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Original Research Article

The correlation of obesity, smoking, fried foods consumption pattern and food intake with lipid profile in civil servant in Yogyakarta, Indonesia

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ABSTRACT

Background: Dyslipidemia is an abnormal change in the levels of lipid profile such as increased levels of total cholesterol, LDL, triglycerides or decreased levels of HDL. The proportion of the Indonesian population (> 15 years old) with a total cholesterol level above the normal value amounted to 35,9%. Objective: To determine the correlation of obesity, smoking, fried food consumption pattern and food intake with lipid profile in civil servant in Yogyakarta.
Methods: This study is an observational study with cross sectional design at employees of Gadjah Mada University who perform medical check-up at the GMC-Health Center Yogyakarta. There are 179 respondents in the study. Subjects are categorized to have dyslipidemia (based on NCEP ATP III criteria) if it meets ≥ 1 of the following criteria: (1) Total cholesterol ≥ 200 mg/dL; (2) LDL cholesterol ≥ 130 mg / dL; (3) HDL cholesterol < 40 mg / dL; and (4) Triglycerides ≥150 mg / dL. Fried food consumption patterns and food intake is obtained using semi-quantitative food frequency questionnaire (SQ-FFQ). Data were analyzed by Chi Square, Independent t test and Mann Whitney test (adjusted for scale variables used) with a confidence level of 95%.
Results: One hundred and fifty five of 179 respondents (87.3%) diagnosed with dyslipidemia. There are 52% abnormal cholesterol, abnormal LDL 67%, 43% and 28.5% with abnormal HDL and abnormal triglycerides, respectively. The statistical test showed the correlation of obesity (p=0,022), smoking (p=0,013), the type of fried food (p=0.047), the amount of fried foods (p=0,013) and fat intake from fried foods (p=0.036) has significant association with lipid profile levels.
Conclusions: There is significant correlation between obesity, smoking, type of fried food, amount of fried foods and fat intake from fried food with lipid profile levels.

Keywords: Consumption pattern, Dyslipidemia, Fried foods

INTRODUCTION

Blood lipid profile consist of cholesterol, triglycerides, LDL, and HDL. Normal levels of total cholesterol is <200 mg/dL, LDL is<130 mg/dL, HDL is ≥ 40 mg/dL and triglycerides is<150 mg/dL.[1] Dyslipidemia is an abnormal condition in the levels of lipid profile which are increase in total cholesterol, LDL, triglycerides levels or decreasein HDL levels.[2]

Dyslipidemia prevalence data has not been registered properly, however the prevalence is predicted to be increased steadily. Data from Riskesdas (Riset Kesehatan Dasar or Basic Health Research) Indonesia 2013, with a

reference regulated in NCEP-ATP III.[1,3] The proportion of Indonesian aged>15y with total cholesterol above normal levels was 35.9%, HDL under normal levels was 22.9%, LDL above optimal levels was 76.2%, and triglycerides above normal levels was 24.9%.

A research done by Kreisberg and Oberman in Ginting, reported dyslipidemia was attributable to obesity, lack of physical activity, high consumption of saturated fat, cholesterol, carbohydrate, and low consumption of fibre.[4] High consumption of fried food is one of the causes of high intake of saturated fat. Majority of Indonesian used oil for cooking. Daily total fat intake of people living in urban area was about 21.96%-26.52% and rural area was at 19.08%. The highest contribution to the total fat intake was from fried food at70%.[5]

National proportion of Indonesia people who consumed food containing fat and cholesterol, also fried food ≥1x/d was 40.7%. Five provinces with the highest consumption above the national average were Central Java (60.3%), Yogyakarta Special Region (50.7%), West Java (50.1%), East Java (49.5%), and Banten (48.8%).[3]

METHODS

Study population

This observational study with cross-sectional design involved employees of Gadjah Mada University who were registered as a member of GMC health center and performed medical check-up at the GMC-Health Center Yogyakarta on February-April 2014. The inclusion criterions to determine the sample were: (1) Employee of UGM registered as member of GMC health center, (2) Able to communicate properly, based on observation (interview with subject), (3) Have a good memory, based on observation (interview with subject), (4) Willing to be interviewed and sign the informed consent. The total number of subjects in this study was 179 subjects.

