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Stress Level Relationship with Prediabetes Events in Sleman Yogyakarta

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ABSTRACT

Background: Prediabetes prevalence in the world is increasing, and is estimated to reach 20.6% in 2025. Prediabetes prevalence in Indonesia is almost double the prevalence of diabetes mellitus. Prediabetes often does not cause symptoms but has already started to occur with both microvascular and macrovascular complications in some patients. Stress is a disorder of the body and mind caused by changes and demands of life. Stress that occurs at this time, is part of the effects of modern life, and cannot be avoided, both in the work environment, and school, as well as family and society. In the state of stress the secretion of the hormone cortisol increases, which pushes the pancreas to produce insulin, so that there is an increase in blood sugar levels. **Objective:** This study was conducted with the aim to know the relationship of stress level in prediabetes sufferer and know the description of the stress level of prediabetes patient in Sleman Yogyakarta area. **Methods:** This research was a quantitative study with a cross-sectional design, done in the working area of the first health facility of Sleman Regency, Yogyakarta. Sampling was done by simple random sampling, and research subjects were patients in the working area of *Puskesmas* in Sleman that fulfilled inclusion and exclusion criteria then examined. **Results:** The mean age of the study subjects was 46.7 years (SD 11.02). The distribution of subjects of the study was 121 females (78.1%), and 34 males (21.9%). Based on a total of 155 respondents, 19 respondents (12.3%) were diagnosed with prediabetes based on TTGO results and 136 people (87.7%) had normal TTGO results. Based on a total of 155 respondents, 69 respondents (47.1%) had a mild stress level, 80 respondents (49%) moderate stress level and 6 respondents (3.9%) had severe stress level. The result of the bivariate analysis showed that there was no correlation between stress level and prediabetes occurrence in Sleman Yogyakarta and $p = 0.825$ (CI 95%: 0.879-1.67) was not statistically significant ($p > 0.05$). Prediabetes prevalence was 12.3% in the study population. **Conclusion:** There was no correlation between stress levels with the occurrence of prediabetes in Sleman Yogyakarta area. Stress levels were moderate among prediabetes sufferers more than mild and severe stress levels.

Keywords: *Prediabetes, Stress Level, Sleman Yogyakarta*

INTRODUCTION

Prediabetes is also called Impaired Glucose Tolerance or Disturbed Blood Glucose, which is one of the degenerative diseases in which a person has blood glucose levels higher than normal values but has not reached the condition of diabetes and there is no sign or no symptom at all¹. It is estimated that worldwide there were 8% of prediabetes sufferers in 2011, and this is expected to increase to 20.6% by 2025². Research conducted by Soewondo and Pramono³, using secondary Riskesdas 2007 data on 33 provinces shows prediabetes prevalence in Indonesia of 10%, while the prevalence of Diabetes Mellitus was only 5.7%. This indicates that the prevalence of prediabetes

in Indonesia is almost double the prevalence of diabetes mellitus.

Prediabetes often does not cause symptoms, so the patient is not already aware of their condition, which has started to occur with both microvascular and macrovascular complications in some patients⁴. The earliest complication that occurs in prediabetes patients is neuropathy⁵. In the course of the illness, one-third of people with prediabetes will become Diabetes Mellitus, one-third will remain as prediabetes and another third will be normoglycemia⁶. Prediabetes risk factors are similar to risk factors for diabetes mellitus and include heredity, poor diet, and

lack of physical activity, aging, medication, smoking, and stress⁷.

