CORRELATION OF FAT INTAKE AND WAIST TO HIP RATIO (WHR) WITH LOW DENSITY LIPOPROTEIN (LDL) CONCENTRATION IN MENOPAUSE WOMEN AT POSYANDU NGUDI WALUYO SURAKARTA

Dyah Intan Puspitasari*, Nesti Rahmawati, Setyaningrum Rahmawaty

Department of Nutritional Science, Universitas Muhammadiyah Surakarta, Indonesia

dyah_intan@ymail.com (Dyah Intan Puspitasari)

ABSTRACT

Beside hormonal factors, high intake of fat and waist to hip ratio (WHR) are predicted as risk factors to the increasing of LDL levels in menopause women. The aim of the present study was to assess the association of fat intake and WHR with LDL levels in menopause women. A cross sectional study was conducted in a simple random sample of 33 menopause women aged 45-65 years old in Posyandu Ngudi Waluyo Surakarta. An average of three 24-hour dietary recalls of each woman was analyzed using Nutrisurvey to obtain fat intake. WHR and LDL concentration on each respondent were undertaken. The results of the research showed that 17 participants (51.5%) had high intake of fat, 26 participants (78.8%) with WHR more than 0.85 cm and 15 (45%) had LDL concentration above 150 mg/dL. There was no relationship between fat intake and LDL concentration (p=0.139) as well as WHR and LDL levels (p=0.67). This research concluded that both fat intake and WHR appeared not to be the risk factor to the increasing of LDL level in menopause women at the Posyandu Ngudi Waluyo Surakarta.

Keywords: Fat Intake, LDL Level, Menopause, Waist to Hip Ratio

Presenting Author's biography

Dyah Intan Puspitasari. A faculty member at Department of Nutritional Science, Universitas Muhammadiyah Surakarta. Received Bachelor's degree from Department of Health Nutrition at Universitas Gadjah Mada and Master's degree from Department of Nutrition at University of Canberra.

BACKGROUND

Menopause is a natural phase that is experienced by women due to the depletion of sex steroid hormone, such as progesterone and estrogen [1] .The low level of estrogen and progesterone may alter lipid profiles, including Low Density Lipoprotein (LDL) [2]. The LDL level in menopause women will be significantly higher and the particles are denser compared with that in pre menopause women [2]. This condition may lead to the increasing risk of atherosclerosis and it can significantly increase cardiovascular diseases in women after menopause [3].

There are some factors that may influence the LDL levels, and one of the factors is dietary intake of fat. Eating high-fat food will decrease the excretion of cholesterol and lower the LDL receptors activity, therefore the LDL levels in circulatory system will increase. High level of LDL in circulation will be oxidized and it may promote fat deposition in blood vessels and increase the risk of atherosclerosis [4]. Some research indicated that decreasing dietary fat intake will lower the LDL level in menopause women [5].

Another factor that may influence the LDL level is abdominal obesity. It has been reported that abdominal fat increases with menopause [6]. One of the indicators that can be used to determine abdominal obesity is waist to hip ratio (WHR). WHR can be used to measure different aspects of fat distribution and body composition [7]. Fat cells located in the abdominal wall have larger size and dominated by LDL, it means that the higher fat deposits in the abdominal cavity will be followed by higher levels of LDL [8].

The preliminary survey conducted in August 2015 at Posyandu Ngudi Waluyo showed that 60% of menopause women had LDL levels> 130mg / dL. This indicated high risk of degenerative diseases such as coronary heart disease. Based on those backgrounds, the researchers will examine the correlation between fat intake and WHR with LDL levels in menopause women at Posyandu Ngudi Waluyo Surakarta.

METHODS

This cross sectional study was conducted in August 2014 until November 2015 at Posyandu Ngudi Waluyo Surakarta. A total of 33 postmenopausal women involved in the study were recruited by using simple random sampling technique with a lottery system. The respondents who were taking medication that could affect the LDL level were excluded from the study.

Dietary fat intake data

Dietary fat intake data were obtained by interview using 3 x 24 hours non-consecutive food recall. The researcher documented all of the foods and drinks that had been consumed by the respondents for 3 non-consecutive days. The collected data then were analyzed with *Nutrisurvey* software.

Waist to hip ratio data

WHR ratio is defined as the ratio of waist circumference (the level midway between the superior anterior iliac crest and the lateral lower rib margin) divided by hip circumference (level of the bilateral great trochanters) [9]. WHR measurements were conducted by using a measuring tape or metlin to the nearest 0.1 cm. The measurements were performed two times. The average of 2 measurements of WHR was used to determine the amount of fat in the abdominal cavity. The categories of WHR were divided into two groups, normal WHR was <0.85 cm and high WHR was 0.85 cm

The Data of LDL Levels

LDL levels of blood were obtained from venous blood tests using enzymatic methods. The categories of LDL levels were divided into three groups, optimal LDL level was ≤ 129 mg / dL, high borderline LDL level was 130-149 mg / dL, and high LDL level was ≥ 150 mg / dL.

