RELATIONSHIP OF BODY FAT PERCENTAGE AND APO B/APO A-1 RATIO AS CARDIOVASCULAR RISK MARKER IN RURAL ADULTS OF YOGYAKARTA INDONESIA

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ABSTRACT

Objective: Prevalence of obesity and cardiovascular disease has increased in both urban and rural areas in Indonesia. High body fat percentage (BF%) is associated with a high cardio metabolic risk. The apolipoproteins (Apo) B/Apo A-1 ratio is a better risk predictor for cardiovascular disease. This study aimed to explore the relationship of BF% and Apo B/Apo A-1 ratio among rural adults in Yogyakarta Indonesia.

Methods: This cross-sectional study included 40 men and 62 women (40-60 y old). Those who had cardiometabolic diseases, edema or currently taking cardio metabolic medicines were excluded. Information about sociodemographic details was obtained by using a self-administered questionnaire. The questionnaire also assessed smoking status, reproductive history and medical history. Anthropometric measurement, apo B, Apo A-1, fasting blood glucose and blood pressure were measured.

Results: The prevalence of high BF% was 12.7% and 6.9% in men and women, respectively. There was negative correlation between BF% and apo A-1 and positive correlation between BF% and apo B as well as BF% and apo B/apo A-1 ratio. A significant weak correlation was observed between BF%-apo B/apo A-1 ratio in women (r: 0.280; p: 0.027).

Conclusion: BF% is associated with apo B/apo A-1 ratio among women adults in rural area of Yogyakarta Indonesia findings support the importance of using BF% to predict cardiovascular disease in rural area.

Keywords: Body Fat Percentage, Apo B/apo A-1 ratio, Relationship

INTRODUCTION

The prevalence of obesity and cardiovascular disease (CVD) has increased in developing countries, including Indonesia [1-3]. Based on the household health survey in Indonesia (2004), the study demonstrated that the prevalence of overweight was 7.2% and 10.4% for men and women, respectively. The prevalence of overweight was higher in urban areas (10.8%) than in rural areas (7.5%) [1]. A national survey showed that the highest incidence of central obesity was 36.9% among adults 45 to 54 y old, and the percentage of abnormal low-density lipoprotein (LDL) and high-density lipoprotein (HDL) profile is more prevalent in rural Indonesia. The CVD prevalence was greater in urban compared with rural population (23.4% and 19.5%, respectively) [2]. Another study indicated that the prevalence of prehypertension and hypertension were relative high among young Indonesian adults in primary health care of rural area [4]. Our previous study found that prevalence of metabolic syndrome in rural areas of Yogyakarta was 25%, female more prevalent than male subjects [5]. According to World Health Organization (WHO), more than 1.9 billion adults (≥18 y) were overweight in 2014, and of this, over 600 million were obese [6]. The increased of obesity is closely associated with elevated risk of CVD and obesity is an independent risk factor for all-cause mortality as well as for CVD [7, 8].

Frequently, obesity is diagnosed using body mass index (BMI), however this measurement has been criticized because could not identify fat distribution and low specificity regarding body composition [9, 10]. Deurenberg-Yap et al. [11,12] who studied Singaporean adults confirmed the high BF% increases the risk factor for CVD in normal and low-BMI and the relationship between BF% and BMI is different among three ethnic groups in Singapore; whereas Kim et al. [13] who studied Korean reported the same. Body fat percentage as anthropometric measurement has not been extensively used in epidemiological studies in Indonesia. An unpublished study showed that there was significant correlation between BF% with lipid ratio as a CVD risk factor in the urban adolescents and in rural adult’s area.

Apolipoproteins are proteins associated with lipids in lipoprotein particles. The ratio of apolipoprotein B (apo B) and apo A-1 represents the balance between apo B-rich potentially atherogenic cholesterol particles and apo A-1-rich anti-atherogenic cholesterol particles. The apo B/apo A-1 ratio are the best predictor of CVD related to lipids as compared with other lipids ratio [14].

