Relationship between plasma lipid profile and the severity of diabetic retinopathy in type 2 diabetes patients

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Abstrak

Penelitian ini bertujuan untuk mengetahui hubungan antara profil lipid darah dengan derajat retinopati diabetik penderita DM tipe-2. Penelitian potong-lintang pada 52 pasien retinopati diabetika dilaksanakan di Poliklinik Mata, Rumah Sakit Cipto Mangunkusumo, Jakarta. Data yang dikumpulkan meliputi data demografi, gaya hidup, lama menderita DM, pemeriksaan fisik dan antropometrik, asupan lemak, asam lemak dan kolesterol data kadar gula darah puasa, A1C, kolesterol total, kolesterol-LDL, kolesterol-HDL and trigliserida, dan pemeriksaan fundus. Analisis statistik yang digunakan adalah uji chi-square untuk mengetahui hubungan antara profil lipid darah dengan derajat retinopati diabetik. Subyek terdiri dari 20 orang laki-laki dan 32 orang perempuan dengan rerata usia 53,8 ± 5,2 tahun. Sebanyak 53,8% telah didiagnosis DM selama >10 tahun, dengan rerata IMT adalah 24,1 ± 3,3 kg/m² dan 38,5% diklasifikasikan sebagai obes I dan II. Rerata kadar gula darah puasa 157,5 ± 71,8 mg/dL, dan A1C 9,1 ± 2,4 %. Sebanyak 40,4% subyek mempunyai kadar kolesterol total darah tinggi, 34,6% kadar kolesterol-LDL darah sangat tinggi, dan 65,4% dengan kolesterol-HDL dan trigliserida darah normal. Derajat keparahan retinopati diabetika ditunjukkan dengan adanya 61,6% subyek dengan retinopati diabetika non-proliferasi berat (NPDR) and retinopati diabetika proliferasi (PDR). Kesimpulannya, belum dapat dibuktikan adanya hubungan yang bermakna antara profil lipid dengan derajat retinopati diabetika. ***(Med J Indones 2008; 17: 221-5)***

Abstract

This study aimed to determine the relationship between plasma lipid profile and the severity of diabetic retinopathy in type 2 diabetes patients. A cross sectional study was done in Ophthalmologic Clinic, Cipto Mangunkusumo General Hospital, Jakarta for 52 diabetic retinopathy (DR) patients. Data collected were demographic, life style, duration of diabetes, physical and antropometric examinations, fat, fatty acid and cholesterol intake, fasting plasma glucose, A1C, total-, LDL-, HDL-cholesterol and triglyceride level, and fundus examination. Statistical analysis was done using chi-square test to see the associations between plasma lipid profile and DR in type 2 diabetes patients. Subjects comprised of 20 males and 32 females diabetes patients with mean age of 53.8 ± 5.2 years. As much as 53.8% had been diagnosed as DM for >10 years. The mean value of BMI was 24.1 ± 3.3 kg/m² and 38.5% were classified as obese I and II. The mean value of fasting plasma glucose was 157.5 ± 71.8 mg/dL, and A1C was 9.1 ± 2.4 %. For lipid profile, 40.4% had high total cholesterol level (>240 mg/dL), 34.6% had high and very high LDL-cholesterol level (≥160 mg/dL), and 65.4% had normal HDL-cholesterol (40-60 mg/dL) and triglyceride level (<150 mg/dL). For the severity of retinopathy, 61.6% had severe non-proliferative diabetic retinopahy (NPDR) and proliferative diabetic retinopahy (PDR). In conclusion, there were no significant associations between plasma lipid profile and the severity of diabetic retinopathy. ***(Med J Indones 2008; 17: 221-5)***

Keywords: Fat intake, lipid profile, diabetic retinopathy

Diabetes mellitus is continuing to become a health problem because the prevalence of DM increases dramatically over the past two decades.[1] Prevalence of diabetic retinopathy (DR), the ophthalmologic com-plication of DM, in Indonesia is 27.1%.[2] Strategies to prevent the development and progression of DR is very crucial regarding its blindness end result. Risk factors of DR among others are hyperglycemia, hypertension, pregnancy, obesity and dyslipidemia.[3-6] Dyslipidemia associated with DM are hyper triglyceride and decrease HDL-cholesterol concentrations.[1,7]

Chen et al found that dyslipidemia, not hyperglycemia, that induces inflammatory adhesion molecules expression

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in microvascular human retinal vascular endothelial cells.[8] High lipid levels are known to cause endothelial dysfunction via a local inflammatory response resulting in the release of cytokines and growth factors, activation of oxygen-sensitive biological changes in vessel walls, increased low-density lipoprotein (LDL) oxidation, and quenching of nitric oxide. Endothelial dysfunction in diabetic vasculature results in blood-retinal barrier breakdown that will lead to DR. Elevated level of LDL and triglycerides in DM have been linked with higher levels of advanced glycation end products, which play an important role in the pathogenesis of diabetic complications.[6,9,10]

Previous studies found that high dietary fat intake among DM patients at Cipto Mangunkusumo General Hospital (27.3%-33% total energy intake).[11,12] High intake of dietary fat will influence plasma lipid profile and worsen the existing abnormal metabolism. This research was aimed to investigate the associations between dietary fat intake, plasma lipid profile and DR in type 2 diabetes patients.