Statistical analysis

All of the results were analyzed using computer software. The analysis of statistical test between fat intake and LDL levels was done by using Spearman's Correlation Coefficient test; whereas statistical test between the WHR and LDL levels was conducted by using Pearson Product Moment test. The statistical significance was accepted at $p<0.05$.

RESULTS AND DISCUSSION

Characteristics of Respondents

According to the results of the research, data characteristics of subjects can be seen in Table 1.

Table 1. Characteristics of Respondents (n=33)

Characteristics	N	%
Age		
45-59 years old	23	69.7
60-65 years old	10	30.3
Fat Intake		
Adequate	16	48.5
High	17	51.5
WHR		
Normal	7	21.2
High	26	78.8
Levels of LDL		
Optimal	12	36.4
High Borderline	6	18.2
High	15	45.5

It could be seen in Table 1 that majority of the respondents (69.7 %) who were aged 45-59 years old, had high WHR (78.8%), and had high level of LDL (45.5%). Some researchers found that age can influence the changes in body fat distribution, especially in abdominal fat

[10] and this can be indicated by the high WHR. The alteration of sex hormone on menopause women can lead to the visceral adipose tissue accumulation and deteriorated metabolic profile [11]. The lipolytic action of adipose tissue leads to the increase flux of free fatty acid in portal circulation to liver that may increase the availability of triglyceride and stimulate secretion of very low density lipoprotein. The hepatic lipase involved in the hydrolysis of triglyceride and phospholipid contains LDL particles. The higher hepatic lipase activity in menopause may increase the small dense of LDL subfraction that is potential for atherogenic [11].

Another factor that can influence LDL level is dietary fat intake. The total respondents who consumed high fat intake (> 30% of total energy) amounted for 51.5%. The respondents who had high fat intake consume foods with deep fry processing and cooking vegetables with coconut milk more often. Consuming high fat intake will lead to the higher LDL level and may increase the risk of cardiovascular disease [4].

The Relationship between Dietary Fat Intake and LDL Levels

The data of fat intake were obtained from 3x24 hour non-consecutive food recall. The distribution of fat intake and LDL levels could be seen in Table 2.

Table 2. The Correlation between Fat Intake and LDL Levels

Variable	*Mean*	Std. Deviation	Median	p-value*
Fat Intake	25.77	11.34	22.77	0.261
LDL Levels	142.22	35.62	143.44	

**Rank Sperman Test*

Based on Table 2, the mean of fat intake and LDL levels were 25.77 and 142.22, respectively. The correlation test between fat intake and LDL levels using Spearman rank correlation test showed that the statistical p-value was 0.261 ($p \geq 0.05$). This meant that there was no correlation between fat intake and LDL levels in menopause women.

There are several types of fat, including saturated and unsaturated fat. Saturated fat is generally known as the type of fat that may have impact on the increase of LDL level; meanwhile, polyunsaturated fat has beneficial impact on lowering the LDL level [12]. This study did not differentiate the types of fat that were consumed by the respondents. Dietary food recall was recorded the total fat consumed; therefore, it might be the reason why there was no correlation between fat intake and LDL level in this study.

Another factor that may influence LDL level is fiber intake. The high intake of fiber may lower the LDL level due to its mechanism to bind the cholesterol during the intraluminal formation of micelles [13]. The reduction of cholesterol in liver will lead to the clearance of LDL and lowering the LDL level [14]. This research did not examine the fiber intake of respondents. Therefore, the non- correlation between fat intake and LDL level maybe due to the high fiber intake of respondents that may influence the LDL level.

The Correlation between WHR and LDL Levels

The WHR data were obtained through waist and hip circumference measurements using measuring tape with 2 repetition of measurement. The distribution of WHR and LDL levels could be seen in Table 3

Table 3. The Relationship between WHR and LDL Levels

Variable	*Mean*	Std.Deviation	Median	p-value*
WHR	0.88	0.069	0,89	0.674
LDL Level	142.22	35.62	143,44	

**Product Moment Correlation Test*

Based on Table 3, the mean of WHR and LDL levels were 0.88 and 142.22, respectively. The correlation between WHR and LDL levels was tested by using Product Moment correlation test. The test showed that the p-value was 0.674 ($p \geq 0.05$). This means that there was no correlation between WHR and LDL levels in postmenopausal women.

