher than Kamble et.al (2010) [22] which was 16.5% in males and 28.2 in females but lower than Baek and his colleagues (2014) which was 61.7% in males and 62.9 in females [23]. Meanwhile Norafidah and his colleagues (2013) research showed that central obesity in males and females was 40% and 70% respectively [24]. On the other hand Saad and his colleagues (2015) study showed that central obese in males and in females was 46.6% and 32.8% respectively [21].

TC was higher in females (19%) than males (13.2). LDL cholesterol also was found higher in females (19.3%) than males (14.5). On the contrary HDLC was lower in males (31%) than females (8%). Hypertriglyceride

percentage was higher in males (12%) than females (6.6%) (Table 1).

Table 1: Respondent characteristic based on obesity index and lipid profile

Characteristic	Male=1612		Female=2942	
	n	%	n	%
Body Mass Index (BMI)				
Underweight (<18.5 kg/m^2)	184	11.4	119	4.0
Normal (18,5-24.9 kg/m^2)	925	57.4	1235	42.0
Overweight (25,0-29.9 kg/m^2)	401	24.9	1095	37.2
Obese (>=30 kg/m^2)	102	6.3	493	16.8
WC				
Normal	860	53.3	1359	46.2
Obese	752	46.7	1583	53.8
TC				
Normal (<240 mg/dl)	1400	86.8	2384	81.0
High (≥240 mg/dl)	212	13.2	558	19.0
LDLC				
Normal (<160 mg/dl)	1379	85.5	2375	80.7
High (≥160 mg/dl)	233	14.5	567	19.3
HDLC				
Normal (≥40 mg/dl)	1112	69.0	2706	92.0
Low (<40 mg/dl)	500	31.0	236	8.0
TG				
Normal (<200 mg/dl)	1419	88.0	2747	93.4
High (≥200 mg/dl)	193	12.0	195	6.6
Total	1612	100.0	2942	100.0

Table 2 and 3 showed that the average of total cholesterol in obese males was significantly higher than the ones with normal BMI ($p<0.05$). The average of LDL cholesterol in overweight females was significantly higher than normal BMI females ($p<0.05$). The average of HDL cholesterol in obese females was significantly higher than females with normal BMI ($p<0.05$) while the average of triglycerides was significantly higher in overweight and obese males and females ($p<0.05$).

Table 4 showed that the average TC and TG in obese both males and females was significantly higher than the normal ones. Next, the average of LDLC in obese females was significantly high than the normal ones ($p<0.05$).

Table 2: The average of lipid profile based on BMI in Males

Lipid Profile	BMI				
	Normal	Overweight	*p*-value	Obese	*p*-value
TC (mg/dl)	196.1±36.4	208.2±38.6	0.181	211.7±48.8	0.019
LDLC (mg/dl)	126.6±31.2	134.2±31.9	0.307	131.4±31.1	0.452
HDLC (mg/dl)	45.1±8.5	42.3±8.6	0.818	41.4±7.7	0.374
TG (mg/dl)	117.7±59.7	164.1±103.3	0.000	181.3±132.1	0.000

Table 3: The average of lipid profile based on BMI in Females

Lipid Profile	BMI				
	Normal	Overweight	*p*-value	Obese	*p*-value
TC (mg/dl)	200.6±37.2	211.6±39.5	0.066	216.3±37.6	0.741
LDLC (mg/dl)	125.5±31.9	135.3±34.4	0.012	140.4±32.1	0.616
HDLC (mg/dl)	54.9±10.8	52.4±10.3	0.141	50.4±10.0	0.012
TG (mg/dl)	91.7±48.7	116.3±69.8	0.000	131.3±71.9	0.000

Table 4: The average of lipid profile based on WC in Females

Lipid Profile	Male			Female		
	Normal	Obese	*p*-value	Normal	Obese	*p*-value
TC (mg/dl)	192.8±35.8	207.6±39.5	0.043	199.7±36.6	213.8±39.2	0.013
LDLC (mg/dl)	124.2±30.6	133.6±31.8	0.213	125.0±31.6	137.4±33.9	0.035
HDLC (mg/dl)	45.8±8.5	42.5±8.4	0.935	54.9±10.7	51.7±10.3	0.078
TG (mg/dl)	110.3±48.1	157.9±101.9	0.000	90.7±52.4	121.9±68.4	0.000