Stress is a disorder of the body and mind caused by changes and demands of life, are influenced by the environment and the appearance of individuals within the environment, and can have a total impact on individuals, on both physical, intellectual, and psychological aspects, as well as social and spiritual, which can threaten physiological balance⁸. Stress that occurs at this time, is part of the effects of modern life, and cannot be avoided, both in the work environment, and school, as well as the family and society. Some modern lifestyles that cause stress include work, where today many people whose lives are very busy with work, they leave early in the morning and just go home at night, because they have a certain target goal, not to mention facing traffic congestion when leaving and going home from the office. They are also used to doing many activities at a time, as well as the demands of a highly competitive job world that also can cause stress. In addition, family life in the present is also not free from stress, when family members (father, mother, and children) do not have enough time to be together, many mothers who have multiple roles as housewives and as workers who sometimes make children isolated, when children lack love, and because they do not have time to prepare food at home, family members are forced to buy food outside, and often buy fast food that is less good for their health³.

In the state of stress the secretion of the hormone cortisol increases, which pushes the pancreas to produce insulin, then hyperinsulinemia occurs so that there is an increase in blood sugar levels⁹. In addition, increased secretion of the hormone cortisol also causes increased glucose production by the liver and disrupts the use of glucose in muscle tissue and increases fat by fighting against the work of insulin¹⁰.

METHODS

This research was a quantitative study with a cross-sectional design. The population of the research was the residents of Sleman Yogyakarta. The subjects of the study were the patients who were in the working area of *Puskesmas* Sleman, in the Yogyakarta District with the following inclusion and exclusion criteria and a sample size of 155. Selection of research samples was done by simple random sampling method. The inclusion criteria were: 25-65 years old, live in Sleman or live in the Sleman area and are willing to be respondents by signing the informed consent form. While the exclusion criteria were: aged less than 25 years and over 65 years, pregnant women, previously diagnosed DM, diagnosed DM on blood tests, and did not sign the informed consent form. The diagnosis of prediabetes was done through 2 stages, namely by examining fasting blood glucose and oral glucose tolerance test (TTGO). Blood sampling was done with venous blood which was then examined in the Clinical Pathology laboratory. Measurement of stress levels used the Perceived stress scale (PSS) questionnaire, where stress levels were categorized into mild, moderate and severe stress levels. This research consisted of two variables namely the dependent variable (bound) which was prediabetes and the independent variable (free) which was stress level. Analysis of research results used univariate analysis to give a description of the characteristics of each data collected, and bivariate analysis was conducted to determine the relationship between the dependent variable and independent variable. The statistical test used was the Chi-Square test.

RESULTS

After giving the explanation of the research procedure and signing the informed consent, we enlisted 180

Table 1. Distribution of Research Subjects by Characteristics

Variables	Frequency	Percentage*
Gender		
Men	34	21.9%
Women	121	78.1 %
Age		
Average and SD	46.7 years old (SD±11,02)	
Age <45 years old	67	43.2 %
Age ≥ 45 years old	88	56.8 %
Level of education		
No school	15	9.7%
SD or equivalent	20	12.9%
SMP or equivalent	31	20%
SMA or equivalent	56	36%
Diploma or equivalent	10	6.5%
S1 or equivalent	18	11.6%
Postgraduate or equivalent	5	3.2%
Work		
Housewife	77	49.7%
Private / Civil Servants	45	29.1 %
Etc.	33	21.2 %
Stress level		
Light	69	47.1%
Medium	80	49.0 %
Weight	6	3.9%
Prediabetes based on TTG		
Normal	136	87.7 %
Prediabetes	19	12.3%

people who were willing to be the subjects of research. However, based on profound anamnesis and blood glucose examination results, 25 people were excluded from the study, bringing the total subjects to 155 respondents. The results of the univariate analysis included a description of the distribution of respondent's characteristics of gender, age, education level, occupation, stress level, and sugar content.