Data of self-identity, age, sex, education background, ethnic group, family history of dyslipidemia and smoking status were collected using questionnaire. The weight and height of subjects were measured to calculate the BMI. Physical activity was estimated using IPAQ. While, food and fried food intake and lipid profile were collected using semi quantitative frequency questionnaire (SQFFQ). Lipid profile data was obtained from secondary data from GMC health center.

Working definitions

The definitions of dyslipidemia based on National Cholesterol Education Program-Adult Treatment Panel III(NCEP-ATP III) is an abnormality of lipid profile in blood which can be seen if ≥1 following factors emerge: total cholesterol ≥ 200 mg/dl, triglycerides ≥ 150 mg/dl, HDL < 40 mg/dl, LDL ≥ 130 mg/dl. Education background was categorized as basic (graduated from junior high school and elementary school), moderate (graduated from senior high school or equal) and high (graduated from higher education). Ethnic group was distinguished as Javanesse and non-Javanesse. Subjects was also adjusted for smoking status (never or smoking ≥ 1 cigarettes/d), physical activity (high, moderate and low based on IPAQ measurement), family history of dyslipidemia ("no" or yes" if ≥1 family member has history of dyslipidemia).

Nutrition intake consist of energy, protein, fat, carbohydrate, and fibre intake were categorized as high (intake >110%RDA), adequate (intake 90-110%RDA), low (intake <90%RDA). Subjects who consumed fried food ≥4x/w were adjusted to "often" and those who consumed< 4x/w was categorized as "rarely". Daily fried food weight in gram was high if >median or moderateif<median. Fried food intake was the percentage of energy and fat intake from daily fried food consumption toward RDA, high if >median and moderate if<median. Subjects were categorized as obese (BMI ≥ 25 kg/m^2) and non-obese (BMI<18.5 kg/m^2)

Statistical analysis

To anticipate data entry error, data was re-examined before being analyzed using SPSS version 20.0. Categorical variable was tested using Chi Square test to examined the association between variable. Association was significant if p<0.05.

RESULTS

Background characteristics

Background characteristics can be seen in Table 1. All of the subjects were aged ≥40 year, 50.8% (91 persons) aged 40-50 y and 49.2% (88 persons) aged ≥50 y which consist of 120 men (67%) and 59 women (33%). Majority of subjects had high education background (102 persons or 57%) and were Japanese (174 persons or 97.2%). Statistical analysis of Chi Square test in this study showed that sex was associated with dyslipidemia (RP; 95%Cl: 3.422; 1.416-8.271), and the higher prevalence of dyslipidemia was in men. While there were no significant association between age, education background, and ethnic group with dyslipidemia (p>0.05).

The number of subjects who has normal levels of cholesterol was 86 persons (48%), while 93 persons (52%) had abnormal levels of cholesterol. Employment status was distinguished to lecturers and non-lectures. Lipid profile consisting of total cholesterol, LDL, HDL, dan triglycerides can be seen in Table 2. Based on the employment status, 27 lecturer (15.1%) had normal total cholesterol levels(Mean±SD=169.56±12.93) and 34 lecturer (19%) had abnormal levels (Mean±SD=232.26±21.98), while 59 non-lecturer subjects (33%) has a normal cholesterol levels(Mean±SD=172.73±19.04) and 59 non-lecturer

subjects (33%) had abnormal levels of cholesterol (Mean±SD=224.85±19.85).

Of these, 24 lectures (13.4%) had normal levels of LDL(Mean±SD=110.75±11.45) and 37 lecturer (20.7%) had abnormal levels(Mean±SD=168.30±27.08). While, 35 non-lecturer (19.6%) had normal levels of LDL(Mean±SD=107.23±16.70) and 83 non-lecturer (46.4%) had abnormal levels(Mean±SD=161.70±21.38). Regarding HDL levels, 39 lecturers (21.8%) has normal levels(Mean±SD=50.15±9.13) and 22 lecturer (12.3%) has abnormal levels(Mean±SD=33.55±3.23). While, 63 non-lecturer (35.2%) had normal levels of HDL (Mean±SD=49.65±9.13) and 55 non-lecturer (30.7%) had abnormal levels(Mean±SD=32.00±4.57). Regarding triglycerides levels, 41 lecturer (22.9%) had normal levels(Mean±SD=96.95±30.29) and 20 lecturer (11.2%) had abnormal levels(Mean±SD=232.85±133.05). While, 87 non-lecturer subjects (48,6%) had normal levels of triglycerides (Mean±SD=99.20±29.19) and 31 non-lecturer subjects (17,3%) had abnormal levels(Mean±SD=236.77±77.57).

