Conference Paper

# Association of Eating Pattern and Nutritional Status with Dyslipidemia Among Adults in Yogyakarta - Indonesia

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## Abstract

As 35.9 % Indonesian has cholesterol > 200 mg · $dL^{-1}$ which higher than 2007 (31.9 %). This study is to investigate the association between eating pattern and nutritional status with dyslipidemia. Cross-sectional study and subjects represent the most populated areas in Yogyakarta, taken in Umbulharjo (urban), Turi and Minggir (rural) by cluster sampling. It is used by interview using food consumption pattern, questionnaire, and measured nutritional status such as body mass index (BMI), waist circumference (WC), body fat mass, and blood serum. The subject is categorized dyslipidemia if total cholesterol (TC), triglyceride (TG) or low-density lipoprotein (LDL) is higher than standard. Prevalence dyslipidemia in urban (55.6 %) was higher than rural (44.4 %). From 385 subjects, 195 (50.6 %) had dyslipidemia and 190 (49.4 %) had normal. BMI, percent body fat, and visceral fat were higher on dyslipidemia than normal (24.30 *vs.* 23.16, 26.73 % *vs.* 25.84 %, and 8.42 *vs.* 6.72; $P = 0.02$, $P = 0.31$ and $P = 0.001$, respectively). WC was higher on dyslipidemia than normal (81.66 cm *vs.* 77 cm on male and 82.49 cm *vs.* 79.44 cm on the female; $P = 0.005$ and $P = 0.06$). Fatty, grilled and processed food, and instant noodle were associated with dyslipidemia ($P \leq 0.0001$). Mean of fruits and vegetable consumption was lower on dyslipidemia than normal (0.59 *vs.* 0.63) portions · $d^{-1}$ and (1.57 *vs.* 1.61) portions · $d^{-1}$, respectively). BMI, visceral fat, WC on male, and food consumption pattern are associated with dyslipidemia. For prevention risk of dyslipidemia, we should control nutritional status in the normal category, increase the portion of fruit and vegetable and minimize unhealthy food consumption.

**Keywords:** Adults, Dyslipidemia, Eating pattern, Nutritional status, Yogyakarta.

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Received: 10 November 2018
Accepted: 6 January 2019
Published: 10 March 2019

Publishing services provided by Knowledge E



Selection and Peer-review under the responsibility of the UASC Life Sciences 2016 Conference Committee.

## 1. Introduction

The Basic Health Research [1] by the Ministry of Health stated that 35.9 % (2013) Indonesian has cholesterol > 200 mg · $dL^{-1}$ which be one of the signs of dyslipidemia. This amount is higher than 2007 (31.9 %). Dyslipidemia is one of the main risk factors which

causing non-communicable diseases (NCD) such as type 2 diabetes, stroke, atherosclerosis, and cardiovascular disease (CVD) [2]. Morbidity and mortality are increased due to CVD in Indonesia. According to Basic Health Research, CVD's ranking has increased from $11^{th}$ (1972) to $3^{rd}$ (1986) and the leading cause of death in 1992, 1995, and 2001.

The NCD above can be influenced by some factors such as socio-demographic, genetic, and overweight or obesity, imbalance diet and physical inactivity [3]. Research data on risk factors of dyslipidemia and CVD are not widely available even though, precise estimation of the prevalence and risk factors of dyslipidemia is essentials for proper planning of health actions for prevention of negative clinical consequences and other complications [3]. It is a challenge for researchers to conduct epidemiological studies in urban and rural areas. We aimed at finding out the association between food consumption pattern and nutritional status with dyslipidemia in Yogyakarta.

## 2. Materials and Methods

### 2.1. Materials

The data is collected by interviewing characteristics data about socio-demography using characteristic data questionnaire and food consumption using food consumption pattern questionnaire. The data is also measured by nutritional status that is body mass index (BMI) and body fat mass (percent body fat and visceral fat) using bioelectrical impedance analysis (BIA); waist circumference (WC) using met line; and assessed blood serum to obtain profile lipid that is cholesterol (TC), triglyceride (TG), high-density lipoprotein (HDL), and low-density lipoprotein (LDL).