Table 2, Table 3 and Table 4 showed the average lipid profile difference according to BMI and WC. According to the index BMI, the study found that the increase in the serum of each indicator lipid profile, such as TC in men obese, LDLC in women overweight, HDLC in women obese, TG in men and women overweight and obese compared to normal weight. According WC, increased serum cholesterol occurs in TC and TG in men and women are obese compared to normal. While the increase in serum HDLC and LDLC only occurs in obese women. In study Fatemeh and Farahnaz (2014) showed that the serum level of each indicator lipid profile, such as TG, TC and LDL-C in obese adult males were significantly higher than men of normal weight.[25] According to research Qi and his colleagues (2015) showed that the index of BMI and WC was positively correlated with LDL cholesterol, triglycerides and negatively correlated with HDL cholesterol.[26]

Table 5: Regression analysis of the relationship of obesity index and lipid profile in Males (Adjusted by Age)

Obesity Index	Lipid Profile	*Intercept* (a)	*Slope* (b)	*Pearson* R	p
BMI	TC	115.398	2.028	0.328	0.000
(kg/m^2)	LDLC	74.027	1.174	0.262	0.000
	HDLC	52.135	-0.511	0.248	0.000
	TG	-37.655	6.676	0.348	0.000
WC (cm)	TC	105.488	0.758	0.330	0.000
	LDLC	68.072	0.442	0.264	0.000
	HDLC	54.194	-0.195	0.256	0.000
	TG	-66.575	2.440	0.346	0.000

Table 6: Regression analysis of the relationship of obesity index and lipid profile in Females (Adjusted by Age)

Obesity Index	Lipid Profile	*Intercept* (a)	*Slope* (b)	*Pearson* R	p
BMI (kg/m^2)	TC	144.005	1.307	0.399	0.000
	LDLC	61.660	1.344	0.319	0.000
	HDLC	59.496	-0.489	0.240	0.000
	TG	-39.503	3.397	0.346	0.000
WC (cm)	TC	104.595	0.559	0.400	0.000
	LDLC	54.824	0.535	0.314	0.000
	HDLC	63.528	-0.216	0.250	0.000
	TG	-60.831	1.409	0.344	0.000

Dyslipidemia prediction using obesity index (WC and BMI) also can be seen in Table 5 and Table 6. The result of this study showed that obesity index (WC and BMI) and lipid profile were related. Sarkar and his colleagues (2015) found that BMI can be used to predict dyslipidemia in males and WC can better be used for total cholesterol and LDL cholesterol in females [27]. In the previous research by Bertsias and his colleagues (2003), Females waist-to-height (WHtR) index can better be used for LDL cholesterol, WC for TG and HDLC and waist to-hip (WHpR) index for HDLC [28].

Ashwell and his colleagues (2012) reviewed about the advantage of WHtR from WC and BMI to detect cardio metabolic risk factors on both males and females from 300,000 adults in some ethnic groups [29]. Van Dijk and his colleagues (2012) concluded that WC had strong correlation with all CVD risk factors in both males and females except for HDL and LDL risk factor in males [30]. Meanwhile Savva and his colleagues (2013) in his cross-sectional study revealed that BMI and WHtR were able to detect diabetes mellitus, dyslipidemia,

hypertension, and metabolic syndrome on people in Asia [31]. Goh and his colleagues (2014) study in 20 to 65year-old females also showed that WC and WHtR were a good predictor for CVD risks. The ability of WHtR to predict them was stronger than WC and BMI in Caucasian females. In addition WC prediction for CVD in Asian females and BMI for CVD in North European females were good indicators [32].

The results of this study did not show any difference in mean serum lipid elevation in all indicators according to BMI and WC, but found a correlation between the obesity index (BMI and WC) and lipid profile. The limitation of this study were (1) the design used was cross-sectional so it was not strong enough to explain the cause and effect relationship; (2) this study no other anthropometric measurements such as WHtR and WHpR; (3) the number of male samples is fewer than women, so it can be effect in the results (bias of the result).

4. Conclusion and Recommendation

This study showed that the high prevalence of overweight and obesity. Parameters (BMI and WC) can be used to predict the presence of early lipid profile disorders. Further research with longitudinal design on obesity and lipid profile disorder is expected to provide better results. In addition other anthropometric measurements can also be involved to provide better alternative options in preventive of non-communicable diseases.

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