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Research Article

Fiber, Coffee, Cigarette and Gestational Diabetes Mellitus in Makassar Indonesia

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Abstract

Background and Objective: Prevalence of gestational diabetes mellitus has increased globally 10-100% for each ethnic or race in the past 20 years and the number of women with diabetes is predicted to rise to 222 million in 2030 from only 143 million in 2010. The study aimed to investigate the risk of fiber, coffee consumption and cigarette smoke exposure on the incidence of the prediabetes and Gestational Diabetes Mellitus (GDM) in Makassar from January, 2012 to December, 2014. The study was conducted in Rskdia Pertiwi of Makassar city. **Methodology:** The study used observational analytic with retrospective design. Samples were as many as 135 respondent consisting of 45 cases (undergoing GDM) and 90 control group (not undergoing GDM). The data were analyzed using the Odds Ratio (OR) test and multivariate analysis with the multiple logistic regression method. **Result:** The study result indicates that the prediabetes and GDM risk increases by the existence of less fiber consumption history (OR = 2.355, 95% CI: 1.12-4.94) and less coffee consumption history (OR = 2.406, 95% CI: 1.10-5.25). There is no difference of the risk of the giving birth women to undergo the prediabetes and GDM between the giving birth women who have the high smoking exposure history and the low smoking exposure history (OR = 1.902, 95% CI: 0.81-4.47). **Conclusion:** Fiber and coffee consumption history affect the incidence of the prediabetes and GDM incidence with probability 96%. Therefore, it is important to control dietary consumption in pregnant women.

Key words: Prediabetic, dietary, tobacco, coffee, history

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Gestational Diabetes Mellitus (GDM) was defined as a temporary condition (transient) that affect the clinical state of the fetus. There is physiological changing happened during pregnancy and affected carbohydrate metabolism. This physiological changing occur due to placental hormones, which is resistant to insulin and make pregnancy becomes a diabetogenic condition. Increased of gestational age and presence of various factors can disturb the balance of carbohydrate metabolism, result in impaired of glucose tolerance.

Data shows the prevalence of gestational diabetes mellitus increased globally about 10-100% at every race or ethnic during the last 20 years¹. The increasing prevalence of diabetes mostly occurred in countries with low or moderate income. The number of women with diabetes was predicted to rise to 222 million in 2030 from only 143 million² in 2010. The incidence of gestational diabetes in Indonesia ranged from 1.9-3.6%³. The incidence of diabetes in pregnancy is 0.7% but it is often difficult to find because of the low capability of case detection⁴.

Suspected risk factors for gestational diabetes mellitus is lifestyle. Many study result prove that the incidence of diabetes related to person's lifestyle. Dietary consumption and physical activity is known as factors related to the incidence of DM. Ding *et al.*⁵, found that coffee consumption is associated with risk of type 2 diabetes associated with a dose response. Consumption of sugar and fiber are also associated with the incidence of diabetes. Study by Ventura *et al.*⁶ in latin women who are overweight found that reducing sugar intake and increasing fiber intake can lower the risk of type 2 diabetes.

Smoking is also suspected of being a risk factor for diabetes. Smoking increases the risk of developing diabetes and worsen the micro and macro vascular complications of diabetes. Smoking was also associated with insulin resistance, inflammation and dyslipidemia⁷.

There is still less research on gestational diabetes mellitus in Indonesia. However, from a variety of epidemiological studies, trends of diabetes incidence to increase may reflect the prevalence of gestational diabetes mellitus is also increase, then it is possible the effects of gestational diabetes on maternal, fetal and neonatal will also increase.

Several studies have shown that the incidence of diabetes correlated with a history of gestational diabetes mellitus⁸. This study aimed to determine the risk of fiber consumption, coffee and cigarette smoke exposure on the incidence of

prediabetes and Gestational Diabetes Mellitus (GDM) in Makassar from January, 2012 to December, 2014.