Other studies have reported apo B/apo A-1 ratio might be of greatest value in diagnosis and treatment in people who have common lipid abnormalities, but have normal or low concentrations of LDL-cholesterol [15]. People with the unfavorable apo B/apo A-1 had more atherogenic lipid profile, therefore apo B/apo A-1 ratio can be considered as a sensitive marker of atherogenic risk [16].

In this study, we determined the relationship of BF% and ratio apo B/apo A-1 among rural adult people in Indonesia.

MATERIALS AND METHODS

Design and sample

This cross-sectional evaluation was carried out in Cangkringan Sub-District, a rural area in Yogyakarta Indonesia. This study was conducted from June 2016 to August 2016 involved a total number of 102 adults who lived in Cangkringan. Adults aged 40 to 60 y were eligible to participate in the study after signing a written consent form according to Helsinki Declaration.

Those who had cardiometabolic diseases, edema or currently taking cardio metabolic medicines were excluded. Each subject gave a written informed consent for participating in the study, which was approved with approval number KE/FK/048/EC/2016. by Medical and Health Research Ethics Committee (MIREC) Faculty of Medicine Gadjah Mada University Indonesia.
Measurements

Measurements were taken using standardized equipment. Anthropometric measurements, biochemical assessments and self-reported questionnaire were used for data collection. Clinical data including blood pressure (BP) was also obtained. Biochemical assessments included estimation of fasting blood glucose, apo A-1 and apo B. The questionnaire was constructed to assess socio-demographic details, smoking habits, reproductive history and medical history.

BF% was determined by the sum of the thickness of three skinfolds (triceps, suprailiac, and abdominal), measured using a Skinfold Caliper (Pai dou II®) and calculated by Siri's equation [17-19]. We used a modified Jackson-Pollock 3-site equation because the 3-site equation analysis method is simpler and faster than other methods. Previous study showed there was a strong correlation between the equation and dual-energy X-ray absorptiometry (DEXA) as a gold standard \( R^2 = 0.98, p: 0.0001 \) [20]. Based on American College of Sports Medicine (ACSM's), BF% associated with optimal health of standard \( R^2 = 0.98, p: 0.0001 \) [20]. According to American College of Sports Medicine (ACSM's), BF% associated with optimal health of standard \( R^2 = 0.98, p: 0.0001 \) [20].

Blood sample were collected from the subjects by registered nurses in the morning after a fasting period of 10-12 h. The apo A1, apo B and fasting blood glucose were measured on Architect Ci8200-integrated-system (Abbott Laboratories, USA) in certified laboratory of Yogyakarta.

**DISCUSSION**

In our study, we examined the relationship between BF% and apo B/apo A1 ratio as a better marker for predicting CVD than conventional another marker.

**Table 1: Characteristics of study participants**

| Variables                  | Men (N=40) | Women (N=62) |
|---------------------------|------------|--------------|
| Age (y)                   | 51.6±9.8   | 48.0±7.0     |
| Body Fat Percentage (%)   | 17.9±9.9   | 26.2±6.9     |
| Systolic arterial pressure (mmHg) | 133.5 (98.5-196.5) | 138.8±2.9     |
| Diastolic arterial pressure (mmHg) | 80.5±1.7   | 82.7±1.5     |
| Fasting blood glucose (mg/dl) | 81 (62-276) | 82.5 (68-220) |
| Apo A1 (mg/dl)            | 129.1±2.5  | 134.4±2.2    |
| Apo B (mg/dl)             | 98.3 (63.7-180.5) | 92.0±3.0     |
| Apo B/Apo A-1 ratio       | 0.75 (0.5-1.0) | 0.7 (0.3-1.3) |

Table 2 shows, in women, there are 13 obese (12.7%); 37 normal (36.3%); 12 underweight (11.8%), respectively. In men, there are 7 obese (6.9%); 31 normal (30.4%); 2 underweight (1.9%), respectively. Based on BF%, the overall prevalence of obese (ACSM) was 19.6% in rural area of Yogyakarta Indonesia. Women (12.7%) showed higher prevalence when compared with men (6.9%).