### 2.2. Methods

Data were taken in July to August 2016 by cross-sectional study design. The population was healthy people residing in Yogyakarta. As many as 385 subjects (195 subjects in urban and 190 subjects in rural) were taken by cluster sampling, represent the most populated areas in Yogyakarta that are Umbulharjo Sub-district for urban areas, Turi and Minggir Sub-districts for rural areas (Turi represents highland/mountain areas and Minggir represents lowland areas). Inclusion criteria for the subjects are live in Umbulharjo Sub-district or Turi and Minggir Sub-districts, adult age (19 to 64) yr, and signing inform consent as subject, while exclusion criteria have non-communicable diseases history

(hypertension, diabetes mellitus, stroke, coroner heart disease, and chronic obstructive pulmonary disease).

Dyslipidemia defined as elevated total cholesterol (TC) ($\geq$ 200 $\cdot$ $dL^{-1}$) or triglycerides (TG) ($\geq$ 150 mg $\cdot$ $dL^{-1}$) or low levels of high-density lipoprotein cholesterol (HDL) ($<$ 40 $\cdot$ $dL^{-1}$) or low density lipoprotein (LDL) ($\geq$ 130 $\cdot$ $dL^{-1}$) [3]. Body mass index of subjects were divided into two groups: normal [(18.5 to 23.9) kg $\cdot$ $m^{-2}$] and overweight [(23 to 29.9) kg $\cdot$ $m^{-2}$] or obese ($>$ 30 kg $\cdot$ $m^{-2}$), while waist circumference was grouped into two categories: central obesity ($\geq$ 0.9 m for male and $\geq$ 0.8 m for female) and normal ($<$ 0.9 m for male and $<$ 0.8 m for female).

Food consumption pattern of subjects was grouped into three category, i.e. often ($>$ 1 times $\cdot$ $d^{-1}$ and 1 times $\cdot$ $d^{-1}$) sometimes [(3 to 6) times $\cdot$ $wk^{-1}$ and (1 to 2) times $\cdot$ $wk^{-1}$] and rarely ($<$ 3 times $\cdot$ $mo^{-1}$ and never). Total portion of fruit and vegetable per day were obtained from frequency consumption per week cross portion per day then divide seven.

### 2.3. Data analysis

Data were analyzed using SPSS® version 19.0. Dyslipidemia was adjusted by areas which are urban and rural with Cochran's and Mantel Haenszel analysis. Dyslipidemia groups were compared with normal group related to all measured variables. Numeric variables (profile lipid, BMI, WC, body fat mass, and fruit-vegetable consumption) and their mean with dyslipidemia and the normal group were analyzed using independent sample t-test. Categorical variables (category of profile lipid and food consumption pattern) were analyzed using the chi-square test. A two-tailed *P*-value $<$ 0.05 was statistically significant. The mean and standard deviation were 95 % confidence intervals (CIs).

## 3. Results

Research findings from 385 subjects (195 in urban and 190 in rural), 195 (50.6 %) had dyslipidemia (Table 1). Most of the subjects have normal BMI (64.70 %) and normal WC (81.1 % on male) but central obesity in female (51.2 %) (Table 1).

Prevalence dyslipidemia in urban [109 subjects (55.9 %)] was higher than rural [86 subjects (44.1 %)] and showed statistically significant ($P$ = 0.03) (Table 2).

Levels of TC, TG, and LDL were higher on dyslipidemia than normal, while HDL was lower on dyslipidemia (181.88 *vs.* 159.27, 123.75 *vs.* 87.87, 117.85 *vs.* 90.41, and 39.06 *vs.* 51.14, respectively) (Table 3). BMI, percent body fat, and visceral fat were higher

TABLE 1: Characteristics data.

| Characteristics | Urban | | Rural | | Total |
|---|---|---|---|---|---|
| | N | % | n | % | |
| **Gender** | | | | | |
| Male | 90 | 46.2 | 90 | 47.4 | 180 |
| Female | 105 | 53.8 | 100 | 52.6 | 205 |
| **Age** | | | | | |
| Young adult | 51 | 26.1 | 47 | 24.7 | 98 |
| Adult | 100 | 51.3 | 93 | 48.9 | 193 |
| Elderly | 44 | 22.6 | 50 | 26.4 | 94 |
| **Waist circumference** | | | | | |
| *Male* | 24 | 26.7 | 10 | 11.1 | 34 |
| Central obesity | 66 | 73.3 | 80 | 88.9 | 146 |
| Normal | | | | | |
| *Female* | 65 | 61.3 | 40 | 40.4 | 105 |
| Central obesity | 41 | 38.7 | 59 | 59.6 | 100 |
| Normal | | | | | |
| **Body mass index (BMI)** | | | | | |
| Normal | 118 | 60.5 | 131 | 68.9 | 249 |
| Overweight | 55 | 28.2 | 46 | 24.2 | 101 |
| Obese | 22 | 11.3 | 13 | 6.7 | 35 |

