

## **GLYCEMIC LOAD, FIBER, MAGNESIUM, ZINC, PHYSICAL ACTIVITY, STRESS FACTOR AND FASTING BLOOD GLUCOSE LEVEL**

*(Indeks glikemik, serat, magnesium, zinc, aktivitas fisik, factor stress dan tingkat glukosa darah puasa)*

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### **ABSTRACT**

Background: Diabetes mellitus is a group of metabolic diseases and some of the trigger factors are food intake, physical activity and stress factors. Objective: To know the relationship between glycemic load, intake of fiber, magnesium, zinc, stress levels, physical activity, and fasting blood glucose levels of female Patients with Type 2 Diabetes Mellitus in Cibinong Hospital. Research methods: This research is a quantitative study with a cross sectional study design. The population of this study were all female patients with type 2 diabetes mellitus who attended exercise as many as 30 subjects. Measurement of food intake data used the 3 x 24 recall method. Physical activity data used a 3 x 24 hour recall questionnaire while stress data used the Diabetes Distress Scale (DDS). The data analysis of this research used Pearson correlation, independent sample t test. Research result: The mean age of respondents was 59 years, glycemic load was 127.4 units, fiber intake was 17.31 grams, magnesium 380.5 mg, zinc 6.84 mg. A total of 9 people with moderate stress levels, physical activity PAL value of 1.81 and fasting blood glucose levels 138.23 mg / dL. There is a relationship between glycemic load ( $p = 0.003$ ), fiber intake ( $p = 0.03$ ), magnesium ( $p = 0.001$ ), physical activity ( $p = 0.043$ ) and fasting blood glucose levels. There was no relationship between zinc intake and fasting blood glucose levels ( $p = 0.178$ ). There was no difference in fasting blood glucose levels based on the subject's stress level ( $p = 0.161$ ). Conclusion: Glycemic load, fiber intake, magnesium and physical activity are all factors that affect fasting blood glucose levels.

Keywords: glycemic load, magnesium, fiber, zinc, physical activity, fasting blood glucose, stress

### **ABSTRAK**

*Latar Belakang : Diabetes mellitus merupakan kelompok penyakit metabolik dan beberapa faktor pemicunya adalah asupan makan, aktivitas fisik dan juga faktor stress. Tujuan : mengetahui hubungan beban glikemik bahan makanan, serat, magnesium, zink, kegiatan fisik, faktor stres dan kadar glukosa darah puasa pada pasien wanita penderita diabetes mellitus tipe 2 di RSUD Cibinong. Metode : penelitian ini merupakan penelitian kuantitatif dengan desain studi cross sectional. Populasi penelitian ini adalah semua pasien wanita diabetes melitus diabetes tipe 2 yang mengikuti senam sebanyak 30 subjek. Pengukuran data asupan makan dengan metode recall 3 x 24. Data aktifitas fisik menggunakan kuisioner recall 3 x 24 jam sedangkan data stress menggunakan Diabetes Distress Scale (DDS). Analisis data penelitian ini menggunakan korelasi pearson, uji t sampel independen. Hasil : rerata usia responden 59 tahun, beban glikemik 127,4 unit, asupan serat 17,31 gram, magnesium 380,5 mg, seng 6,84 mg. Sebanyak 9 orang tingkat stress sedang, nilai PAL aktivitas fisik 1,81 dan kadar glukosa darah puasa 138,23 mg / dL. Ada hubungan antara beban glikemik ( $p = 0,003$ ), asupan serat ( $p = 0,03$ ), magnesium ( $p = 0,001$ ), aktivitas fisik ( $p = 0,043$ ) dan kadar glukosa darah puasa. Tidak ada hubungan asupan seng dengan kadar glukosa darah puasa ( $p = 0.178$ ). Tidak ada perbedaan kadar glukosa darah puasa berdasarkan tingkat stres subjek ( $p = 0.161$ ). Kesimpulan: Beban glikemik, asupan serat, magnesium dan aktivitas fisik merupakan faktor-faktor yang mempengaruhi kadar glukosa darah puasa.*

*Kata Kunci : beban glikemik, magnesium, serat, seng, aktivitas fisik, kadar glukosa darah puasa, stres*

## INTRODUCTION

Diabetes mellitus is a group of metabolic diseases characterized by increased blood glucose levels due to impaired secretion and insulin action (ADA, 2015). Enhancement sustainable glucose levels can cause chronic complications that cause damage and malfunctioning of the kidneys, eyes, nerves, and the risk of cardiovascular disease (Hardinsyah, 2017).

