

Low fiber intake increase risk of Diabetes mellitus in overweight people

Yurista Permanasari, Rika Rachmawati

National Institute of Health Research and Development, Indonesian Ministry of Health

Abstrak

Latar belakang: Pola makan yang tidak seimbang dan rendah serat merupakan salah satu penyebab timbulnya Diabetes mellitus (DM). Tujuan dari penelitian ini adalah menganalisis konsumsi serat terhadap penyakit DM pada orang dengan kelebihan berat badan di Indonesia.

Metode: Data untuk analisis ini ialah sebagian data Riset Kesehatan Dasar (Riskesdas) 2007. Subjek yang dipakai ialah yang diperiksa laboratorium dan dipilih yang mempunyai kelebihan berat badan ($IMT \geq 23$) dan berumur ≥ 15 tahun. Kriteria DM berdasarkan Perkumpulan Endokrinologi Indonesia (Perkeni) tahun 2006: Non DM = < 200 mg/dl; DM = ≥ 200 mg/dl.

Hasil: Dari 7,807 subjek yang diperiksa laboratorium, terdapat 2.550 subjek dengan kelebihan berat badan yang berumur ≥ 15 tahun. Selanjutnya, 201 subjek (7,9%) berpenyakit DM dan 2.349 (92,1%) tidak berpenyakit DM. Subjek dengan konsumsi kurang serat dibanding yang cukup serat berisiko DM sebanyak 2 kali [rasio odds suaian (OR)=2,02; 95% interval kepercayaan (CI)=1,00-4,08]. Risiko DM semakin naik dengan pertambahan umur. Bila dibandingkan dengan kelompok umur 15-39 tahun, kelompok umur 40-55 memiliki risiko DM sebesar 2,4 kali (OR)=2,42; 95% (CI)=1,66-3,51), dan yang berumur ≥ 56 tahun memiliki risiko DM sebesar 4,9 kali (OR)=4,88; 95% CI=3,18-7,49). Selanjutnya subjek yang hipertensi 57% lebih banyak berisiko DM dibandingkan yang tidak hipertensi (OR=1,57; 95% CI=1,15-2,16). Perokok tiap hari dibandingkan dengan yang tidak/kadang-kadang/pernah merokok memiliki risiko 40% lebih rendah untuk DM (OR=0.60; 95% CI=0.4-0.91).

Kesimpulan: Kurang konsumsi serat, semakin tua umur, dan hipertensi meningkatkan risiko penyakit DM di antara subjek kelebihan berat badan. (*Health Science Indones 2011;2:28-33*)

Kata kunci: kelebihan berat badan, diabetes melitus, umur, serat, hipertensi

Abstract

Background: A diet with unbalanced foods and low in fiber among others are the causes of Diabetes mellitus (DM). The purpose of this paper was to assess the risk of low fiber intake and several other factors on DM in overweight people in Indonesia.

Methods: As part of Riskesdas 2007 data, we assessed and were overweight [body mass index (BMI) ≥ 23] and aged ≥ 15 years old among subjects who had laboratory test. They were divided into 2 groups based on reference value of the Indonesian Endocrinology Associations (Perkeni) in 2006: Non DM = < 200 mg/dl; DM = ≥ 200 mg/dl,

Results: Out of 7,807 who underwent laboratory for glucose tests, 2,550 subjects were overweight and aged 15 years or over. Furthermore, 201 (7,9%) had DM dan 2.349 (92,1%) did not have DM. Compared to those with sufficient fiber intake, those with low fiber intake had a 2-fold risk for DM (adjusted odds ratio (ORa)=2.02; 95% confidence interval (CI)=1.00-4.08).

Risk of DM increased along with increased of age. Compared to those in the 15-39 years age group, those in the ≥ 56 years age group had a 4.9-fold risk for DM (ORa=4.88; 95% CI=3.18-7.49), whereas the 40-55 age group had a 2.4-fold risk for DM (ORa=2.42, 95% CI=1.66-3.51). In term of hypertension, those with hypertension had 57% more for DM (OR=1.57, 95% CI=1.15-2.16). Compared with those with no/sometimes/never smoking, daily smokers had a 40% less risk for DM (ORa=0.60, 95% CI=0.4-0.91).