TABLE 2: Prevalence of dyslipidemia in urban and rural areas.

| Variables | Areas | | | | Total | p-value |
|---|---|---|---|---|---|---|
| | Urban | | Rural | | | |
| | n | % | n | % | | |
| **Lipid profile** | | | | | | |
| Dyslipidemia | 109 | 55.6 | 86 | 44.4 | 195 | 0.03* |
| Normal | 87 | 45.5 | 103 | 54.5 | 190 | |

*$P$ is significant if $< 0.05$

on dyslipidemia than normal (24.30 *vs.* 23.16, 26.73 % *vs.* 25.84 %, and 8.42 *vs.* 6.72; $P = 0.02$, $P = 0.31$, and $P = 0.001$, respectively) (Table 3). WC was higher on dyslipidemia than normal (81.66 cm *vs.* 77.02 cm on male and 82.49 cm *vs.* 79.44 cm on female; $P = 0.005$ and $P = 0.06$). No association of total fruit and vegetable consumption with dyslipidemia ($P = 0.11$), even mean of them was lower on dyslipidemia than normal [(0.59 *vs.* 0.63) portions $\cdot$ d$^{-1}$ and (1.57 *vs.* 1.61) portions $\cdot$ d$^{-1}$, respectively].

Consumption of fatty, grilled, and processed food and instant noodle were associated with dyslipidemia ($P \leq 0.0001$) (Table 4).

TABLE 3: Mean of BMI, waist circumference, body fat mass, and fruit and vegetable consumption in dyslipidemia and normal.

| Variables | | n | Mean±SD | P-value (CI) |
|---|---|---|---|---|
| Total cholesterol (TC) (mg · $dL^{-1}$) | Dyslipidemia | 195 | 181.88 ± 40.2 | < 0.001* |
| | Normal | 190 | 159.27 ± 23.1 | (16.02 to 29.20) |
| Triglyceride (TG) (mg · $dL^{-1}$) | Dyslipidemia | 195 | 123.75 ± 65.7 | < 0.001* |
| | Normal | 190 | 87.87 ± 21.4 | (26.03 to 45.72) |
| Low-density lipoprotein (LDL) (mg · $dL^{-1}$) | Dyslipidemia | 195 | 117.85 ± 33.8 | < 0.001* |
| | Normal | 190 | 90.41 ± 25.03 | (21.48 to 33.42) |
| High-density lipoprotein (HDL) (mg · $dL^{-1}$) | Dyslipidemia | 195 | 39.06 ± 10.5 | < 0.001* |
| | Normal | 190 | 51.14 ± 11.0 | [(–14.23) to (–9.93)] |
| Body mass index (BMI) (kg · $m^{-2}$) | Dyslipidemia | 195 | 24.30 ± 4.4 | 0.02* |
| | Normal | 190 | 23.16 ± 5.3 | (0.16 to 2.11) |
| Male waist circumference (WC) (cm) | Dyslipidemia | 106 | 81.66 ± 11.7 | 0.005* |
| | Normal | 74 | 77.02 ± 9.4 | (1.41 to 7.87) |
| Female waist circumference (WC) (cm) | Dyslipidemia | 89 | 82.49 ± 11.3 | 0.06 |
| | Normal | 116 | 79.44 ±11.5 | [(–0.13) to 6.23] |
| Percent body fat (%) | Dyslipidemia | 195 | 26.73 ±8.9 | 0.31 |
| | Normal | 190 | 25.84 ± 8.2 | [(–0.83) to 2.60] |
| Visceral fat | Dyslipidemia | 195 | 8.42 ± 5.0 | 0.001* |
| | Normal | 190 | 6.72 ± 5.0 | (0.71 to 2.71) |
| Fruit consumption (portion · $d^{-1}$) | Dyslipidemia | 195 | 0.59 ± 0.05 | 0.57 |
| | Normal | 190 | 0.63 ± 0.04 | [(–0.09) to 0.16] |
| Vegetable consumption (portion · $d^{-1}$) | Dyslipidemia | 195 | 1.57 ± 0.1 | 0.71 |
| | Normal | 190 | 1.61 ± 0.1 | [(–0.23) to 0.16] |
| Total fruit and vegetable consumption (portion · $d^{-1}$) | Dyslipidemia | 195 | 2.19 ± 0.09 | 0.11 |
| | Normal | 190 | 3.20 ±0.08 | [(–0.25) to 0.24] |

* *P* is significant if < 0.05

## 4. Discussion

The main finding of this study was the prevalence of dyslipidemia among adult is higher in urban than rural areas in Yogyakarta and showed statistically significant. BMI, WC on male, visceral fat, and food consumption pattern were associated with dyslipidemia.