Approximately 347 million people worldwide, or approximately 5% of the world's population suffer from diabetes mellitus type 2. Indonesia ranks fourth in the world with a prevalence of diabetes of 8.6% of the total population (WHO, 2013). According to the Basic Health Research in an increase in the prevalence of diabetes in West Java 1.1% in 2007 to 2.0% in 2013 (Ministry of Health, 2013). Under the Bogor District Health Profile 2015, DM disease pattern Case Outpatient Hospital aged 45 to 75 years as many as 11 836 or 11.52% and is the second largest case after hypertension (Ministry of Health, 2013b).

The increasing number of people with diabetes can be caused by many factors, which can also increase blood glucose levels which are the wrong diet is eating foods that are high in glycemic load, and the lack of fiber and mineral intake, stress factors and lack of physical activity (Soegondo, 2015).

The glycemic load is a parameter to judge the speed of glucose from a food enter the blood stream and assess the amount of glucose that is contained on the food, so the glycemic load can be used to assess the effect of food on blood glucose

levels. Glycemic Load is proportional to the carbohydrate content. That is, the higher the carbohydrate content the greater the food's Glycemic Load the same (Foresters, 2014).

fiber is part of the plant that can not be digested by the digestive enzymes (Winarno, 2004). Fiber can slow the absorption of carbohydrates in the control of blood glucose levels of diabetics (Arisman, 2011). When metabolized in the digestive system, fiber forms a gel that can slow down the movement of peristaltic nutrients (glucose) from the intestinal wall to the absorption area resulting in a decrease in blood glucose levels (Kobayashi, 2013).

The importance of intake of minerals like magnesium and zinc in patients with diabetes mellitus type 2 because there is a potential insulin action with the presence of these minerals (Yiqing, 2013). Magnesium will facilitate glucose entry into cells and also is a cofactor of various enzymes for the oxidation of glucose (Bolknet, 2009). Zinc intake can improve the structure, synthesis, storage, and secretion of insulin so as to synthesize glucose transporter from intracellular translocate to the plasma membrane. Helps glucose transporter of glucose molecules across the cell membrane and reduce the increased glucose outside the cell (Gionitti, 2015).

Stress is a reaction / body's response to psychosocial stressors (mental stress / load life). Stress causes excessive production of cortisol increases blood glucose levels by stimulating hepatic gluconeogenesis, and inhibit the action of insulin (Waspadji, 2011).

Physical activity is any body movement that increase energy expenditure and energy or calorie burning (Barnes, 2011). When physical activity, the muscles use the glucose that is stored so that the stored glucose is reduced. To fill the gap muscles take up glucose in the blood so that glucose in the blood falls where it can improve blood sugar control (Soegondo, 2015).

Fasting blood glucose levels allows to describe the overall glucose balance. The importance of controlling blood glucose levels to remain normal can be done through proper management of diet, avoid stress and physical activity (ADA, 2015).

At Cibinong Hospital, type 2 diabetes is in the top five diseases suffered by many patients, as many as 115 new patients in 2017 at Cibinong Hospital and joined the Persadia club which routinely does diabetes exercise every Saturday.

The purpose of this study is the relationship of glycemic load, intake of fiber, magnesium, zinc, stress levels, physical activity and fasting blood glucose levels of female patients with type 2 diabetes mellitus patients in Cibinong Hospital in 2018.

## **RESEARCH METHODS**

### **Research design**

The research design used was an analytical study with a cross sectional approach. This research was conducted at Cibinong Hospital, Bogor Regency in July-August 2018. The variables in this study were glycemic load, fiber intake, magnesium, zinc, stress levels, physical activity and fasting blood glucose levels.

