Original Research Article

The relationship between fried food consumption and physical activity with diabetes mellitus in Yogyakarta, Indonesia

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ABSTRACT

Background: Diabetes mellitus (DM) is one of degenerative disease and the prevalence is increasing each year. WHO predicted that in 2025 the number of diabetes mellitus outpatients in the world can reach up to 300 milions people. Early detection is needed to prevent higher prevalence in type 2 DM. Moreover, nowadays people are tend to have sedentary lifestyle and bad food pattern. The Objective of this research aims to determine risk factors which related the evidence of type 2 DM.

Methods: It was an observational study with cross sectional design. Subjects were 179 people of the study were staffs of Gadjah Mada University who did general check-up at Gadjah Mada Medical Center (GMC) health cencer on March and April 2014. Research variable included diabetic family history, ethnic, physical activity, habit of smoking history, obese, eating pattern, fried foods consumption and diabetes. Data of eating pattern and fried foods consumption are obtained by semi quantitative food frequency questionnaire (SQFFQ). Data about diabetic family history, ethnic, habit of smoking are obtained by interview. Data about physical activity is obtained by IPAQ questionnaire and data about obese an fasting blood glucose value are obtained by secondary data from GMC health center. Data were analyzed using chi square.

Results: There was significant association between diabetic family history, fried food's consumption frequency and the incidence of type 2 diabetes mellitus (p<0.05). There was no significant association between ethnic, physical activity, habit of smoking, obese, eating pattern, fried food consumption (fried foods mass, fried foods energy and fried foods fat) (p>0.05).

Conclusions: Risk factors related with type 2 DM evidence are diabetic family history and fried food's consumption frequency.

Keywords: Diabetes mellitus, Fried food consumption, Physical activity

INTRODUCTION

Degenerative disease is an epidemiologist transition from infectious diseases which dominated in some developing countries, including Indonesia. Type 2 diabetes mellitus (DM) is one of the disease with increasing prevalence year by year. WHO predicted there are 300 million people with type 2 diabetes mellitus in 2025.

Health basic survey of Indonesia in 2013 showed that highest diabetes cases is in Yogyakarta (2.6%).[1] According to GadjahMada Medical Center (GMC), when diagnosed Universitas Gadjah Mada staffs, there are signs

and symptoms related to metabolic disorder, such as hypercholesterolemia, cardiovascular disease risk factor, and also type 2 DM.

The risk factor of type 2 DM related to the society's preference about fast food containing high fat and protein with low complex carbohydrate, especially fiber.[2] Moreover, obesity has greater risk up to 5.5 times to get type 2 DM than normal people.[3] People with central obesity has tendency to get type 2 DM 3.9 times greater than normal people. Family history of type 2 DM also has relationship with type 2 DM as much as 5.5 times greater. Moreover, race or ethnic and physical activity also contribute to type 2 DM prevalence.[4-6]

This study aims to observe the risk factors of type 2 DM. This finding would be an alternative intervention to prevent more patients of type 2 DM. Moreover, this finding can prevent the complication risk factors from type 2 DM.

METHODS

This is an observational cross sectional study. Research happened in GadjahMada Medical Center (GMC), Yogyakarta in March and April 2014. The study population is UGM staffs registered as member in GMC. The inclusion criteria are: UGM staffs regularly have medical checked up there, well communicated and has good memory, tend to be observed and interviewed, and also signed the inform consent. There are 179 persons as sample.

Data were collected and classified as: respondent identity, diagnosed has type 2 DM, race, smoking habit which collected by interview, physical activity collected with IPAQ, BMI, and also fasting blood glucose got from secondary data of GMC data, and food pattern, fried food consumption collected with *semi quantitative frequency quesionnaire* (SQFFQ).

Sample categorized based on family history. It is divided into "yes group" who have minimal 1 family member with type 2 DM and "no group" if there is none. Race is divided into 2, Javanese and non-Javanese. Physical activity divided into 3 groups, high, moderate, and light based on IPAG category.[7] Smoking habit divided into 2 groups, not smoking, and smoking more than 1 cigarette per day. Category of obesity is someone with BMI ≥ 25 kg/m^{2}.[8] Type 2 DM diagnosed by fasting blood glucose as much as ≥ 126mg/dl.[9] Food pattern were categorized into 3 groups, high (>110% Indonesian recommended dietary intake (AKG)), well (90-110% AKG), and also low (<90% AKG). Fried food consumption were asked about consumption frequency, amount, energy and fat value of the food. Consumption frequency was categorized into 2 groups, frequent (≥4x/week) and rare (<4x/week). Amount, energy, and fat value were divided into high (>mean/ median) and low (<mean/median).

Mean value used if data was normally distributed. Median value used if it is not. Data were analyzed with chi square test.