Table 4: Association between lipid profile and food consumption pattern with dyslipidemia.

| Variables | Urban | | | | Rural | | | | Total | P-value |
|---|---|---|---|---|---|---|---|---|---|---|
| | Dyslipidemia | | Normal | | Dyslipidemia | | Normal | | | |
| | n | % | n | % | n | % | n | % | | |
| **Total cholesterol (TC)** | | | | | | | | | | |
| High | 32 | 100 | 0 | 0 | 38 | 100 | 0 | 0 | 70 | < 0.001* |
| Normal | 77 | 47 | 87 | 53 | 48 | 31.8 | 103 | 68.2 | 315 | |
| **Triglyceride (TG)** | | | | | | | | | | |
| High | 25 | 100 | 0 | 0 | 22 | 100 | 0 | 0 | 47 | < 0.001* |
| Normal | 84 | 49.1 | 87 | 50.9 | 64 | 38.3 | 103 | 61.7 | 338 | |
| **High-density lipoprotein (HDL)** | | | | | | | | | | |
| Low | 84 | 100 | 0 | 0 | 49 | 100 | 0 | 0 | 84 | < 0.001* |
| Normal | 25 | 22.3 | 87 | 77.7 | 37 | 26.4 | 103 | 73.6 | 112 | |
| **Low-density lipoprotein (LDL)** | | | | | | | | | | |
| High | 36 | 100 | 0 | 0 | 40 | 100 | 0 | 0 | 76 | < 0.001* |
| Normal | 73 | 45.6 | 87 | 54.4 | 46 | 30.9 | 103 | 69.1 | 309 | |
| **Fatty food** | | | | | | | | | | |
| Often | 59 | 60.8 | 38 | 39.2 | 43 | 41.7 | 60 | 58.3 | 200 | |
| Sometimes | 43 | 51.2 | 41 | 48.8 | 39 | 48.1 | 42 | 51.9 | 165 | < 0.001* |
| Rarely | 7 | 46.7 | 8 | 53.3 | 4 | 80 | 1 | 20 | 20 | |
| **Grilled food** | | | | | | | | | | |
| Often | 5 | 55.6 | 4 | 44.4 | 4 | 100 | 0 | 0 | 13 | |
| Sometimes | 32 | 50.8 | 31 | 49.2 | 12 | 32.4 | 25 | 67.6 | 100 | < 0.001* |
| Rarely | 72 | 58.1 | 52 | 41.9 | 70 | 47.3 | 78 | 52.7 | 272 | |
| **Processed food** | | | | | | | | | | |
| Often | 3 | 75 | 1 | 25 | 3 | 60 | 2 | 40 | 9 | |
| Sometimes | 21 | 41.2 | 30 | 58.8 | 22 | 52.4 | 20 | 47.6 | 93 | < 0.001* |
| Rarely | 85 | 60.3 | 56 | 39.7 | 61 | 43 | 81 | 57 | 283 | |
| **Instant noodle** | | | | | | | | | | |
| Often | 9 | 75 | 3 | 25 | 3 | 60 | 2 | 40 | 17 | |
| Sometimes | 65 | 55.1 | 53 | 44.9 | 45 | 44.1 | 57 | 55.9 | 220 | < 0.001* |
| Rarely | 35 | 53 | 31 | 47 | 38 | 46.3 | 44 | 53.7 | 148 | |

*$P$ is significant if < 0.05

Meanwhile, percent body fat and fruit and vegetable consumption were not associated with dyslipidemia, even mean of them were higher on dyslipidemia than normal.

Dyslipidemia is known as the powerful risk factor for CVD. The frontline for dyslipidemia treatment are nutritional and lifestyle modifications to minimize and lower the risk of CVD [4]. A study by Pongchaiyakul et al. stated rising dyslipidemia prevalence in

Asia are related to age, race, sex, economic development, urbanization, per capita food intake (mainly fat), and the increase of non-lipid factors such as type-2 diabetes mellitus [5].