### **Data source**

The data used in this study were primary data obtained from several methods. The characteristics of the subject data include age, level of education, work measured using a questionnaire with interview techniques.

Data obtained from the questionnaire glycemic load food recall 3x24 hours, then analyzed for carbohydrate content and glycemic index food. Glycemic load was obtained by multiplying the glycemic index and then divided by 100. Data carbohydrate intake of fiber, magnesium, zinc was obtained using semi-quantitative food frequency questionnaire and analyzed using Nutrisurvey program.

The data was obtained using a questionnaire stress levels Diabetes Distress Scale. Results of measuring are divided into three categories: mild stress (average score <1), moderate stress (an average score of 1-2) and stress (mean score > 2) [13]. Physical activity data were obtained using a physical activity level kuesioer recall 3x24 hours ) (Paramitha, 2014) .

### **Research Goals**

The population in this study were all female patients with type 2 diabetes mellitus who were outpatient and attended DM exercises at Cibinong Hospital for the past month with 30 patients with total sampling technique. All patients were women with diabetes mellitus type 2 outpatient and follow gymnastics DM is taken as a sample.

### **Data Analysis Techniques**

Data characteristics of subject and the respective data variables were

analyzed descriptively. Bivariate analysis to examine the relationship or correlation significance with 95% confidence level. using Pearson Product Moment Correlation test for normally distributed variables of all data.

Test Independent t-test statistic used to determine differences in the mean of two independent data sets. Data in the form of numerical and categorical data. Test with 95% confidence level.

Multivariate analysis using multiple linear regression analysis were used to determine the amount of influence on the relationships independent and dependent variables. how much influence the relationship variables  $X_1$ ,  $X_2$ ,  $X_3$ , ...  $X_k$  to variable  $Y$ .

## **RESULTS AND DISCUSSION**

### **Characteristics of Subject**

Subject characteristics, age, education, and occupation in female patients with type 2 diabetes mellitus are shown in Table 1. Based on the results of the analysis, the average age of the subjects was  $58.9 \pm 9.327$  years and most of them graduated from elementary and junior high school. According to their livelihoods, the majority of subjects are housewives

### **Glycemic load**

Data obtained from the method of food recall 3x24 hours on two weekdays and one day off, and then analyzed the glycemic index and carbohydrate content in food. Furthermore, the glycemic load is calculated by multiplying the glycemic index and carbohydrate then divided by 100. The glycemic load average subject was  $127.4 \pm 20.642$  units in detail can be seen in Table 2.

### **Fiber intake**

Fiber intake data obtained using a semi-quantitative food frequency over the last month. Then calculated the average daily dietary intake of fiber sources and analyzed receipts subject Nutrisurvey program. The average fiber intake amounted to  $17.3 \pm 2.3$  g subject can be seen that no subject who consume enough fiber a day can be seen in table 2,

### **Intake of Magnesium**

Magnesium intake data was obtained using a semi-quantitative food frequency over the last month. Then calculated the average intake of dietary sources of magnesium over the last month. The average magnesium intake was  $380,503 \pm 60.86$  mg. Intake is average. based on the 2013 RDA. The daily intake of magnesium is sufficient for adult women

### **Zinc intake**

Data obtained using zinc intake semi-quantitative food frequency over the last month. Then calculated the average intake of dietary sources of zinc during the last month. The average intake of zinc by  $6.84 \pm 1.211$  mg. The average intake is sufficient for daily zinc intake is 10 mg for adult women.

### **Physical activity**

Physical activity data obtained using level of physical activity recall 3x24 hours. Then the calculated value of Physical Activity Level (PAL) subject by means of Physical Activity Rate (PAR) value multiplied by the duration of the physical activity. The average value of physical activity PAL subject is  $1.81 \pm$

0.13. Subject level of physical activity medium category can be seen on table 2.

### Stress level

The stress level data obtained using

Diabetes Distress Scale (DDS). Then calculated the average score of stress responders.