MATERIALS AND METHODS

Subject: This study was conducted at the Mother and Child Hospital (Rskdia) Pertiwi Makassar. The location selected because of pregnancy examinations in Makassar is generally performed at a maternity hospital.

Study design: This type of study is observational analytic with retrospective design.

Population and sample: The population in this study were all mothers giving birth in Rskdia Pertiwi Makassar from January, 2012 to December, 2014. Samples consist of the case and the control group. The case group consisted of pregnant women with prediabetes or gestational diabetes mellitus. The control group is pregnant women not undergoing prediabetes or gestational diabetes mellitus. Case group selected by purposive method that is the case with all cases that qualify as samples included in the study. Control group selected by simple random sampling method.

Statistical analysis: Data collected from medical record of Rskdia Pertiwi Makassar from January, 2012 to December, 2014. In addition, it also conducted primary data collection for history of dietary consumption and cigarette smoke exposure. Primary data was collected through interview to respondent. Data analysis was performed using SPSS 18.00 for windows. The risk is measured by analysis of Odds Ratio (OR) and logistic regression analysis with backward logistic regression method to determine the probability of the incidence of prediabetes and gestational diabetes mellitus based on independent variables studied.

RESULTS

The distribution of respondents by age, there are more cases in the age group >30 years which amounted to 55.6%. In the control group, the largest age group is 20-30 years which amounted to 51.1%. The proportion of respondents based parity in this study are mostly with parity 2-3 times (44.4%). This parity is the dominant group in the case group, as well as in the control group (Table 1).

Distribution of respondent dominated by Makassar (51.1%) and Buginese ethnic group (39.3%). The majority of respondents in this study were housewife (65.2%) consist of 53.3% in the case group and 71.1% in the control group.

The percentage of respondents in the case group was the education diploma/bachelor and the control group is with senior high school education/equivalent (Table 1).

In case group, the proportion of respondents who have a history of lack fiber consumption 48.9% higher compared with 28.9% in the control group (Table 2). Results of bivariate analysis showed that women with less fiber consumption history have an opportunity risk of developing prediabetes and gestational diabetes mellitus 2 times greater

than women with good consumption of fiber ($p = 0.022 > 0.05$, OR = 2.355, 95% CI: 1.12-4.94).

The percentage of respondents who have a history of lack coffee consumption is greater in the case group which amounted to 73.3% compared with 53.3% in the control group. Respondents who had less coffee consumption before pregnancy and in early pregnancy have risk 2 times greater to have prediabetes or gestational diabetes mellitus compared with women who had plenty consumption of coffee (Table 2).

Respondents who had a history of high risk cigarette smoke exposure in the case group 80.0 and 67.8% in the control group. This showed that the proportion of respondents who have a history of high risk cigarette smoke exposure who have prediabetes and gestational diabetes mellitus is greater than the low risk respondents. Results of bivariate analysis showed that the independent variable was a risk factor but not significant ($p = 0.137 > 0.05$) (Table 2).

Moderator variables in this study consisted of parity, weight gain during pregnancy, family history of DM, stillbirth history, history of giving birth macrosomia, history of polihidramnion and history of delivery with treatment. Variable moderator that statistically significant with the incidence of prediabetes and gestational diabetes mellitus are family history of DM, history of giving birth macrosomia and history of delivery with treatment (Table 3).

Results of multiple logistic regression showed that the influence of coffee consumption higher than consumption of fiber. The most influential factor for the incidence of prediabetes and gestational diabetes mellitus is a history of delivery with the treatment. Probability of prediabetes and gestational diabetes mellitus in the mother who delivered at Rskdia Pertiwi Makassar and have a family history of diabetes, history of delivery with the treatment in previous pregnancy, less fiber and coffee consumption history amounted to 96% (Table 4).