WHR is associated with abdominal obesity [14]. The higher fat deposits in the abdominal cavity will involve the excess exposure of liver with fatty acids. This mechanism may result in higher levels of LDL [14]. However, some research indicated that waist circumference is a better reflection of visceral fat compared to WHR [15]. This is because WHR does not reflect variations in accumulation of visceral fat only. Waist circumference reflects visceral and subcutaneous fat, while hip circumference reflects variation of bone, gluteal muscle, and subcutaneous gluteal fat [14]. Those explanations showed that waist and hip circumferences were both independently related to LDL level and it was confounded in WHR.

In conclusion, there was no significant correlation between the intake of fat and WHR with LDL levels in menopause women at Posyandu Ngudi Waluyo Surakarta. Future research are needed to examine other factors that can affect LDL levels, such as the types of fat, dietary fiber intake, physical activity, and abdominal obesity; therefore it can indicate the risk factors of cardiovascular disease in menopause women.

REFERENCES

[1] Stachowiak, G, Pertynski, T, and Pertynska-Marczewska, M, "Metabolic disorders in menopause", *Prz Menopauzalny*, vol. 14, no.4, 59-64, 2015

[2] Carr, MC , Kim, KH , Zambon, A , Mitchell, ES , Woods, NF , Casazza, CP , Purnell, JQ , Hokanson, JE , Brunzell, JD , Schwartz, RS, "Changes in LDL density across the menopausal transition", vol. 48, no. 4, 245-250, 2000

[3] de Aloysio, D, Gambacciani, M , Meschia, M, Pansini, F, Modena, A B, Bolis , PF, Massobrio, M, Maiocchi, G, Peruzzi, E, "The effect of menopause on blood lipid and lipoprotein levels", *Atherosclerosis,* vol.147, 147-153, 1999

[4] Bull, E and Morrell, J., "*Simple Guides Kolestrol*. *First Edition*". Erlangga, Jakarta, 2007

[5] Stefanick, MA, Mackey, S, Sheehan, M, Ellsworth, N, Haskell, WL, Wood, PD, "Effects of diet and exercise in men and postmenopausal women with low levels of HDL cholesterol and high levels of LDL cholesterol", *The New England Journal of Medicine,* vol. 339, no.1, 12-20, 1998

[6] Franklin, RM, Ploutz-Snyder, L, Kanaley, JA, "Longitudinal changes in abdominal fat distribution with menopause", *Metabolism Clinical and Experimental,* vol.58, 311-315, 2009

[7] Seidell, JC, Pérusse, L, Després, J, Bouchard, C, "Waist and hip circumferences have independent and opposite effects on cardiovascular disease risk factors: the Quebec Family Study", *American Journal Clinical Nutrition,* vol. 74, 315-321, 2001

[8] Soeharto, I. "*Serangan jantung dan stroke hubungannya dengan lemak dan kholestrol* . PT Gramedia Pustaka Utama, Jakarta, 2004

[9] Larsson B, Bengtsson C, Bjo Èrntorp P, Lapidus L, Sjo Èstro Èm L, Sva Êdsudd K, Tibblin G, Wedel H, Welin L, Wilhelmsen L, "Is abdominal body fat distribution a major explanation for the sex difference in the incidence of myocardial infarction?", *American Journal Epidemiology*, vol. 135, 266-273, 1992

[10] Mesch VR, Boero LE, Siseles NO, Royer M, Prada M, Sayegh F, Schreier L, Benencia HJ, Berg GA, " Metabolic syndrome throughout the menopausal transition: influence of age and menopausal status", *Climacteric,* vol. 9, 40–48, 2006

[11] Berg, G, Mesch, V, Siseles, N, "Abdominal obesity and metabolic alterations in the menopausal transition", *Curr Obstet Gynecol Rep,* vol. 1, 63–70, 2012

[12] Mozaffarian , D, Micha, R, Wallace, S, "Effects on coronary heart disease of increasing polyunsaturated fat in place of saturated fat: a systematic review and meta-analysis of randomized controlled trials", *Journal pmed,* 2010

[13] Brown, L, Rosner, B, Willet, WW, Sacks, FM, "Cholesterol-lowering effects of dietary fiber: a meta-analysis", *American Journal of Clinical Nutrition,* vol. 69, 30-42, 1999

[14] Seidell, JC, Pérusse, L, Després, JP, Bouchard, C, "Waist and hip circumferences have independent and opposite effects on cardiovascular disease risk factors: the Quebec Family Study*", Am J Clin Nutr ,* vol. 74, 315–321, 2001

[15] Pouliot MC, Després JP, Lemieux S, et al., "Waist circumference and abdominal sagittal diameter: best simple anthropometric indexes of abdominal visceral adipose tissue accumulation and related cardiovascular risk in men and women", *Am J Cardiol* , vol. 73, 460–468, 1994