It is known that most of the subject have mild stress levels, can be seen in Table 3.

Table 1. Distribution of subject by Characteristics

Category	Frequency	Percentage (%)
Age group		
45-60 years	17	56.67%
61-76 years	13	43.3%
Education		
Elementary and junior high school	21	70%
High School and College	9	30%
Work		
Does not work (housewives)	26	86.7%
civil servant	2	6.7%
entrepreneur	2	6.7%

Table 2. Distribution of Intake Several substances Nutrition, Physical Activity and Fasting Blood Glucose.

variables	Unit	<i>mean</i> ± SD	Min-Max
Glycemic load	unit	127.4 ± 20.642	92.59 to 174.82
Fiber intake	gram	17.313 ± 2.265	11.8 to 21.7
intake of Magnesium	mg	380.503 ± 60.86	269.3 to 481.2
Zinc intake	mg	6.84 ± 1.211	4.3 to 9.9
Physical activity	value PAL	1.81 ± 0.13	1.53 to 2.06
Fasting Blood Glucose Levels	mg / dL	138.23 ± 52.957	90-370

Table 3. Distribution of Stress Level Subject

Category	Frequency	Percentage (%)
Mild stress	21	70%
stress Medium	9	30%

### Fasting Blood Glucose Levels

Fasting blood glucose levels of data obtained by direct measurement after subject fasted at least 8 hours. Fasting blood glucose tests using a glucometer Easy Touch. The average fasting blood glucose levels of  $138.23 \pm 52.957$  mg / dL. The average blood glucose level is

still high at more than 125 mg / dL can be seen in Table 2.

### Correlation Intake Several substances Nutrition, Physical Activity and Fasting Blood Glucose Levels

Based on Pearson correlation test results showed that the value of  $p =$

0.003 ( $p < 0.05$ ), which means that there is a significant association between glycemic load and fasting blood glucose levels of female patients with type 2 diabetes mellitus patients in hospitals Cibinong, Bogor regency. Values obtained correlation coefficient ( $r$ ) = 0.522. Variable intake and glycemic load fasting blood glucose levels have a strong relationship and a positive pattern. The higher the glycemic load of the subject, the higher levels of fasting blood glucose.

Based on Pearson correlation test results showed that the value of  $p = 0.03$  ( $p < 0.05$ ), ie there is a significant association between fiber intake and fasting blood glucose levels of female patients with type 2 diabetes mellitus patients in hospitals Cibinong, Bogor regency. Variable intake of fiber and have a fasting blood glucose level of relationship and a negative pattern. The lower intake of fiber, the higher levels of fasting blood glucose.

Based on Pearson correlation test results demonstrate the value of  $p = 0.001$  ( $p < 0.05$ ) that there was a significant association between magnesium intake and fasting blood glucose levels of female patients with type 2 diabetes mellitus patients in hospitals Cibinong, Bogor regency. Variable intake of magnesium and fasting blood glucose levels have a strong relationship and a negative pattern. The lower the magnesium intake, the higher levels of fasting blood glucose.

Based on Pearson correlation test results showed that the value of  $p = 0.178$  ( $p > 0.05$ ), which means that there

is no significant relationship between zinc intake and fasting blood glucose levels of female patients with type 2 diabetes mellitus patients in hospitals Cibinong, Bogor regency. Variable intake of zinc and fasting blood glucose levels have a weak correlation and negative patterned. The lower zinc intake, the higher levels of fasting blood glucose.

Based on Pearson correlation test results demonstrate the value of  $p = 0.043$  ( $p < 0.05$ ), no significant relationship between physical activity and fasting blood glucose levels of female patients with type 2 diabetes mellitus patients in hospitals Cibinong, Bogor regency. Variable physical activity and fasting blood glucose levels have a relationship that is being patterned negative. The lower the physical activity, the higher levels of fasting blood glucose.

Then analyzed the effect of variable magnitude of the fasting blood glucose.