Conclusion: In overweight people, low fiber intake, older age, and hypertension may increase the risk of DM. (*Health Science Indones 2011;2:28-33*)

Key words: diabetes mellitus, age, fiber intake, hypertension

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Diabetes mellitus (DM), usually appears as type 2 diabetes, is still a major problem in Indonesia. If left unchecked, this disease will lead to other diseases such as heart, kidney, and blindness. According to WHO survey in 2005, Indonesia is currently ranked world's number 4, with a prevalence DM of 8.6% of the total population.¹

This was reaffirmed by the results of *Riskesdas* (2007) which stated that the prevalence of DM in urban population aged 15 years and above in Indonesia was 5.7%.²

Steyn NP stated that the people who have a high Body Mass Index (BMI) have a much higher risk of developing type-2 at an earlier age than those with lower BMI.³ The National Health Survey analysis showed that overweight proved to significantly affect the DM incidence.⁴ However, not all with overweight have DM. Many factors influence the occurrence of diabetes in overweight people.

Some risk factors of DM are not modifiable, such as age, genetic, and gender, and others can be controlled/modified such as unhealthy lifestyles with low fiber diet, less physical activity, and smoking. A diet with unbalanced foods and low in fiber is one of the causes of DM. Strong evidence, as that presented in the FAO/WHO workshop in 2004 about the importance of fruits and vegetables to health, indicate that fruits and vegetables intake have a potential role in lowering risk of type-2 DM.⁵

The purpose of this assessment was to identify the risk of low fiber intake and other factors for DM in overweight people in Indonesia.

METHODS

This assessment used a part data of Basic Health Research (*Riskesdas*) in Indonesia in 2007. *Riskesdas* was a survey conducted in 33 provinces in Indonesia. The samples was identical to the two-stage sampling used in the National Health Survey (*Susenas*) 2007, which was followed by determining household samples by simple random sampling, where all household members in the selected households was to be interviewed and measured. Samples for biomedical parameters were household

members over 1 year old living in census blocks with urban classification.

The data collected in *Riskesdas* included disease, risk factors, measurements and physical examinations, as well as biomedical parameters.

The total sample included by the inclusion criteria was 7,807. Subjects who had missing values and outliers were removed. Variables measured were weight and height, and overweight those who had body mass index (BMI) ≥ 23 based on the criteria of Western Region of WHO Pacific (WPRO) in 2000.⁶

Blood sugar levels, total blood cholesterol, blood pressure, economic status, education, employment, fiber intake, physical activity, and smoking. From the results 2550 samples were obtained.

From the entire selected sample, further selection was based on the inclusion criteria, aged ≥ 15 years and overweight.

The outcome in this analysis was blood sugar levels, which was categorized into DM and non DM based on reference value of the Indonesian Endocrinology Associations (*Perkeni*) in 2006: Non DM= <200 mg/dl; DM= ≥ 200 mg/dl.⁷

Blood sugar levels were obtained from the results in hospitals or medical laboratories. Blood glucose was taken after fasting 10-14 hours, they were then given an oral glucose load of 75 grams (300 calories), except for patients who had history of DM (confirmed by the physician coordinator of the laboratory team). Venous blood of 15 cc was taken after 2 hours of loading.

Several risk factors, among others, were demographic characteristics, lifestyles, blood pressure, and cholesterol levels. Demographic characteristics consisted of age, gender, economic status, education, and employment. Ages were grouped into 3 categories: 15-39 years, 40-55 years, ≥ 56 years; economic status into 2 categories: low (quintile 1 - quintile 2) and high (3-quintile quintile 5); education into 2 categories, low (\leq junior high school) and high

(> junior high school); work classified into 3 categories: does not work which were those with no work, in school, or housewives; fixed income such as military and police, civil servants, state-owned, private employees; no-fixed income that is self-employed traders, services, farmers, fishermen, laborers, others.

Life styles variable consisted of the intake of fiber from fruits and vegetables, physical activity, and smoking which were collected by those conducting the interviews using structured questionnaires. Card displays were used to standardize perception at the time of the interview regarding the classification of physical activity and the portion of fiber intake.