RESULTS

Sample's characteristic: Based on Table 1, more than half of the sample was 40-50 years old (50.8%), male (67%), had high education level (57%), and never been diagnosed type 2 DM (91.1%).

Table 1: Basic characteristic of sample in GMC.

Characteristic	Frequency n=179	Percentage (%)
Age group (years)		
40-50	91	50.8
≥50	88	49.2
Sex		
Male	120	67.0
Female	59	33.0
Education level		
High	102	57.0
Moderate	72	40.2
Low	5	2.8
Diagnosed type 2 DM		
Yes	16	8.9
No	163	91.1

High education level: finished university; Moderate education level: finished high school; Low education level: finished junior high school, elementary school.

Chi square table result was shown in Table 2. There was significant result according to age group and type 2 DM accident (p>0.05), with RP = 0.197 (CI 95%: 0.054-0.716). Significant result also shown from education level with type 2 DM (*p*<0.05) with RP=5.955 (CI 95%: 1.314-27.095). In addition, occupation as lecturer also has a relationship with type 2 DM accident (*p*<0.05) with RP=3.17 (CI 95%: 1.117-9.016). On the other hand, there was no significant result between sex and type 2 DM accident (*p*>0.05) with RP=1.475 (CI 95%: 0.471-4.958).

Risk factor of type 2 DM accident: The risk factors were shown in Table 3. Most of the subjects don't have type 2 DM in their family history (84.9%), ethnically Javanese (97.2%), never been smoked (85.5%), moderate physical activity (50.3%), non-obese (60.3%), low energy intake (70.9%), low fat intake (73.2), low intake protein (48%), low carbohydrate intake (71.5%), high fiber intake (63.7%), rarely eat fried food (55.9%), small amount of consumed fried food (50.3%), and also low fat proportion from consumed fried food (50.3).

Table 4 showed that there is a significant relationship between heredity factors and type 2 DM accident (*p*>0.05) with RP=0.132 (CI 95%: 0.044-0.393). In addition, there is also a significant relationship between frequency of consuming fried food with type 2 DM accident (*p*<0.05) with RP=0,325 (CI 95%: 0.108-0.979).

In contrast, there is no significant relationship among ethnic, smoking habit, physical activity, obese, energy intake, fat intake, protein intake, carbohydrate intake, fiber intake, amount of the fried food, energy from fried food, and fat from fried food with type 2 DM accident (p>0.05).

Table 2: Relationship between respondent's characteristic and type 2 DM accident.

| | Diabetes mellitus | | | | Total | | *p* | RP |
| | Yes | | No | | | | | CI (95%) |
	n	%	n	%	n	%		
Age group								
40-50	3	1.7	88	49.2	91	50.8	0.007*	0.197
≥50	13	7.3	75	41.9	88	49.2		(0.054-0.716)
Sex								
Male	12	6.7	108	60.3	120	67.0	0.478	1.475
Female	4	2.2	55	30.7	59	33.0		(0.471-4.958)
Education level								
High	14	7.8	88	49.2	102	57.0	0.010*	5.966
Moderate and low	2	1.1	75	41.9	77	43.0		(1.314-27.095)
Lecturer								
Yes	9	5.0	47	26.3	56	31.3	0.024*	3.173
No	7	3.9	116	64.8	123	68.7		(1.117-9.016)

Table 3: Risk factors of type 2 DM.

Variables		Frequency (n=179)	Percentage (%)
Family history	Yes	27	15.1
	No	152	84.9
Ethnic	Javanese	174	97.2
	Non-javanese	5	2.8
Smoking	Yes	26	14.5
	No	153	85.5
Physical activity	High	31	17.3
	Moderate	90	50.3
	Low	58	32.4
Obese	Yes	71	39.7
	No	108	60.3
Energy intake	High	19	10.6
	Adequate	33	18.4
	Low	127	70.9
Fat intake	High	24	13.4
	Adequate	24	13.4
	Low	131	73.2
Protein intake	High	52	29.1
	Adequate	41	22.9
	Low	86	48.0
Carbohydrate intake	High	17	9.5
	Adequate	34	19.0
	Low	128	71.5
Fiber intake	High	114	63.7
	Adequate	5	2.8
	Low	60	33.5
Frequency consume fried food	Frequent	79	44.1
	Rare	100	55.9
Amount of fried food	High	89	49.7
	Low	90	50.3
Fried food's amount of energy	High	88	49.2
	Low	91	50.8
Fried food's amount of fat	High	89	49.7
	Low	90	50.3

Table 4: The relationship of risk factors with type 2 DM accident.