#### **Fasting Blood Glucose difference based Stress Levels**

Based on the test results Independent T Test showed that the value of  $p = 0.161$ , which means there is no significant difference between fasting blood glucose levels based on patient stress levels of women with type 2 diabetes mellitus in hospitals Cibinong, Bogor regency. The average fasting blood glucose levels of patients with diabetes mellitus type 2 lower stress levels better than patients who have moderate stress levels.

### Magnitude Influence Nutritional Intake Several substances and Fasting Blood Glucose Levels

Based on the results of multiple regression analysis of values obtained  $r^2 = 0.380$ , this means that 38% of fasting blood glucose levels are determined by magnesium intake, glycemic load, and

fiber. The higher the glycemic load, the lower the intake of fiber, magnesium and physical activity, the higher levels of fasting blood glucose. The variables that most affect fasting blood glucose levels is the glycemic load with a value of  $p = 0.026$ .

Table 4. Correlation Intake of Some Substances Nutrition, Physical Activity and Fasting Blood Glucose Levels

Variables	R	p value
Glycemic load	0.522	0.003
Fiber intake	-0.396	0.03
intake of Magnesium	-0.562	0,001
Zinc intake	-0.252	0.178
Physical activity	-0.372	0.043

Table 5. Differences Fasting Blood Glucose Based Stress Levels

Stress level	Fasting Blood Glucose Levels	t	p value
Mild stress	129.29 ± 34.407 mg / dL	1,440	0.161
stress Medium	159.11 ± 80.659 mg / dL		

Table 6. Magnitude Influence Nutritional Intake Several substances and Fasting Blood Glucose Levels

Variable	B	Std. Error	T	Sig	R Square
(Constant)	178.121	95.491	1.865	0.073	.380
intake of Magnesium	-0.343	.159	-2.161	0,040	
Glycemic load	0.946	0.4	2.363	0,026	
Fiber intake	-1.743	4.168	-0.418	0.679	

### Correlation Glycemic Load and Fasting Blood Glucose Levels

Glycemic load is defined as the glycemic index multiplied by the carbohydrate content of the meal. Glycemic load is a parameter to judge the speed of a meal glucose enters the blood circulation and assess the amount of glucose contained on these foods (Foresters, 2004).

Based on the results of this research note glycemic load and fasting blood glucose levels have a significant relationship. These results are also consistent with research Wirrawani in 2008 in patients with type 2 diabetes mellitus in DR Kariadi Hospital Semarang (Wirrawani, 2008). Greenwood research shows that there is a positive relationship between glycemic load with an increased

incidence of type 2 diabetes mellitus (Greenwood, 2013).

The glycemic load is closely related to blood glucose levels in which foods with a low glycemic load will decrease the rate of glucose absorption and suppresses pancreatic insulin secretion so that no increase in blood glucose levels. Conversely, if food with a high glycemic load will increase the rate of absorption of blood glucose, causing a surge in blood glucose levels (Brand-Miller, 2002).

Ill effects of a diet high in glycemic load is the change in body hemoestasis beginning with hyperglycemia, subsequent impact on lipid metabolism disorders. This increases the free fatty acids thus worsening the beta cell function in insulin secretion (Poitout, 2002). If resistance insulin gain weight with increased glucose load Persistent, pancreatic beta cells within a short time was not able to secrete insulin to lower blood glucose levels, with an increase in hepatic glucose and decreased glucose by muscle and fat affect fasting blood glucose levels , Finally, the secretion of insulin by the pancreatic beta cells will decrease and there were more severe hyperglycemia and continuously take place (Permana, 2011).

### **Correlation Magnesium Intake and Fasting Blood Glucose Levels**

Fiber is the part of the plant that can not be digested by digestive enzymes. Many fibers derived from the cell walls of various vegetables and fruits. Consumption of fiber provide a

positive effect on blood glucose levels in Type 2 Diabetes Mellitus Dietary fiber will slow gastric emptying and glucose absorption by the intestine (Soegondo,2015).