Risk factors of dyslipidemia

This study examined the risk factors which are family history of dyslipidemia, smoking status, physical activity, obesity status, main food intake includes energy, fat, protein, carbohydrate and fibre intake, also fried food intake includes frequency, weight and energy and fat content (Table 3).

Table 1: Association of background characteristic with dyslipidemia.

	Dyslipidemia				Total		*p*	RP CI (95%)
	Yes (n=155)		No (n=24)					
	n	%	n	%	N	%		
Age								
40-50 y	81	45.3	10	5.6	91	50.8	0.334	1.532 (0.642-3.660)
≥50 y	74	41.3	14	7.8	88	49.2		
Sex								
Men	110	61.5	10	5.6	120	67	0.004*	3.422 (1.416-8.271)
Women	45	25.1	14	7.8	59	33		
Education								
High	85	47.5	17	9.5	102	57	0.141	0.500 (0.196-1.274)
Moderate+Basic	70	39.1	7	3.9	77	43		
Ethnic group								
Japanese	150	83.8	24	13.4	174	97.2	1.000	0.862 (0.812-0.915)
Non-Japanese	5	2.8	0	0	5	2.8		

Table 2: Background characteristic according to lipid profile and employment status.

	Lecturer (n=61)			Non-lecturer (n=118)			Total
Variable	Total		Mean±SD (mg/dL)	Total		Mean±SD (mg/dL)	N (%)
	n	%		n	%		
Total cholesterol							
Normal	27	15.1	169.56±12.93	59	33	172.73±19.04	86(48)
Abnormal	34	19.0	232.26±21.98	59	33	224.85±19.85	93(52)
LDL							
Normal	24	13.4	110.75±11.45	35	19.6	107.23±16.70	59(33)
Abnormal	37	20.7	168.30±27.08	83	46.4	161.70±21.38	120(67)
HDL							
Normal	39	21.8	50.15±9.13	63	35.2	49.65±9.13	102(57)
Abnormal	22	12.3	33.55±3.23	55	30.7	32.00±4.57	77(43)
Triglycerides							
Normal	41	22.9	96.95±30.29	87	48.6	99.20±29.19	128(71.5)
Abnormal	20	11.2	232.85±133.05	31	17.3	236.77±77.57	51(28.5)

Table 3: Risk factors of dyslipidemia.

	Dyslipidemia				Total		*P*	RP CI (95%)
	Yes (n=155)		No (n=24)					
	n	%	n	%	N	%		
Dyslipidemia family history								
Yes	7	3.9	2	1.1	9	5	0.346[a]	1.922
No	148	82.7	22	12.3	170	95		(0.375-9.850)
Smoking								
Yes	23	12.8	3	1.7	26	14.5	1.000[a]	0.820
No	132	73.7	21	11.7	153	85.5		(0.226-2.973)
Physical activity								
High	28	15.6	3	1.7	31	17.3	0.772[a]	1.543
Moderate+Low	127	70.9	21	11.7	148	82.7		(0.430-5.534)
Obese								
Yes	65	36.3	6	3.4	71	39.7	0.115[b]	0.462
No	90	50.3	18	10.1	108	60.3		(0.174-1.227)
Energy intake								
High	29	16.2	7	3.9	36	20.1	0.273[a]	1.789
Adequate+Low	126	70.4	17	9.5	143	79.9		(0.679-4.712)
Fat intake								
High	28	15.6	6	3.4	34	19.0	0.410[a]	1.512
Adequate+Low	127	70.9	18	10.1	145	81.0		(0.550-4.153)
Protein intake								
High	62	34,6	12	6,7	74	41,3	0,355[b]	1,500
Adequate+Low	93	52,0	12	6,7	105	58,7		(0,633-3,553)
Carbohidrate intake								
High	24	13,4	8	4,5	32	17,9	0,045[a]*	2,729
Adequate+Low	131	73,2	16	8,9	147	82,1		(1,052-7,083)
Fiber Intake								
High	98	54,7	19	10,6	117	65,4	0,127[b]	2,210
Adequate+Low	57	31,8	5	2,8	62	34,6		(0,783-6,240)
Fried food frequency								
Often	70	39,1	9	5,0	79	44,1	0,482[b]	0,729
Rarely	85	47,5	15	8,4	100	55,9		(0,301-1,765)
Fried food weight								
High	76	42,5	13	7,3	89	49,7	0,640[b]	1,228
Moderate	79	44,1	11	6,1	90	50,3		(0,519-2,910)
Fat from fried food								
High	75	41,9	14	7,8	89	49,7	0,364[b]	1,493
Low	80	44,7	10	5,6	90	50,3		(0,625-3,566)
Energy from fried food								
High	73	40.8	15	8.4	88	49.2	0.160[b]	1.872
Low	82	45.8	9	5.0	91	50.8		(0.773-4.534)