Table 1 shows the mean age of the study subjects was 46.7 years (SD 11.02). There were more subjects with age ≥ 45 years older than the age of fewer than 45 years. The dominant distribution of female subjects was 78.1% compared to men as much as 21.9%. The highest level of education was SMA or equivalent as much as 36%, while

almost half worked as a housewife which was 49.7%. Based on a total of 155 respondents, 19 respondents (12.3%) were diagnosed with prediabetes based on TTGO results and 136 people (87.7%) had normal TTGO results. Based on a total of 155 responders, moderate stress levels were most commonly experienced by respondents compared with mild and severe stress levels

The result of bivariate analysis in Table 2 shows data results which were analyzed using Fisher Exact statistic test. The results of the tests show that there was no correlation of stress level with prediabetes occurrence in Sleman Yogyakarta region, and $p=0.825$ (CI 95%: 0.879-1.67) was not statistically significant ($p>0.05$), where the Confidence Interval passed the value of 1.

Table 2. The relationship of Stress Level with Prediabetes Occurrence

Prediabetes Stress Level	Prediabetes Stress Level	
	Yes	No
Weight	2 (12%)	4 (4%)
Medium	10 (52%)	70 (51%)
Light	7 (36%)	62 (45%)

$\chi^2 p=0.250$ (CI 95%: 0.901-1.889), Fisher Exact $p=0.825$ (CI 95%: 0.879-1.67)

Table 2 also shows an overview of prediabetes and non-prediabetes stress levels, where prediabetes found the most common stress level was moderate stress (52%) compared with mild and severe stress levels. In non-prediabetes the same results were also obtained, namely, the most stress was the level of moderate stress (51%) compared to mild and severe stress levels.

The result of bivariate analysis in Table 3 shows Fisher Exact test was used to find any correlation between age and prediabetes occurrence. The result showed no correlation

between age and prediabetes event in Sleman Yogyakarta and $p=0.100$ (95% CI: 0.988-2.117) was not statistically significant ($p>0.05$) where the Confidence Interval value passed the value of 1.

Table 3 also shows that respondents older than 45 years (12.5%) are more likely to experience prediabetes compared to those with age less than 45 years. The age of fewer than 45 years of pre-diabetes tendency was then compared to age over 45 years.

Table 3. Age Relationships with Prediabetes Occurrences

Age of Prediabetes	Age of Prediabetes	
	Yes	No
Age <45 years old	8 (11.9%)	59 (89%)
Age ≥ 45 years old	11 (12.5%)	77 (87.5%)

$\chi^2 p=0.916$ (CI 95%: 0.726-1.937), Fisher Exact $p=0.100$ (CI 95%: 0.988-2.117)

DISCUSSION

In this study, the prevalence of prediabetes aged 25-65 years was 12.3%, and this number was higher than the prevalence rate found in Soewondo and Pramono³ study on the prevalence of prediabetes in Indonesia using secondary Riskesdas 2007 data in 33 provinces which had a prevalence of prediabetes in Indonesia of 10%. The results of this study were also higher than the prevalence of prediabetes in the DIY region of 11.2% (prevalence of prediabetes predicted by prevalence ratio prediabetes doubled prevalence of DM, taken from the prevalence of DM diagnosed by doctors for DIY with a total prevalence of 5.6%). A high prevalence rate is a matter of serious concern because diabetic patients are often unaware of the presence of the disease. Even when diagnosed, more than half of the patients had microvascular complications. Therefore, it is wise if diabetes can be prevented and detected when the patient is experiencing prediabetes¹¹.

This study shows that the highest prevalence of prediabetes occurs in late adult age (≥ 45 years) which was 12.5%. This finding is in line with the Soewondo and Pramono³ study that showed getting older increases the risk for developing prediabetes. The age-related United States Preventive Services Task Force (USPSTF) guidelines recommend screening or screening prediabetes at the age of over 45 years periodically every 3 years. This recommendation is also included in the consensus on the prevention and treatment of type 2 DM, which is recommended for age screening > 45 years if one does not have the classic symptoms of DM¹². Physiologically at the age of more than 30 years, there will be a fasting blood glucose rise of about 1-2 mg/dl per year and blood glucose after eating about 5.6 to 13 mg per year¹³. Whereas in elderly prediabetes can occur at the age of 60-79 years¹⁴. Patients with age ranging from 40 years are susceptible to DM although not excluding the possibility of occurring at

age below 40 years. This pattern happens because most people experience physiologic decline that drastically decreases rapidly at the age of 40 years. This decrease will lead to a decrease in the function of the pancreas to produce insulin¹⁵.

