Blood Glucose Profile Among Adult Women in Semarang

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Background: The total burden of death from blood glucose in the world in 2012 was predicted to reach 3.7 million. Impaired Fasting Glucose (IFG) is intermediate condition in the transition between normal blood glucose level and diabetes. Also, people with IFG are at increased risk of cardiovascular disease. Women are at risk of blood glucose imbalance because they are more prone to hormonal disturbances. Blood glucose increases by age, obesity and physically inactive. The aim of this research was to describe fasting blood glucose, age, body mass index and physical activity (PA) levels among adult women. *Method*: The study design was a descriptive cross sectional. Study population was adult women. Seventy four samples were recruited by random sampling from 6 districts in Semarang city, Indonesia. Fasting blood sample were collected by finger-prick and analyzed by *Autocheck glucose test strips*. Socio-demographic, PA and physical examination were collected. Subjects undergone anti diabetic treatment and anti-hypertension treatment were excluded from the study. *Results*: The mean of FBG was 103.7 mg/dl, age was 42.3 years, BMI was 24.05 kg/m^2, physical activity level was 1.58. The majority of the samples have normal blood glucose level (64.9%), aged 45–54 years (33.8%), have normal BMI (52.7%), and have sedentary PA (78.4%). *Conclusion*: The increasing physical activity and weight monitoring represent feasible options for preventing impaired fasting glucose.

Keywords: Blood Glucose, Age, Body Mass Index, Physical Activity, Woman.

1. INTRODUCTION

Glucose metabolism is influenced by various genetic and environmental factors.[1] Another term in the disruption of blood sugar levels is impaired fasting glucose (IFG), which is one of the metabolic syndromes. On condition of IFG, insulin in the body is not able to regulate glucose as efficiently as normal people. Thus, the absorption of glucose in the body into energy is also inhibited.[2]

Women are at risk of blood sugar imbalance because they are more prone to hormonal disturbances. Hormonal disorders in woman were affected by menopause status that may occur after the age of 35 years. If a woman experienced an increase in blood sugar, there will be increase of the body fat around the abdomen, lower the level of good cholesterol, and increase the level of insulin.[3]

Some non-communicable diseases are related to blood glucose. People with IFG are at risk of developing not only type 2 diabetes but also heart diseases.[4] The total burden of death from high blood glucose in the world in 2012 according to the WHO was expected to reach 3.7 million. This number includes 1.5 million deaths from diabetes, and 2.2 million deaths from cardiovascular diseases, chronic kidney disease and tuberculosis associated with high blood glucose.[5] Estimate mortality among Indonesian women basic on global status report on non-communicable disease 2014 was around 337/100.000 women for cardiovascular disease and about 71,9/100.000 women for diabetes.[6] Both diabetes mellitus and heart disease are common in Semarang city. According to data from provincial health department in 2014, Semarang city was ranked third for diabetes mellitus and was rated first for cardiovascular disease.[7]

Middle age or adult people tend to have higher risk of high blood glucose. The lowest proportion of deaths due to high blood glucose in women is among people aged 20–29 years old (<2%), while the highest proportion of deaths is among those who aged 60–69 years old (>12%).[8] It is important issue to know the situation of blood glucose profile among adult women in Semarang city.

2. METHOD

The study design was a descriptive cross sectional study. It was conducted at Puskesmas Kedungmundu located in Semarang City from June to August 2016. Study population was adult women. The subjects were selected by random sampling method.

Women from age of 18 and above were the subject used. Total of 74 samples were collected. Subject undergone anti diabetic treatment and anti-hypertension treatment were excluded from

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the study. The subjects were told to fast overnight and were given questionnaire each.

Biochemical measurement was collected to assess blood glucose levels by using *Autocheck blood glucose test strips*. This test is for *in-vitro* diagnostic use only and critical ill patients should not be tested with glucose strips. The accuracy of the *Autocheck blood glucose test* was performed with capillary finger blood and compared with NIST SRM 917c Standard, majority of its results (95%) are within 15% bias interval. The precision were measured with venous blood sample in the laboratory.

Socio demographic information, physical activity and physical examination were collected. Physical activity was collected by using Physical Activity Level measurement. Physical examination such as weight was measured using portable digital scale and recorded with one decimal digit precision. Height was measured with subjects standing without socks and shoes using inflexible measurement tapes, and the reading was rounded to the nearest 0,1 cm.

After collection of data, it was checked, cleaned, edited and verified. Data were entered and analyzed by using IBM SPSS 20 (IBM:2011) statistical software. The data were presented descriptively such as percentage (frequency) or mean with standard deviation (SD). The study protocol was approved by the ethics committee of Diponegoro University.

3. RESULTS

Table I below demonstrates the socio demographic and economic characteristic of subjects in Puskesmas Kedungmundu. On level of education, majority of respondents indicated that they had attended senior high school (39.2%), college (35.1%), and 8,1% of them never attended school. The result showed that the majority of the women were housewife (29,7%) and governmental organization worker (29,7%). Level of income showed that low-income level households were those who had income below the regional employee salary in Semarang city which amount was IDR. 1900.000. The majority of subject had fairly high income (51.4%).

Mean, standard deviation, minimum and maximum value of fasting blood glucose, age, body mass index and physical activity level were presented in Table I. Mean of fasting blood glucose (FBG) in this study was 103,4 mg/dL, the lowest FBG was 66 mg/dL, and the highest value of FBG was 388 mg/dL.

Table I. Demographic characteristics of the subjects.