**Table 2: Prevalence of obesity among adult in rural area based on BF%**

| Subjects     | Prevalence (%) |          |          | Total |
|--------------|----------------|----------|----------|-------|
|              | Women          | Men      |          |       |
| Underweight  | 11.8           | 1.9      | 13.7     |       |
| Normal       | 36.3           | 30.4     | 66.7     |       |
| Obese        | 12.7           | 6.9      | 19.6     |       |

**Table 3: Spearman correlation coefficients between the apo A1, apo B, apo B/apo A-1 ratio and BF%**

| BF%       | Men |          |          | Women |          |          |
|-----------|-----|----------|----------|-------|----------|----------|
|           | Spearman, r | P-level | Spearman, r | P-level |
| apo A-1   | -0.264 | 0.100   | -0.141   | 0.247 |
| apo B     | 0.080  | 0.224   | 0.240    | 0.060 |
| apo B/apo A-1 | 0.118 | 0.467 | 0.260 | 0.027 |

Among men and women, there was significant negative correlation between BF% and apo A-1 and positive correlation between BF% and apo B as well as BF% and apo B/apo A-1 ratio (table 3). A significant weak correlation was also observed between BF% and apo B/apo A-1 in women \( p<0.05 \).

**RESULTS**

Using purposive sampling technique a total of 102 adults were recruited, men were 39% and women were 61%. The characteristics of study participants were summarized in table 1. BF% of men and women were 17.9±0.9 and 26.2±6.9 respectively. Among men and women, systole arterial pressure, diastolic arterial pressure, fasting blood glucose levels were comparable. Serum apo A1 as expression of plasma HDL levels was higher in women than men. Apo B as expression of LDL was lower in women than men subjects. Apo B/apo A-1 ratio were higher in men compared to women subjects.

**Statistical analysis**

Statistical analysis was done using SPSS version 20.0. Continuous variables are expressed as mean±standard deviation (SD) if data were distributed normally or median (minimum-maximum) if data were not distributed normally. Categorical variable were expressed as percentages. The statistical significance of differences in subjects cardiovascular risk factors based on BF% was analyzed using the ANOVA test. Correlations between the indices were assessed using the Spearman’s rank correlation. A p-value of less than 0.05 was considered as statistically significant.

**Measures**

Measurements of plasma HDL levels was higher in women than men. Apo B as expression of LDL was lower in women than men subjects. Apo B/apo A-1 ratio were higher in men compared to women subjects.
Our study demonstrated that BF% had negative correlation with apo A-1 and positive correlation with apo B and apo B/apo A-1 ratio. Only apo B/apo A-1 ratio showed significant weak correlation with BF% in women subjects (r: 0.280; p: 0.027). Previous studies showed BF% was only weakly associated with predicted CVD risk compared to other body composition indices and body mass index and waist-to-hip ratio were better predictors of CVD risk than BF% [26, 27]. Although the correlation between BF% and apoB/apo A-1 ratio was weak, however this finding strengthens that BF% is associated with cardio metabolic risks.

Our study has a few limitations. Firstly, the small number of subjects with cross-sectional design may be unable to provide strong and significant correlation. The directionally of the correlation can be suggested. Secondly, we used skinfold thicknesses measurement to measure BF%, DEXA as a gold standard to measure BF%, but it is not used commonly in clinical setting because it is expensive and inconvenient [13]. However, another study showed strong correlation between the modified Jackson-Pollock 3-site equation and DEXA [20]. Thirdly, the results of this study cannot be generalized Indonesia, because the subjects were adults only between 40-60 y in rural area with different socio-cultural characteristics from other population.

CONCLUSION
Our results demonstrate that BF% is weakly associated with apo B/apo A-1 ratio among women adults in rural area of Yogyakarta Indonesia with contract number 010/HB-LIT/III.2016. Study Research, Technology and Higher Education of the Republic of Indonesia. This research project was supported by a grant from Ministry of Research, Technology and Higher Education of the Republic of Indonesia. Our results demonstrate that BF% is weakly associated with apo B/apo A-1 ratio among women adults in rural area of Yogyakarta Indonesia. However these findings support the importance of using BF% in to predict cardiovascular disease in rural area.

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CONFLICT OF INTERESTS
Declared none

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