METHODS

Fifty two diabetic retinopathy patients were consecutively recruited from Ophthalmology Clinic at Dr Cipto Mangunkusumo General Hospital, Jakarta. The inclusion criteria was age under 60 years while the exclusion criteria were pregnant, lactating woman and/or taking antihyperlipidemic agent. All participants were given written informed consent. The study protocol was approved by The Medical Research Ethics Committee of The Faculty of Medicine University of Indonesia.

This was a cross sectional study to collect data by interview, medical records, physical and laboratory examination. Data collected were demographic characteristics, life style, duration of diabetes, physical and antropometri examinations, fat, fatty acid and cholesterol intake by FFQ semiquantitative method, laboratory (fasting plasma glucose, A1C, total-cholesterol, LDL-, HDL-cholesterol and triglyceride level), and fundus examination.

Body weight was measured using a digital Seca scale with accuracy to the nearest 0.1 kg. Body height was measured using a microtoise with accuracy to the nearest 0.1 cm. Both measures were used to classify nutritional status of the subjects based on body mass index (BMI). Nutrients intake was analyzed using data provided from the semi-quantitavie food-frquency questionnaires. Blood samples were analyzed for glycaemic control (blood glucose and A1C) and classified using local reference (*PERKENI,* 2006) and lipid profile was analyzed by using high performance liquid chromatography and classified using NCEP-ATP III 2001 reference. Classification of retinopathy was based Victor et al (1999) reference.

The data were analyzed using SPSS version 11.5. All group data were presented as frequency distribution (proportion) and the average values was presented as means ± SD for the normal distribution data and as median (minimum-maximum) for the non normal distribution data. Data were analysed statistically using chi-square or fischer exact test to see the associations between plasma lipid profile and DR in type 2 diabetes patients. The minimal level of significance was set at $p<0.05$.

RESULTS

Subjects comprised of 20 (38.5%) males and 32 (61.5%) females, with mean age of 53.8 ± 5.2 years. Majority of the subjects (80%) had low and moderate education level, 94.2% were above the poverty line, 53.8% had been diagnosed DM for >10 years, 88.5% were non-smokers and 57.7% had low physical activity index. The mean value of BMI was 24.1 ± 3.3 kg/m², which were within the risk range for obeisty and 38.5% of the subjects were classified as obese I and II (Table 1).

The mean value of systolic blood pressure was 137.4 ± 21.8 mmHg, diastolic blood pressure 81.5 ± 21.8 mmHg, fasting plasma glucose 157.5 ± 71.8 mg/dL, A1C 9.1 ± 2.4 %. As much as 40.4% had high total cholesterol level, 34.6% had high and very high LDL-cholesterol level, and 65.4% had normal HDL-cholesterol and triglyceride level (Table 2). The median of dietary fat intake was 39.5 (8-146) g/day and 78.8% had high fat intake, 94,2% had high SAFA intake, all of the subjects had enough PUFA and MUFA intake, and 94,2% had enough cholesterol intake (Table 3).

There were no significant association between plasma lipid profile and the severity of DR (Table 4).

Table 1. Characteristics of the subjects (n=52)

Characteristics	Frequency	Percentage (%)
Sex: Male	20	38.5
Female	32	61.5
Educational level: Low	22	42.3
Moderate	20	38.5
High	10	19.2
Incomes: Above poverty level	3	5.8
Below poverty level	49	94.2
Duration DM: ≤10 years	24	46.2
>10 years	28	53.8
Smoking: Non smokers	46	88.5
Light smokers	2	3.8
Moderate smokers	3	5.8
Heavy smokers	1	1.9
Physical activity: Low	30	57.7
Moderate	13	25.0
High	9	17.3
BMI: Underweight	2	3.8
Normal	18	34.6
Overweight		
Risk	12	23.1
Obes I	17	32.7
Obes II	3	5.8

BMI, body mass index

Table 2. Physical examination and laboratory data of the subjects (n=52)

Variables	Frequency	Percentage (%)
Systolic BP: Normal	7	13.5
Prehypertension	20	38.5
Hypertension I	15	28.8
Hypertension II	10	19.2
Diastolic BP: Normal	20	38.5
Prehypertension	14	26.9
Hypertension I	15	28.8
Hypertension II	3	5.8
Fasting glucose level: Good	15	28.8
Moderate	5	9.6
Bad	32	61.5
A1C: Good	8	15.4
Moderate	10	19.2
Bad	34	65.4