Table 1: Distribution of respondent characteristics

Variables	Research groups					
	Case		Control		Total	
	n	%	n	%	n	%
Age group						
<2 years	0	0.0	3	3.3	3	2.2
20-30 years	20	44.4	46	51.1	66	48.9
>30 years	25	55.6	41	45.6	66	48.9
Parity						
≤1 times	15	33.3	31	34.4	46	34.1
2-3 times	25	55.6	35	38.9	60	44.4
>3 times	5	11.1	24	26.7	29	21.5
Ethnic group						
Buginese	19	42.2	34	37.8	53	39.3
Makassar	23	51.1	46	51.1	69	51.1
Toraja	1	2.2	4	4.4	5	3.7
Mandar	0	0.0	2	2.2	2	1.5
Javanese	1	2.2	4	4.4	5	3.7
Others	1	2.2	0	0.0	1	0.7
Occupation						
Government employee	11	24.4	9	10.0	20	14.8
Entrepreneur	1	2.2	3	3.3	4	3.0
Private employee	9	20.0	11	12.2	20	14.8
Housewife	24	53.3	64	71.1	88	65.2
Student	0	0.0	3	3.3	3	2.2
Education						
Elementary school	2	4.4	8	8.9	10	7.4
Junior high school	2	4.4	10	11.1	12	8.9
Senior high school	19	42.2	40	44.4	59	43.7
Diploma/bachelor	22	48.9	32	35.6	54	40.0

Table 2: Distribution of prediabetes and gestational diabetes mellitus due to the history of fiber consumption, coffee consumption and cigarette smoke exposure

Independent variables	Research groups						p-value	OR (95% CI)
	Case		Control		Total			
	n	%	n	%	n	%		
Fiber consumption history							0.022	2.355 (1.12-4.94)
High risk	22	48.9	26	28.9	48	35.6		
Low risk	23	51.1	64	71.1	87	64.4		
Coffee consumption history							0.025	2.406 (1.10-5.25)
High risk	33	73.3	48	53.3	81	60.0		
Low risk	12	26.7	42	46.7	54	40.0		
Cigarette smoke exposure							0.137	1.902 (0.81-4.47)
High risk	36	80.0	61	67.8	97	71.9		
Low risk	9	20.0	29	32.2	38	28.1		

Table 3: Summary of bivariate analysis result of moderator variable on prediabetes and gestational diabetes mellitus

Variables	Research groups						p-value	OR (95% CI)
	Case		Control		Total			
	n	%	n	%	n	%		
Parity							0.066	0.509 (0.25-1.05)
≤1 and >3 times	20	44.4	55	61.1	75	55.6		
2-3 times	25	55.6	35	38.9	60	44.4		
Weight gain during pregnancy							0.222	1.568 (0.76-3.22)
>12 kg	23	51.1	36	40.0	59	43.7		
≤12 kg	22	48.9	54	60.0	76	56.3		
Family history of DM							0.003	3.200 (1.46-6.99)
Yes	20	44.4	18	20.0	38	28.1		
No	25	55.6	72	80.0	97	71.9		
History of stillbirth delivery							0.767	0.875 (0.36-2.12)
Yes	9	20.0	20	22.2	29	21.5		
No	36	80.0	70	77.8	106	78.5		
History of giving birth macrosomia							0.000	13.097 (3.53-48.67)
Yes	14	31.1	3	3.3	17	12.6		
No	31	68.9	87	96.7	118	87.4		
History of polihidramnion							0.732	0.835 (0.30-2.34)
Yes	6	13.3	14	15.6	20	14.8		
No	39.0	86.7	76.0	84.4	115	85.2		
History of delivery with treatment							0.000	16.312 (6.50-40.94)
Yes	29	64.4	9	10.0	38	28.1		
No	16	35.6	81	90.0	97	71.9		

Table 4: Multiple logistic regression analysis of fiber and coffee consumption history on the incidence of prediabetes and gestational diabetes mellitus

Variables	Wald	p-value	OR	95% CI	
				Lower	Upper
Family history of DM	5.233	0.022	3.109	1.176	8.216
History of delivery with treatment	31.312	0	17.906	6.518	49.190
History of fiber consumption	4.626	0.031	2.859	1.098	7.445
History of coffee consumption	4.075	0.044	2.852	1.031	7.893
Constant	18.140	0	0.05		