Intake of fiber was grouped into: adequate fiber intake where composite indicator of the portion and frequency of intake of fruits and vegetables was ≥ 5 servings / day and 7 days a week, and low fiber intake with a composite indicator of the portion and frequency of intake of fruits and vegetables of < 5 servings/day and < 7 days within a week. These groupings based on information about frequency and portion intake of fruit and vegetable intake and measure the number of days per week and average servings per day.

Physical activity habits in the last week were asked and then grouped into 2 groups: adequate or inadequate. Adequate physical activity have to be done continuously for at least 10 minutes in 1 type of activity without stopping, for an accumulation of 150 minutes for 5 days in 1 week. In addition, information on the intensity of activity was gathered by the number of days doing heavy, medium, or just walking. The calculation of the number of minutes and the type of physical activity undertaken were weighted, where strenuous activity were weighted four times, medium activity was two, and light activity or a leisurely stroll one.

Smoking habits was grouped into 2: No smoking at all or occasionally in the last one month; smoking every day in the last one month.

Blood pressure (BP) was measured by a validated instrument digital sphygmomanometer standardized with mercury sphygmomanometer.

BP measurements were carried out at least 2 times, and if the results of these two measurements differed by more than 10 mmHg compared to the first measurement, the third measurement taken. Two measurements with the smallest difference were taken and averaged as BP measurements.

Blood pressure was grouped into 2 categories: no hypertension (systole < 140 mmHg or diastolic < 90 mm Hg); hypertension (systole ≥ 140 mm Hg or diastolic ≥ 90 mm Hg).

Blood cholesterol levels were obtained from total cholesterol, and divided into 2 categories: normal (cholesterol < 200 mg/dl), and hypercholesterolemia (cholesterol ≥ 200 mg/dl).

Logistic regression analysis using the Stata 9 program was used to test the relationship and magnitude of risk of DM. This study has received ethical approval from the Ethics Committee for Health Research, Health Research and Development Agency, Ministry of Health Republic of Indonesia.

RESULTS

Out of 7,807 who underwent for glucose tests, 2,550 subjects were overweight and aged 15 years or over. Furthermore, 201 (7,9%) had DM and 2,349 (92,1%) did not have DM.

There were 61.6% women and the rest men. Based on age groups, 46.2% was under the age of 40 years, 40.4% in the 40-55 age group, and 13.4% in the more than 56 age group. For economic status, more than half (67.5%) were at the upper secondary level and the rest are in the low economic status. As many as 59.3% had low education, and 40.7% of have high education. Percentages between groups that was not working (41.1%) and no fixed income (40.8%) were almost equal, whereas fixed-income group was 18.3%.

Table 1 show that who had or did not have DM similarly distributed with respect to gender, fixed income, and physical activity. However, compared with their references groups those who had high education, upper secondary income, and hypercholesterolemia were more

likely to be DM. On the other hand, those who did not have fixed were less likely to be DM.

Table 1. Several demographic, life styles, blood tests characteristics and risk of Diabetes mellitus in overweight people

	Diabetes Mellitus				Crude odds ratio	95% confidence interval	P
	No (n=2,349)		Yes (n=201)				
	n	%	n	%			
Gender							
Male	905	38.5	74	36.8	1.00	Reference	
Female	1,444	61.5	127	63.2	1.08	0.80-1.45	0.632
Economic Status							
Low	776	33.0	54	26.9	1.00	Reference	
Upper secondary	1,573	67.0	147	73.1	1.34	0.97-1.86	0.074
Education							
Low	1,377	58.6	136	67.7	1.00	Reference	
High	972	41.4	65	32.3	0.68	0.50-0.92	0.013
Job							
Not working	953	40.6	95	47.3	1.00	Reference	
Fixed income	428	18.2	35	17.4	0.82	0.55-1.22	0.337
No fixed income	968	41.2	71	35.3	0.74	0.53-1.01	0.060
Physical activity							
Adequate	1,144	48.7	90	44.8	1.00	Reference	
Low	1,205	51.3	111	55.2	1.17	0.88-1.56	0.286
Smoking habit							
No/sometimes/never	1,857	79.0	173	86.1	1.00	Reference	
Every day	492	21.0	28	13.9	0.61	0.40-0.92	0.019
Cholesterol levels							
Normal	1,310	55.8	93	46.3	1.00	Reference	
Hypercholesterolemia	1,039	44.2	108	53.7	1.46	1.10-1.95	0.010

Table 2 as our final model shows risk of DM was dominantly related to fiber intake, age group, blood pressure, and smoking habits. Compared to those with sufficient fiber intake, those with low fiber intake had a 2-fold risk for DM. Risk of DM increased along with increased of age. Compared to those in the 15-

39 years age group, those in the ≥ 56 years age group had a 4.9-fold risk for DM, whereas the 40-55 age group had a 2.4-fold risk for DM. In term of hypertension, those with hypertension had 57% more for DM. In addition, compared with those with no/sometimes/never smoking, daily smokers had a less 40% risk for DM.