[a] = Fischer test; [b] = Chi Square test, * = significant if p<0.05.

Majority of subjects did not have family history of dyslipidemia (95%) and smoking status (85.5%), had low and moderate physical activity (82.7%), and non-obese (60.3%). Subjects with high energy intake (>110% RDA) accounted for 20.1% (36 persons), high fat intake at 81% (34 persons), high protein intake at 41.3% (74 persons), high carbohydrate intake at 17.9% (32 persons) and high fibre intake at 65.4% (117 persons). Related to the fried food intake, subject who often consumed fried food (>4x/w) accounted for 44.1% (79 persons), high fried food weight (>85.74 g) accounted for 49.7% (89 persons), high percentage of energy intake from fried food (>11.8%) accounted for 49.2% (88 persons) and high percentage of fat intake from fried food (>23.3%) accounted for 49.2% (88 persons). Based on Chi square and Fischer test, only carbohydrate which had significant association with dyslipidemia.

Analysis of association of risk factors of dyslipidemia (age, sex, ethnic group, education background,

employment status, family history of dyslipidemia, smoking status, physical activity, obesity status) with lipid profile can be seen in Table 4. This study showed sex was significantly associated with TG (p; RP:0.002;0.796), education was significantly associated with LDL (p;RP:0.040;1.969), smoking status was significantly associated withHDL (p;RP:0.013;2.928), and obesity status was significantly associated with TG (p;RP:0.022;2.148). The other risk factors had no significant association with lipid profile.

Table 4: Association of risk factors of dyslipidemia with lipid profile.

Variable	KT		LDL		HDL		TG	
	p	RP	p	RP	P	RP	p	RP
Age	0.933	1.025	0.749	1.107	0.389	0.770	0.492	0.796
Sex	0.167	1.559	0.060	0.538	0.000	0.281	0.002*	0.281
Ethnic group	0.587	0.608	0.734	0.731	0.437	2.027	0.323	0.707
Education	0.761	0.912	0.040*	1.969	0.567	1.190	0.754	0.900
Employment status	0.466	0.794	0.191	1.538	0.177	1.548	0.360	0.730
Family history of dyslipidemia	0.251	0.444	0.480	0.598	0.502	1.701	0.277	2.094
Smoking status	0.287	0.635	0.846	0.917	0.013*	2.928	0.091	2.072
Physical activity	0.105	1.914	0.351	0.662	0.791	0.900	0.215	1.820
Obesity status	0.734	1.110	0.629	1.441	0.092	1.681	0.022*	2.148

KT: total cholesterol; LDL: low density lipoprotein; HDL: high density lipoprotein; TG: triglycerides; RP: prevalence ratio; *p<0.05 significant.