Based on these results it is known that fiber intake and fasting blood glucose levels have a significant relationship. The lower intake of fiber, the higher levels of fasting blood glucose. This study is in line with the 2008 Wirrawani study in patients with type 2 diabetes mellitus in DR Kariadi Semarang Hospital stating that there is a significant association between fiber intake and fasting blood glucose levels. Willet (2017) states that dietary fiber, especially soluble fiber associated with diabetes mellitus.

The entire subject has fiber intake is less than the requirement. Though enough fiber diet in patients with diabetes leads to complex carbohydrates and fiber, so the digestibility of carbohydrates is reduced. The state is able to reduce the increase in blood glucose and make blood glucose levels under control (Santoso,2011).

Dietary fiber, especially soluble fiber can absorb liquid and form a gel in the stomach. Gel may slow peristaltic movement of nutrients (glucose) from the intestinal wall towards the area of absorption resulting in decreased blood glucose levels (Gropper, 2005). When there is digestion, fiber is fermented by bacteria to produce fatty acids of short chain (acetate, propionate, and butyrate) and will be absorbed back toward the bloodstream. Acetate can



lower free fatty acids in the blood stream so as to have a good effect on reducing blood glucose levels and insulin sensitivity in the long term because the free fatty acids can inhibit the glucose utilization in the network and improve insulin resistance (Luo,2000).

### **Correlation intake of Zinc and Fasting Blood Glucose Levels**

Zinc is micro minerals that work as antioxidants to protect the intracellular from the oxidation process that will produce free radicals also worked as synthesis, storing and secreting insulin. Zinc plays a role protective against pancreatic beta cell damage, lack of zinc affects the pancreatic beta cells in response to the body to produce and secrete insulin, lower insulin secretion and increase insulin resistance. If the pancreas does not produce and secrete sufficient insulin glucose levels in the body remain high, so that with continued high levels of glucose in the body of the regulation of blood sugar is not well (Daradkeh, 2014).

Based on the results of this research note zinc intake and fasting blood glucose levels had no significant relationship. But the correlation coefficient indicates the higher zinc intake, the lower the fasting blood glucose levels. These results are similar to studies Khairunnisa 2015 that there was no significant correlation between zinc intake and blood glucose levels, because Disobedient subject to the diet with regard to the schedule, the type and

amount of food that consumed, where subject consume more foods that contain high levels of carbohydrate, high in protein and low in fiber.

Based on data collection, all subject has zinc intake less than demand. Only a few subjects who zinc nearly sufficient intake. High levels of blood glucose subject are likely due to the high consumption of foods that quickly raise blood glucose levels. Based on data collection known to the subject still often consume fried foods, sweet biscuits, tea, coffees for breakfast and distraction. Tea contains tannins that can inhibit the absorption of zinc in the body. So, although its consumption is almost sufficient but not optimal absorption of zinc, causing the still high levels of fasting blood glucose.

### **Correlation of physical activity and Fasting Blood Glucose Levels**

Physical activity is any body movement that increase energy expenditure and energy (burning calories). The main objective of physical activity in patients with type 2 diabetes mellitus is increasing physical fitness. Physical activity will improve maximal oxygen uptake and improve insulin sensitivity in skeletal muscle, which leads to increased regulation of blood glucose levels (Moughan, 2000).

Based on these results it is known that physical activity and fasting blood glucose levels have a significant relationship. This study is in line with Paramitha 2014 study in patients with Type 2 Diabetes Mellitus in Karanganyar District Hospital.

Heavier activities conducted, the lower the fasting blood sugar levels (Paramitha, 2014).

Patients with type 2 diabetes mellitus insulin resistance causes the glucose can't enter into the cell. While doing physical activity, muscle contraction will occur, which in turn will facilitate the entry of glucose into the cells, so glucose in the blood will be reduced (Soegondo, 2015). Physical activity and insulin stimulated glucose uptake and stimulates uptake of glucose even in the insulin-resistant muscle. After physical activity increased insulin sensitivity in skeletal muscle, so that people with high physical activity levels had a lower circulating insulin and reduce insulin response to glucose rejection (Moughan, 2000).