Variables	N	%
Education level		
Uneducated	6	8,1
Elementary school	8	10,8
Junior high school	5	6,8
Senior high school	29	39,2
College	26	35,1
Occupation		
Housewife	22	29,7
Governmental organization worker	22	29,7
NGO worker	11	14,9
Service	3	4,1
Other occupation	16	21,6
Salary Status		
Below minimum regional employee salary	36	48,6
Above minimum regional employee salary	38	51,4

Table II. Physiological characteristic of study participants.

Variable	FBG (mg/dl)	Age (years)	BMI (kg/m^2)	PAL
Mean	103,7	42,3	24,05	1,58
SD	49,1	12,18	4,34	0,18
Minimum	60	19	15,51	1,28
Maximum	388	66	38,31	2,18

Mean of respondent's age in this study was 42.3 years old, the youngest respondent was 19 years old and the oldest was 66 years old. Mean of body mass index in the study was 24.05 kg/m^2 with the lowest body mass index values was 15.51 kg/m^2 and the highest was 38.31 kg/m^2. Mean of Physical Activity Level in this study was 1.58 with the lowest value was 1.28 and the highest value was 2.18.

Based on Fasting Blood Glucose levels, subject were categorized by American Diabetes Association criteria into three groups using cutoff value of 100 mg/dl to distinguish subjects into normal Fasting Glucose (<100 mg/dl), having Impaired Fasting Glucose (≥100–≤125 mg/dl), and having diabetes (≥126 mg/dl).[9] The results showed the majority (64.9%) of respondents had NBG, while 16.2% of respondents had IFG, and 18.9% respondents had undiagnosed diabetes. The highest prevalence of age was 33.8% among respondents aged 45 to 54 years, while the lowest prevalence of age was 4.1% among respondents aged 65 to 74 years.

WHO categories of underweight, normal weight, overweight, and obesity which are defined respectively as BMI < 18.5 kg/m^2, BMI = 18,5–24,9 kg/m^2, BMI = 25, 0–29.9 kg/m^2, and BMI ≥ 30 kg/m^2.[10] The highest prevalence of body mass index was 52.7% among respondents who are normal, while prevalence that are overweight was 31.1% and only 1% of respondents had obesity.

The majority of respondents (78.4%) were categorized as having sedentary physical activity, while 21.6% of respondents were categorized as having moderate vigorous physical activity.

Table III. Fasting glucose levels, age level, body mass index levels, and physical activity level.

Variable	N	%
FBG		
Normal blood glucose ≤100 mg/dl	48	64,9
Impaired fasting glucose 110–125 mg/dl	12	16,2
Diabetes mellitus (undiagnosed) ≥126 mg/dl	14	18,9
Age, years		
15–24 years	9	12,2
25–34 years	11	14,9
35–44 years	18	24,3
45–54 years	25	33,8
55–64 years	8	10.8
65–74 years	3	4,1
BMI		
Underweight <18.5 kg/m^2	6	8,1
Normal 18.5–24.9 kg/m^2	39	52,7
Overweight 25–29.9 kg/m^2	23	31,1
Obesity ≥30 kg/m^2	6	8,1
PAL		
Sedentary physical activity	58	78,4
Moderate vigorous physical activity	16	21,6

4. DISCUSSION

Impaired fasting glucose is condition in which blood glucose levels are higher than normal but not high enough to be diagnosed as type 2-diabetes. Risk factors for pre-diabetes which are being overweight, being physically inactive and ageing.[4]

IFG occurs when too much glucose is released into the blood stream from the liver overnight. The liver is mainly responsible for keeping a proper supply of glucose in the blood when we have not eaten for several hours, In IFG, the liver does not respond normally to the hormone insulin and this is called hepatic insulin resistance. This result in too much glucose in the blood on walking.[4]

IFG increases the risk of cardiovascular disease. Individuals with IFG are more prone to progress to the diabetes stage.[11] This study presented that prevalence of IFG is lower than NBG (16.2% vs. 64.9%), while prevalence of undiagnosed diabetes was higher than IFG (18.9% vs. 16.2%). In current study, prevalence of IFG among Iranian women was 13.74%, lower than this study. Trends of impaired fasting glucose in Iranian adult had no substantial changes during 2005–2011.[12]

Current study in Iran told that mean of BMI in women was 25.66 kg/m^2 which was higher than this study, while a study in Bangladesh showed a lower result of BMI which was 21.3 kg/m^2.[13, 14] In Iran, the prevalence of overweight among women was 647%, almost two times higher than this study.[12] In a Moroccan ethnic group, prevalence of obesity among women aged 15 years and older was 49%, about 11 times higher than this study (4.2%).[15]

The lack of physical activity reported in this study which prevalence was 78.4% for subject having sedentary physical activity. Sedentary life, such as sleeping in the afternoon and watching television were common in this study. Previous study in Moroccan women showed that subject with NBG spent more hours for walking activity in a week than subject with IFG.[15]

In this study, the mean age was 42.3 years with the highest prevalence was in subject aged 45–54 years (33.8%). Previous study in Chinese women population presented similar prevalence among subject aged 40–59 years (39.2%). The prevalence of IFG increased with age in China and other Asian, European, and American population.[11]

5. CONCLUSION

Most of adult women have normal blood glucose, with the average fasting glucose of 103.7 mg/dL. Women tended to overweight (BMI average of 24.05 kg/m^2) and physically inactive (PAL of 1.58). Adults should check blood glucose levels frequently using blood glucose strips for easier way, maintain a healthy weight and increase physical activity.

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FINAL GRADE

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GENERAL COMMENTS

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