Table 2. The relationship between age, fiber, blood pressure, smoking, and the risk of Diabetes mellitus in overweight people

	Diabetes mellitus				Crude odds ratio	95% confidence interval	P
	No (n=2,349)		Yes (n=201)				
	n	%	n	%			
Fiber intake							
Adequate	193	8.2	9	4.5	1.00	Reference	
Low	2,156	91.8	192	95.5	2.02	1.01-4.05	0.046
Age group							
15-39 years	1,135	48.3	44	21.9	1.00	Reference	
40-55 years	935	39.8	94	46.8	2.42	1.66-3.51	0.000
56 years or more	279	11.8	63	31.3	4.88	3.19-7.47	0.000
Blood pressure							
No hypertension	1,324	56.4	74	36.8	1.00	Reference	
Hypertension	1,025	43.6	127	63.2	1.57	1.15-2.16	0.005
Smoke							
No/sometimes/never	1,857	79.0	173	86.1	1.00	Reference	
Every day	492	21.0	28	13.9	0.60	0.40-0.91	0.017

*Adjusted for economic status, education, employment, cholesterol not associated with diabetes mellitus

DISCUSSION

We have limitation in these findings, among others, genetic and alcohol intakes were not available, since this assessment based on a big size study in all thirty three provinces in Indonesia.

Perkeni noted that the risk of DM increased with age, and the peak started in age of 45 years.⁷ Another study in Japan in men and women indicates an increased risk of DM at the age of 40-59 years and 60-79 years.⁸ Our finding shows similar figure that the risk of DM increased with age. In addition, we noted that the risk of DM shifted to younger age group (age 40 years). Therefore preventive effort must be initiated earlier before age of 40 years.

Our findings revealed that low fiber intake increased DM risk. It is in accordance with a study in the United States which noted that a high intake of dietary fiber of 25 grams/day can improve blood sugar control, reduce the excessive increase of insulin in the blood and lower blood fat levels. Various studies until

2002 shown that the fiber can improve blood glucose response and insulin index.⁹ The need for dietary fiber in the digestive tract is to reduce glucose absorption resulting in a decline and slowing carbohydrate absorption in the intestines.¹⁰

Chandalia et al. found that increasing dietary intake of total fiber, which consists mainly from soluble fiber, significantly improve blood glucose control and decrease the level of hyperinsulinemia in patients with type-2 diabetes.¹¹ One major source of soluble fiber are fruits and vegetables. The National Consensus for Management of Dyslipidemia in DM (1995) stated that increasing the intake of vegetables and fruits as a source of fiber can reduce fat absorption in the small intestine.¹²

Our assessment also noted that hypertension increased DM risk. Previous epidemiologic studies have also shown that hypertension is a risk factor for the development of DM in Japan and other populations. Hypertension has been recognized as a diagnostic factor for metabolic

syndrome. This pathophysiology of this syndrome is based on high insulin resistance and precedes type-2 DM and atherosclerotic disease.⁸

Our finding was also noted that those who had habit smoking every day than no or never smoking appeared to be less (40%) to be DM risk. Our finding for smoking produced an inverted risk compared to results of other studies. The most likely explanation of our finding due to health people effect. Those who had better health condition most likely may afford smoking. The other explanation is every day smoking habit was asked during the last one month only. This information may mislead our result on smoking habit.

In conclusion, risk of DM increased along with increased of age, insufficient fiber intake and hypertension in overweight people. On the other hand, our finding for smoking produced an inverted risk compared to results of other studies. Therefore, overweight people is suggested having adequate fiber intake to lower the DM risk, and further studies needed to verify or inverted finding on smoking.

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