Table 2. Physical examination and laboratory data of the subjects (n=52)

Variables	Frequency	Percentage (%)
Total cholesterol: Desirable	17	32.7
Borderline high	14	26.9
High	21	40.4
LDL cholesterol: Optimal	7	13.5
Near optimal	8	15.4
Borderline high	19	36.5
High	9	17.3
Very high	9	17.3
HDL cholesterol: High	34	65.4
Low	18	34.6
Triglyceride: Desirable	34	65.4
Borderline high	6	11.5
High	11	21.2
Very high	1	1,9

BP, blood pressure; A1C, glycosilated haemoglobin; LDL, low-density lipoprotein; HDL, high-density lipoprotein

Table 3. Fat, fatty acid and cholesterol intake of the subjects (n=52)

Intake	Frequency	Percentage (%)
Fat: Low	5	9.6
Moderate	6	11.5
High	41	78.8
SAFA: Low	3	5.8
Moderate	49	94.2
PUFA: Moderate	52	100
MUFA: Moderate	52	100
Cholesterol: Moderate	49	94.2
High	3	5.8

SAFA, saturated fatty acid; PUFA, poly-unsaturated fatty acid; MUFA, mono-unsaturated fatty acid

Table 4. Associations of lipid profile and diabetic retinopathy (n=52)

Lipid profile	Category		Diabetic retinopathy, n (%)				p
			Mild NPDR	Moderate NPDR	Severe NPDR	PDR	
Total cholesterol	Desirable	Borderline	4 (44.4)	2 (18.2)	4 (33.3)	7 (35.0)	0.858
	high		3 (33.3)	3 (27.3)	3 (25.0)	5 (25.0)	
	High		2 (22.2)	6 (54.4)	5 (41.7)	8 (40.0)	
LDL cholesterol	Optimal		6 (66.7)	7 (63.6)	7 (58.3)	14 (70.0)	0.569
	Near optimal		0	3 (27.3)	2 (16.7)	1 (5.0)	
	Borderline high		3 (33,3)	1 (9.1)	3 (25.0)	4 (20.0)	
	High		0	0	0	1 (5.0)	
	Very high						
			1 (11.1)	1 (9.1)	0	5 (25.0)	0.190
HDL cholesterol	High		1 (11.1)	0	4 (33.3)	3 (15.0)	
	Low		6 (66.7)	5 (45.5)	2 (16.7)	6 (30.0)	
			1 (11.1)	3 (27.3)	3 (25.0)	2 (10.0)	
Triglyceride	Desirable		0	2 (18.2)	3 (25.0)	4 (20.0)	
	Borderline high						
	High		2 (22.2)	2 (18.2)	5 (41.7)	9 (45.0)	0.371
	Very high		7 (77.8)	9 (81.8)	7 (58.3)	11 (55.0)	

LDL, low-density lipoprotein; HDL, high-density lipoprotein; NPDR, non-proliferative diabetic retinopathy; PDR, proliferative diabetic retinopathy

DISCUSSION

The present study showed that most of the subjects were diagnosed as having severe DR (severe NPDR and PDR). As much as 25% of the male subjects were diagnosed as having PDR and most of the female subjects had moderate NPDR. The Wisconsin Epidemiologic Study of Diabetic Retinopathy (WESDR) showed a similar trend where male had more PDR than female.[13] The mean age of the subjects was 53.8 ± 5.2 years. Epidemiologic studies showed an increased prevalence of DR with increasing age in the younger-onset of DM. Increases in growth hormone, insulin-like growth factor 1, sex hormone, poor glycemic control have been hypothesized to explain the higher risk of DR in the younger-onset of DM.[14]

This study didn't find any trend on the increased of PDR subjects when total cholesterol level increased. This condition might be related to the fact that most of the PDR subjcts had normal plasma triglyceride level and borderline to a very high plasma LDL-cholesterol level. There were PDR subjects with low HDL-cholesterol level as much as PDR subjects with high HDL-cholesterol level.

There were no significant associations between plasma lipid profile and DR by bivariate statistical analysis. This could be explained by the fact that most of the subjects had normal plasma triglyceride and total cholesterol level. Abnormalities in lipid profile that could be associated with DR are high plasma triglyceride and total cholesterol. Beside that, most of the subjects had poor glycemic control in which glycemic control is known as the most important risk factors for DR. This result was similar to the study by Lyons et al that showed no significant association between plasma triglyceride, LDL- and HDL-cholesterol level with DR. Lyons et al found that DR had a significant positive association with LDL small-dense and significant negative association with HDL.[16] Previous studies showed a significant association between plasma lipid profile.[5,9,17] Haddad and Saad found that plasma total cholesterol and triglyceride were risk factors for DR.[18]

It is concluded that there was no association between plasma lipid profile and the severity of DR.

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