Food and fried food intake with lipid profile

Table 5 represented the association between food and fried food intake with lipid profile. Bivariat analysis was used to test the association between food intake including energy, fat, protein, carbohydrate and fibre intake with each of lipid profile including total cholesterol, LDL, HDL, dan triglycerides. There is no significant association between food intake and lipid profile, except the fiber intake and LDL levels (p=0.002) with RP 0.310. Besides, bivariat analysis was also used to examine the association between fried food intake including frequency of consumption, fried food weight, fried food energy and fat intake with lipid profile. It can be seen that fried food intake was significantly associated with lipid profil. There were significant association of fried food weight and LDL levels (p;RP: 0.034; 0.505) and HDL levels (p; RP: 0.020; 2.036). There is also significant association of fat from fried food and LDL (p; RP: 0.015; 0.455).

Table 5: Association of food and fried food intake with lipid profile.

Variable	KT		LDL		HDL		TG	
	P	RP	P	RP	p	RP	P	RP
Energy	0.912	1.042	0.958	0.979	0.349	0.698	0.915	0.957
Fat	0.525	0.785	0.467	0.751	0.361	1.417	0.329	1.483
Protein	0.867	1.052	0.244	0.688	0.506	1.226	0.098	1.733
Carbohydrate	0.526	0.781	0.309	0.666	0.763	0.887	0.960	0.978
Fibre	0.381	0.758	0.002*	0.310	0.832	1.070	0.246	0.673
Fried food frequency	0.373	1.308	0.758	0.906	0.127	1.591	0.865	0.945
Fried food weight	0.205	0.683	0.034*	0.505	0.020*	2.036	0.906	0.962
Fried food energy	0.416	0.784	0.204	0.667	0.342	1.333	0.759	1.107
Fried food fat	0.205	0.683	0.015*	0.455	0.262	1.404	0.832	1.073

KT: total cholesterol; LDL: low density lipoprotein; HDL: high density lipoprotein; TG: triglycerides; RP: prevalence ratio, *p<0.05 significant.

DISCUSSION

Dyslipidemia is health problem commonly happen in developing countries namely Indonesia. Study related to prevalence of dyslipidemia in Indonesia has not been done adequately, but it shows an increase every year.[3] Dyslipidemia can be a single factor of coroner heart disease.[6]

This study was done in GMC Health Center Yogyakarta which involved 179 subjects. This study showed that 86.6% of total subjects were diagnose with dyslipidemia, 52% total subjects has abnormal cholesterol levels, 67% total subjects has abnormal LDL, 43% total subjects has abnormal HDL and 28.5% total subjects has abnormal triglycerides. A research done by Baryam et al in Turki showed that prevalence of dyslipidemia was at 79.6%.[7]

Lipid distribution is different between sex. This study showed sex was significantly associated with dyslipidemia with the prevalence in men was higher (67%) than in women (33%). Similar to this finding, a study in Shanghai China by Wu et al[8] showed that prevalence of dyslipidemia in men was higher (40.2%) than in women (33.8%). Our study also showed sex was significantly associated with triglycerides levels (p=0.02). The risk increase in line with age, 35-44 year in men and ≥65 year in women. Menopousal women has higher risk od dyslipidemia that pre-menopause as it was correlated to the presence of estrogen hormone pre-menopause women which act as controler of the cholesterol levels in body which protect from asterosklerosis.[9,18]

This study represented education background was significantly associated with LDL levels (p=0.040). Education corresponds to knowledge in food choice and nutrition need fulfilment.[24] There was also significant association between smoking status and HDL levels (p=0.013). Smoking increases metabolic rate and likely to decreases food intake.[21] Smoking may also increase total cholesterol, LDL, triglycerides levels and decrease HDL levels in blood.[18] A study by Lesmana (2008) about smoking habit in association with dislipemia concluded smokers are likely have higher risk to obtain dyslipidemia than non-smoker (OR=2.49) and the association was significant between smoking habit with dyslipidemia incidence in one of hospital inYogyakarta.[25]

Obesity status was significantly associated with trigycerides levels (p=0.022). Similar to this finding, a research by Setiono in 2012 showed a significant association between hypertriglyceridemia with obesity status in hospital patients (p=0.001).[20] Lipid profile abnormality was likely associated with obesity (BMI≥23 kg/m^2)[27]. Several studies showed that high precentages of body fat are likely to have high total cholesterol, LDL, and triglycerides than person with normal nutrition status[23]. Family history of dyslipidemia had no significant association with lipid profile (p≥0.05). Different to this finding, a study by Dibyareswati in 2010 showed a significant association beetween family history of dyslipidemia with incidence of dyslipidemia (p=0.025).[19] However, although primary dyslipidemia can be caused by genetic factor, eating habit especially high-fat food play a bigger role in influencing the cholesterol levels in blood.[18]