After doing research discovered that the average subject has a physical activity to the medium category. This is because the majority of subject are housewives, resulting in frequent physical activity at home such as conducting cleaning, washing and cooking. In addition, subject also regularly follow gymnastics Diabetes every Saturday and some subject also follow gymnastics somewhere other than in Cibirong Hospital.

### **Differences Fasting Blood Glucose Based Stress Levels**

Stress is one of the triggers and has been associated with the incidence of Type 2 Diabetes Mellitus, especially in women. When there is stress, the body cope with stress by producing the hormone cortisol increases blood

glucose levels by stimulating hepatic gluconeogenesis, and inhibit the action of insulin and hormones epinephrine impacting antagonize the function of insulin and inhibits the transport of glucose-induced insulin in peripheral tissues, causing hyperglycemia (Isselbacher, 2012).

Based on the results of this research note that there is no difference in fasting blood glucose levels of subject by level of stress. These results are consistent with research to 2018 in hospitals KRMT Wongsonegoro Semarang, where there are no differences in blood glucose levels based on the level of stress for subject is good enough to control the stress on him (Thanks, 2018).

Research Nasriati (2013) states other factors that influence patient behavior in controlling blood sugar Diabetes is social support. Social support which is closely associated with health behaviors is a family support.

Based on the Diabetes Distress Scale questionnaire most subject have mild stress level, and does not have a stress-related interpersonal distress, because a friend or family subject provide emotional support and support for efforts related to diabetes self-care.

Concept by Callista Roy adaptation theory states that a person can experience stress depends on how someone did the coping or adaptation to a stressful event. Coping skills is influenced by three components, namely the main cause of change, change and experience adapt (Wibowo, 2013). This is consistent

with the results of data collection that subject aged > 45 years, it does not work (housewives) as well as most educated. With the age of the subject mostly elderly, influence on the ability to adapt both physically and psychologically and therefore contributes to the increase in fasting blood glucose levels.

### **Magnitude Influence Intake Several substances Nutrition, Physical Activity and Fasting Blood Glucose Levels**

Based on the results of multiple regression analysis, it is known that 38% of fasting blood glucose levels are determined by the glycemic load, intake of fiber and magnesium intake. The higher the glycemic load, the lower the fiber intake, the lower the intake of magnesium and the lower physical activity, the higher the blood glucose levels fasting. The variables that most affect fasting blood glucose levels is the glycemic load.

Glycemic load most affect fasting blood glucose levels as Glycemic load can describe the quantity of food consumed in one meal, where the quantity is what gives a direct effect of the increase in blood glucose levels. Glycemic load gives the sense that although the type of Glycemic Index foods are high, if consumed in small amounts, will be different to be consumed in large quantities, because in addition to taking into account the Glycemic Index, Glycemic Load also take into account the carbohydrate content of the food therefore Glycemic load may take

into account changes in diet associated with fasting blood glucose levels.

### **CONCLUSION**

There is a significant association between glycemic load intake, fiber, magnesium, physical activity and fasting blood glucose levels of female patients with Type 2 Diabetes Mellitus in hospitals Cibinong, Bogor regency. The higher the glycemic load and the lower intake of fiber, magnesium and physical activity, the higher levels of fasting blood glucose. The variables that most affect fasting blood glucose levels is the glycemic load.

### **SUGGESTION**

Type 2 Diabetes Mellitus Patients are advised to eat foods that do not quickly raise blood glucose levels, so as not glycemic load increases so do not spike blood glucose levels after a meal. It is also recommended to increase fiber intake and food sources of magnesium. Patients with diabetes mellitus should also perform regular physical activity in order to keep blood glucose levels within the limits and regularly check fasting blood glucose levels of at least one month

The results of this study can be used as a reference for future research. This study can also be forwarded in patients with diabetes mellitus at different hospitals with more samples.

### **APPROVAL OF ETHICS**

This study has been reviewed and approved by the Esa Unggul's Research Ethics Committee queue by

number: 0314-18298 / DPKE-KEP / FINAL-EA / UEU / VII / 2018.

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