DISCUSSION

Excessive consumption of sucrose may increase blood sugar levels drastically and causing the body release more insulin in an attempt to normalize blood glucose levels. The release of insulin in large quantities for a long time are the early development of prediabetes. It was triggered by the exhaustion of the beta cells of the pancreas⁹. Diets with high fiber content can improve the metabolism of carbohydrates. It can help in controlling and preventing an increase in blood sugar levels³.

The body needs fiber to keep the digestive tract function remains normal. For adults, the need of fiber at least 2 servings of vegetables and 1 serving of fruit each day of the week. Study in Tehran, Iran in 2006 reported that high vegetable consumption correlated with a lower risk of the incidence of metabolic syndrome¹⁰.

In this study, to obtain the results of the proportion of respondents undergoing prediabetes or gestational diabetes mellitus who have a history of less fiber intake is higher than those not undergoing prediabetes and gestational diabetes mellitus. Giving birth women with a history of less fiber consumption have the risk of prediabetes and gestational diabetes mellitus 2 times greater than the others who had a history of consumption of fiber is quite good. This is in line with the study results of Zhang *et al.*¹¹ found that each 10 g day⁻¹ of total fiber diet is associated with reduced risk of GDM 26% (95% CI: 9-49) and 5 g day⁻¹ of dietary fiber cereal or fruit related with GDM risk reduction of 23% (9-36) or 26% (5-42).

Other study results by Ventura *et al.*⁶ found that individuals who reduce sugar intake equivalent to one can of soda per day or increase the fiber intake is equivalent to 1 cup of beans showed improvements in major risk factor for type 2 diabetes, particularly in insulin secretion and visceral fat. Dietary fiber improvement is not only needed by pregnant women with gestational diabetes mellitus, but also for healthy people, especially for individuals who have risk of overweight and unbalanced diet.

Coffee contains antioxidants including chlorogenic acid and magnesium. The content of antioxidants in coffee may increase sensitivity to insulin. The function of chlorogenic acid in coffee is to inhibit the absorption of sugar in the digestive process and stimulates GLP-1, a chemical substance that can

produce insulin¹². However, coffee consumption can not be separated from the consumption of sugar and often added with creamer or milk, especially in instant coffee. It can lead to a reduction or even loss of the protective effect of coffee on the incidence of diabetes.

In this study, the highest proportion to frequency of drinking coffee is a habit of drinking coffee every day, with a ratio of 41.7% in the case group and 47.6% in the control group. Ramos-Levi *et al.*¹³, found that the results emphasize the fact that excessive coffee consumption (>3 times a day) can eliminate the protective effect of coffee. This can be caused by an increase in coffee consumption habits in Spanish society associated with increased consumption of milk, creamer and sweeteners (sugar).

Several studies have found that the type of coffee that provide a protective effect on the incidence of diabetes is caffeinated coffee. This study in line with the results of study of Adeney *et al.*¹⁴, who reported the women who drank the caffeinated coffee reduced their risk of gestational diabetes mellitus were statistically significant compared to women who did not consumed coffee (adjusted RR 0.50, 95% CI: 0.29-0.85). Similarly, the study of French women who reported caffeine intake is associated with decreased risk of diabetes¹⁵. The results also reinforced by study of Boggs *et al.*¹⁶, which found that African-American woman who drank caffeinated coffee or alcohol in moderation had a reduced risk of type 2 diabetes mellitus ($p < 0.0001$).

Smoking can lead to diabetes because the activity of smoking is very likely to be the cause of insulin resistance (type 2 diabetes causes) and the response is not sufficient to insulin secretion. The nicotine content in cigarettes may cause damage to the endothelium lining in the blood vessels and can affect endothelial dysfunction. This can cause oxidative stress and impact on insulin resistance¹⁰.