Lipid profile had no association with age in this study (p≥0.05). In contrast, a result from one study in South Sumatra in 2010 recorded that age was significantly associated with dyslipidemia incidence in shift employees.[19] A study in the United States recorded cholesterol level in men and women began to increase in age 20 year of as the organ are decreasing in function in line with the increase of age. In 10 year of, fat spot can be found inlumenblood vessel and the density increase in 30 year.[18]

This study also reported physical activity had no association with lipid profile (p≥0.05). By contrast, a study by Lesmana in 2008 recorded a significant relationship between physical activity an dyslipidemia insidence in out-patience of one hospital in Yogyakarta (p=0.023 OR=2.95).[25] Regular sport may lower the total cholesterol, LDL and triglycerides levels and increase HDL level significantly. Regular sport may break triglycerides congeries in lipid cell and release lipid acid and glycerol into blood.[22] Habitual coffee drinking has no relationship with lipid profile in this study (p≥0.05). On the contrary, a research by Yogyantini (2008) in out-patient recorded a significant association between habitual coffee drinking with dyslipidemia (p=0.011).[26] Excessive coffee drinking may stimulate the increase of total cholesteroland LDL level in blood.[28] The other finding on this study is no association between ethnic group with lipid profile (p≥0.05). Ethnic grouph as cultural factor in society which has vital role in eating pattern as it has influence in food choice and the way to process the food. Culture determined the way individuals behaviour and the way individuals fulfil the biological need, including food need.[24] Employment status also has no significant association with lipid profile in this study (p≥0.05). Increase and decrease in income have strong influence in food consumption. The increase in income will raise the opportunity to buy higher quality and quantity of food while if the income decline, the quality and quantity of food to buy will decrease.[24]

Carbohydrate intake was significantly associated with dyslipidemia. This finding was similar with a study done by Ginting which recorded a significant relationship between carbohydrate intake with incidence ofdyslipidemia in lecturers of Universitas Gadjah Mada (p=0.000) with OR=4.902 (95%CI 2.03 – 11.834). It can be concluded that high carbohydrate food is a risk factor of dyslipidemia.

Fried food contains fat at around 4% - 14% of its total weight.[10] Analysis between food and fried food intake with lipid profile in this study showed an association between fiber intake with LDL levels, between fried food weight with LDL levels (p;RP:0.034;0.505) and HDL levels (p; RP: 0.020; 2.036), and between fried food fat with LDL (p;RP:0.015;0.455).Frying food may increase trans fatty acid contain.[11,12] Transfatty acid triggers the elevation of cholesterol LDL levels and the decline of HDL levels. Individuals consuming trans fatty acid has higher risk of lipid profile abnormality.[13] Every 1% increase of trans fatty acid may elevate 0.04 mmol/L

LDL and increase 0.013 mmol/L HDL.[14] While, a study dne by Garshick[15] reported that 1% per year decrease of trans fatty acid was significantly associated with decrease of LDL levels at 27 nmol/L. Similar with this finding one study showed a significant relationship between fat intake with LDL levels (p=0.030); thus, higher consumption of fat may trigger the increase of LDL levels [16]. Other finding also reported that individuals with high fat intake has 2.85 higher risk to have hyperlipidemia than moderate intake.[17]

Limitations

This study has several limitations. Firstly, the total sample is too small which may weaken the finding to be generalized. Secondly, SQFFQ which was used to reported food and fried food intake was highly depended to the memory of the subjects. It is also depended in subjects' understanding and ability to estimate the food weight. Therefore, there might be underreporting probability and error in determining the food portion.

CONCLUSION

Carbohidrate intake was significantly associated with dyslipidemia. Fiber intake and fried food fat intake had significant association with LDL levels. Fried food weight was significantly associated with LDL and HDL levels. Some action are needed to control the incidence of dyslipidemia so that the increase of the dyslipidemia prevalencein Indonesia, especially employee of UGM can be prevented.

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