	Diabetes mellitus				Total		p	RP Cl (95%)
	Yes		No					
	n	%	n	%	n	%		
Family history								
Yes	8	4.5	19	10.6	27	15.1	0.001*	0.132
No	8	4.5	144	80.4	152	84.9		(0.044-0.393)
Ethnic								
Javanese	16	8.9	158	88.3	174	97.2	0.623	0.908
Non-Javanese	0	0	5	4.6	5	2.8		(0.866-0.952)
Smoking habit								
Yes	1	0.6	25	14.0	26	14.5	0.289	2.717
No	15	8.4	138	77.1	153	85.5		(0.343-21.504)
Physical activity								
High	3	1.7	28	15.6	31	17.3	0.549	1.113
Moderate+low	13	7.3	135	75.4	148	82.7		(0.297-4.164)
Obese								
Yes	9	5.0	62	98.3	71	39.7	0.155	0.477
No	7	3.9	101	56.4	108	60.3		(0.169-1.347)
Energy intake								
High	1	0.6	18	10.1	19	10.6	0.472	0.537
Adequate+low	15	8.9	145	81.0	160	89.4		(0.067-4.310)
Fat intake								
High	1	0.6	23	12.8	24	13.4	0.335	0.406
Adequate+low	15	8.9	140	78.2	155	86.6		(0.051-3.221)
protein intake								
High	5	2.8	47	26.3	52	29.1	0.520	1.122
Adequate+low	11	6.1	116	64.8	127	70.9		(0.370-3.405)
carbohydrate intake								
High	2	1.1	15	8.4	17	9.5	0.464	1.410
Adequate+low	14	7.8	148	82.7	162	90.5		(0.292-6.802)
Asupan Serat								
Tinggi	12	6.7	102	57.0	114	63.7	0.242	1.794
Baik+Rendah	4	2.2	61	34.1	65	36.3		(0.554-5.811)
Frequency consume fried food								
Frequent	11	6.1	68	38.0	79	44.1	0.038*	0.325
Rare	5	2.8	95	53.1	100	55.9		(0.108-0.979)
Amount of fried food								
High	7	3.9	82	45.8	89	49.7	0.617	1.302
Low	9	5.0	81	45.3	90	50.3		(0.463-3.662)
Energy from fried food								
High	8	4.5	80	44.7	88	49.2	0.944	0.964
Low	8	4.5	83	46.4	91	50.8		(0.345-2.692)
Fat from fried food								
High	6	3.4	83	46.4	89	49.7	0.306	1.729
Low	10	5.6	80	44.7	90	50.3		(0.600-4.979)

DISCUSSION

The relationship between sample's characteristic with diabetes mellitus

There is a significant result between age group with type 2 DM accident among the subject ($p<0.05$) and the value of RP is 0.197 (CI 95%: 0.054-0.716). Approximately 54.33% of type 2 diabetes has been observed in the age group >40-50 years.[10] It has been known that people above 45 years old are tend to have higher risk of type 2 DM and glucose intolerance. It is caused by degenerative factor that reduce physical ability to metabolite glucose. Though that's not only caused by age but also by their abilities to survive.[11]

There is also a significant relationship between education level and type 2 DM accident ($p<0.05$) where the RP is 5.955 (CI 95%: 1.314-27.095).This result is similar to Yunita's in GMC. She found that education level is significantly related to metabolic syndrome.[12] Education

level is related to people's knowledge leads to their food preference and life style, which affect to degenerative syndrome, such as type 2 DM.

The risk factors of diabetes mellitus

Heredity

Statistic test showed a significant result (*p*<0.05) with RP=0.132 (CI 95%: 0.044-0.393) between heredity and type 2 DM among the subject. Family history has a strong possibility to affect the accident of type 2 DM, the OR is 3.75.[13] From this we can conclude that people came from diabetic family are willing to get this disease 3.75 times greater than others. Research conducted in Sweden found that mutation of hepatocyte nuclear factor (HFN)-1α and (HFN)-4α provoke type 2 DM.[14]

Ethnic

Ethnic is not significantly related to type 2 DM (*p*>0.05) with RP 0.908 (CI 95%: 0.866-0.952). It may be caused by un equal proportion between Javanese respondents and non-Javanese.