Study by Willi shows a direct link between smoking and increased risk of diabetes. The study results indicated that smoking without the influence of other activities can lead to glucose intolerance. The risk of diabetes for those who smoked more than 20 cigarettes day⁻¹ by 61% while light smokers only have an increased risk of diabetes by 29%¹⁷.

Exposure to cigarette smoke is very dangerous, especially in pregnant women. Study conducted by Cupul-Uicab *et al.*¹⁸, found that women who are exposed to smoke in utero have relative OR 1.53 times for obese after adjustment for age, education and smoking behavior. After adjustment in BMI, the risk of pregnant women who are exposed to cigarette smoke is 1.14 times to experience the type 2 diabetes mellitus (OR = 1.14, 95% CI: 0.79-1.65) and 1.32 times for gestational diabetes mellitus (95% CI: 1.10-1.58) than women who were not exposed to smoke.

History of delivered macrosomic baby in previous pregnancies in this study showed a greater percentage in the case group compared with the control group 31.1 and 3.3%. Maternal history of macrosomia in previous pregnancies had 13 times greater risk for experiencing prediabetes and gestational diabetes mellitus compared with the giving birth mother with no history of previously before other variables are controlled (OR = 13.097, 95% CI: 3.53-48.67). This is in line with study conducted in Tehran, Iran reported a history of having a baby macrosomia 3.44 times greater risk (OR = 3.44, 95% CI: 2.02-5.84, $p = 0.001$) compared with those not having the history¹⁹. It is also consistent with study of Kalra *et al.*²⁰ showed a statistically significant value to the incidence of gestational diabetes mellitus with a history of large babies (6.06%, $p < 0.001$). After other variables are controlled OR of macrosomia history declined to 4.44.

Delivery history is closely connected with pregnancy and childbirth outcomes further. If there is a previous history of poor delivery it needs awareness of the possibility of complications for subsequent pregnancies and childbirth. The results showed that the proportion of respondents who have a history of delivery with the treatment in a previous pregnancy is greater in the case group, namely 64.4% compared with the control group 10.0%.

Delivery by treatment history in a previous pregnancy had a statistically significant association with the incidence of prediabetes and gestational diabetes mellitus. Giving birth women who had a history of delivery by treatment in a previous pregnancy likely to experience a 16 times greater risk for prediabetes and gestational diabetes mellitus compared with the others without that history ($p = 0.000 < 0.005$ OR = 16.312, 95% CI: 6.50-40.94). But after other variables are controlled risk opportunity to experience prediabetes and gestational diabetes mellitus for the birth mother who had a history of delivery with the treatment turns into 14.031 times.

Reduced risk of incidence of prediabetes and gestational diabetes mellitus for the factor of diabetes in the family, a history of giving birth macrosomia and a history of delivery with the treatment in a previous pregnancy showed that variables can not stand alone in influencing the incidence of prediabetes and gestational diabetes mellitus and in case interaction together, it can increase the risk of incidence of prediabetes and gestational diabetes mellitus. This happens because of a history of having a baby with macrosomia then likely to experience birth complications. With the complications of delivery, need for treatment in the delivery process. Family history of diabetes in the background incidence of neonatal macrosomia. Some studies indicate that the incidence of neonatal macrosomia has a history of

diabetes in the family. In a subsequent study is expected to be able to control other variables that can measure the influence of independent variables on the dependent variable appropriately.

CONCLUSION

The risk of prediabetes and GDM increased with a history of less fiber and coffee consumption. Exposure to cigarette smoke is a risk factor for prediabetes and GDM but not statistically significant. Family history of diabetes, history of delivery with treatment, history of consumption of fiber and coffee before pregnancy and during early pregnancy affect the incidence of prediabetes and GDM with a probability of 96%. Therefore, it is very important to control the diet in pregnant women. Further study is needed with the prospective method using more precise and accurate variable parameter measurements in order to explore the problems with more accurate and specific.

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