A study by Raj et al. [6] revealed the higher prevalence of dyslipidemia in urban areas (74.5 %) than rural areas (68.8 %), even not statistically significant ($P$ = 0.246), while other study reported that the prevalence of dyslipidemia was high in urban and showed statistically significant [5]. Other previous studies also support this finding which found the prevalence of dyslipidemia in urban adult was 56 % to 75.9 % [7–9]. Dyslipidemia is considered as a consequence of modernization because some study reported the prevalence of dyslipidemia is often higher in developed than developing countries, even both of them the prevalence of dyslipidemia is higher in urban than rural areas [5].

The result in this study is similar with the previous study [2, 10, 11] which found that BMI and WC as the strong predictor of dyslipidemia even, in this study, WC on a male is stronger statistically than female. By this result, the previous study [6, 11] found that BMI was higher in dyslipidemia than normal, even not significant.

The previous study found obesity and central obesity were identified as a risk factor for dyslipidemia [2]. It has increased atherogenic, small dense of LDL and elevated level of apolipoprotein B which increasing TC and TG concentration [10] and do not depend on total body fat mass [12]. Therefore, higher BMI and waist circumference considered as main risk factors of dyslipidemia [2]. Similarly, other studies found that the increase of BMI is related to increasing of dyslipidemia [13, 14], hypertension, and diabetes mellitus [13].

Obesity and central obesity are associated with conditions known as metabolic syndrome, namely dyslipidemia, hypertension, hyperglycemia and non-alcoholic fatty liver disease (NAFLD) [15]. A study by Misra et al. [16] found that urban areas have higher obesity rates than rural areas and are most affected by changes in nutrition status, unhealthy food intake, and sedentary lifestyle.

Rapid dietary change with sedentary lifestyle as a consequence of urbanization may be one risk factors of dyslipidemia and further CVD [17]. Higher economic levels in urban areas may be consequences of which is increased fast food consumption and sedentary lifestyle [17]. Another study also stated urban population is experiencing the transition in nutrition characterized by a change in diets such as rich in saturated fatty acids diets, low in polyunsaturated fatty acids and fiber [18]. Refined foods, sugar, and hydrogenated oils, high complex carbohydrate, high fiber and a low-fat diet have been replaced by the diet rich in fats and simple sugars low in dietary fiber [17]. The effect of that change is

in the disease spectrum from communicable to non-communicable diseases, especially CVD and diabetes mellitus type 2.

In the opposite with this study, the previous study found no association between fatty foods with dyslipidemia [11]; even often category was higher than rare category. The previous study [19] also found no association in the high diet of fruit and vegetables with dyslipidemia; even other studies have found the opposite [12, 15, 20]. It may cause sample size was a limiting factor in assessing this association. Whether in other studies found the opposite.

Research findings are the same as a previous study that state that there is an association between fruit and vegetable and food consumption pattern with dyslipidemia [12, 15, 20]. The previous study found that dietary intake of calorie restriction, type of dietary fat, resistant starch, and dietary fiber has been linked to insulin metabolism, lowered free fatty acid/FFA concentration and increased TG lipolysis [12, 15, 20]. Similarly, other study reported that the decreasing consumption of high-calorie food and saturated fat, and body weight management and regular physical exercise has been effective in treatment dyslipidemia [21].

Screening right for risk of dyslipidemia start from younger ages may be early prevention step and promote the healthy lifestyle that can prevent atherogenesis. In another side, effective treatment must be applied to an individual who was dyslipidemia to slow of CVD progression. Several randomized controlled trials (RCT) have reported that effective treatment of dyslipidemia minimizes the rate of morbidity and mortality [22].

## 5. Conclusions

BMI, visceral fat, WC on male, and food consumption pattern are statistically significantly associated with dyslipidemia among adult in rural and urban areas, Yogyakarta. For prevention risk of dyslipidemia, that should control nutritional status in the normal category, increase the portion of fruit and vegetable and minimize unhealthy food consumption.

## Acknowledgments

The gratefully acknowledge to Community Service and Research Directory, Director General of Research and Development, and Ministry of Research, Technology, and Education for the research funding and support University of Gadjah Mada, Indonesia, no 015/SP2H/LT/DRPM/II/2016. The authors also thank all enumerators and participants for

following this study from first to finish. Authors disclosed receipt of the following financial support for the research, authorship, and/or publication of this article.

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