Food pattern is composed by human needs and culture called biocultural interfeca.[15] Moreover, another factors affect food pattern are ecology, social environment, technology, and culture it self.[16] Cultural research showed that most of *Minang* people are willing to have spicy and curry food. On the other hand, Javanese people love sweet food. It is not absolute for all the people, but there is similar mind in society about their own food preference.[17]

Smoking habit

The relationship between smoking habit and type 2 DM is not significant (*p*>0.05), RP2.717 (CI 95%: 0.343-21.504). It can be concluded that smoking habit is not the risk factor. Smoking habit is strongly related to type 2 DM (*p*<0.05), OR 2.6.[18] Smoking habit is not the predictor that caused death in people with type 2 DM who also have CVD.[19]

Physical activity

The relationship between physical activity and type 2 DM is not significant (*p*>0.05) with the value of RP is 1.113 (CI 95%: 0.297-4.164). Another study conducted in Riau found that physical activity is not significantly related to glucose blood value (p=0.385).[20] On the other hand, another research found that physical activity is related to type 2 DM (p=0.024 dan OR 2.37).[21] Physical activity can increase blood circulation, reduce body weight, and repair insulin sensitivity, which lead to better glucose blood level.[21] The different result may be caused by the major characteristic of the subject have moderate level of physical activity. Moreover, type 2 DM is caused by a lot of factors, whereas food pattern and physical activity are not the only one.

Obese

Obese is not a significant risk factor of type 2 DM (*p*>0.05), RP=0.477 (CI 95%: 0.169-1.347). Another study found that obesity is related to type 2 DM (*p*<0.05), OR=1.66 (CI 95%: 1.35-2.03).[22] Another study found that 65.5% are centrally obese.[23] Another study also found that obesity is not significantly related to type 2 DM (*p*=0.435).[24]

Overweight people has higher leptin level in body. Leptin is a hormone related to gene that caused obesity. In hipotalamus, leptin regulates lipid level and converts fat into energy. Leptin works in peripheral nervous system and central system. Leptin can inhibit insulin receptorsubstrate-1(IRS). It reduces intake glucose in cell, so the glucose blood level is increased.[25] Fat people is not always have type 2 DM, this study found that obesity is not the key factor of type 2 DM. This disease caused by sedentary lifestyle.[26]

Food pattern

Food pattern with high energy is not significantly related to type 2 DM (*p*>0.05), RP=0.537 (CI 95%: 0.067-4.310).On the other hand, Lasmiati found that energy intake related to type 2 DM (*p*<0.05, OR=4.8 CI 95%: 1.8-12.4).[27] Excess of high energy intake caused insulin resistant. Glucose and free fatty acid in blood are excessive and adipose tissue in body also increase and caused obesity. Central obesity is strongly known related to insulin resistant.[28]

Fat intake also not significantly related to type 2 DM (*p*<0.05, RP=0.406, CI 95%: 0.051-3.221). Juleka in her study said that fat intake affects blood glucose level in people with type 2 DM (*p*<0.05, OR=5.20, CI 95% 1.08-24.89).[29] Excessive fat intake makes more deposit energy storage. Moreover, fat inhibit gene produced mitochondria. It leads to broken metabolism of cell, including in insulin response. In conclusion, people consumed high fat food are tend to have type 2 DM.[30]

Amount of protein consumption also not significantly related to type 2 DM (*p*>0.05, RP=1.122, CI 95%: 0.370-3.405). Another study also has similar result that protein is not the risk factor of type 2 DM (*p*>0.05, CI 95%: 1.0-6.2).[27] Carbohydrate consumption also not significantly related to type 2 DM (*p*>0.05, RP=1.41, CI 95%: 0.292-6.802). On the other hand, a study found that type 2 DM is related to carbohydrate intake (*p*<0.05, OR=4.67, CI 95%: 1.35-16.19).[30] Reducing carbohydrate consumption can increase insulin sensitivity in healthy people, which leads to lower glucose blood in diabetic people.[28]

Fiber consumption has no significant relationship with type 2 DM (*p*>0.05, RP=1.794, CI 95%: 0.554-5.811). In

contrast, a study found that fiber intake is strongly related to type 2 DM.[28] Higher fiber intake leads to slower digestive speed from gastric to intestine. It inhibit fast increasing in post-prandial blood glucose.[29]

Some results are different with the previous study and theories. It may be caused by the characteristic of the subject. Most of them have low energy, carbohydrate, protein, and fiber intake. Moreover, there isn't any robust different between healthy people's intake and diabetic people's.

Konsumsi gorengan

Fried food consumption is significantly related to type 2 DM ($p<0.05$, RP=0.325, CI 95%: 0.108-0.979). The amount of the fried food ($p>0.05$, RP=1.302, CI 95%: 0.463-3.662) and the amount of energy in fried food are not relevant with type 2 DM accident ($p>0.05$, RP=1.729, CI 95%: 0.600-4.979). Fried food is a high fat food. People with type 2 DM are tend to get heart and vascular disease. This is the strong reason why fat and cholesterol should be consume in a small portion.[31]

CONCLUSION

Heredity and the frequency of fried food consumption are the two risk factors of type 2 DM. We wish that people nowadays have better food preference and avoid trans and saturated fat. For further study, the relationship among low sugar food, low GI food, soluble fiber and reducing in glucose blood level should be conducted.

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