The result of the bivariate analysis showed that there was no correlation between stress level and prediabetes occurrence in Sleman, Yogyakarta with $p= 0.825$ (CI 95%: 0.879-1.67), which was not statistically significant ($p> 0.05$). This finding is in line with William's study¹⁶ that found there is no perceived stress relationship with prediabetes events in Australia. It is possible that there are several other contributing factors and pathophysiological processes of stress affecting glucose levels in an acute and inconsistent manner. In addition, some confounding factors are also potentially leading to increased blood glucose intolerance such as low energy levels and health status, and physical inactivity¹⁷. Heikes *et al.*¹⁸ argued that the three main factors that contribute to the pathogenesis of prediabetes are diet, physical activity, and inherited genes. Some other conditions that can be related to what is eaten as well as an activity are increased blood pressure and heart disease. Result of statistic test of patient's blood glucose level compared with stress level concluded that there was no difference between the three categorical stress level in the research subjects with $p= 0.954$ ($p> 0.005$). This finding may also be influenced by other factors such as drug consumption which may also affect the condition of prediabetes such as steroid tablets, and treatment for schizophrenia and AIDS.

The results of this study are not in line with the results of research Puustinen *et al.* in 2011¹⁹ which indicated that there is a relationship of psychological stress with the incidence of prediabetes after the adjustment of other factors, i.e. age gender, sociodemographic, and health behavior. Similar results were also obtained in the Wisnatul Izzati and Nirmala²⁰ studies conducted in Bukittinggi in 2015, which had results indicating a significant relationship between stress and blood sugar levels.

In the Suwondo and Pramono³ study, there are 8 risk factors associated with pre-diabetes events. These factors include male sex, age greater than 58 years, high socioeconomic status, low level of education, hypertension, obesity, central obesity, and smoking become risk factors in prediabetes patients. In addition, several factors that may cause no relationship between stress levels and the incidence of prediabetes in this study, were among others, respondents' perceptions of stress, respondent's stress coping, duration of stress experienced, and other predominant risk factors for prediabetes, among others, hypertension, central obesity, lack of physical activity and obesity. These risk factors can also simultaneously trigger the emergence of prediabetes.

Limitations in this study include the fact that most of the respondents were women, (Selection bias), and this is possible because the measurement was done during working hours, so many men were the artwork. Improper subject selection will affect the result because it is not

an accurate representative or true representative of the population. This fact can be seen from the unequal distribution of sex where most of the women who are not working are housewives. Another limitation of this recall is that it occurs when the interviewee has to answer the questionnaire of the stress level in accordance with his / her retrospective memory so that the accuracy of the answer depends on the respondent's ability and the willingness of the respondent to answer truthfully. Recall biases can result in misclassification due to the possibility of the subjects' improperly estimating stress levels. Prevalence of high prediabetes in Sleman region needs to get special attention especially by primary service physicians who should be more vigorous doing the promotive and preventive effort, so it is expected prediabetes patients not become diagnosed with Diabetes Mellitus. It is necessary to conduct further research using a cohort method with sufficient time to be able to see and follow the research directly, with larger sample size and more structured sampling method so that distribution of other factors that can influence the incidence of prediabetes like the proportion of sex of research subject can be more equally distributed

CONCLUSION

From the results of the study, we concluded there is no correlation of stress level with the occurrence of prediabetes in Sleman Yogyakarta. The description of stress level in prediabetes sufferers in Sleman Yogyakarta region was more dominated by moderate stress level than mild and severe stress level. Prediabetes prevalence in Sleman District was higher than the prevalence found in Indonesia and D.I.Y.

Ethical Approval and Informed consent

This study had obtained a research permit from the Medical and Health Research Ethics Committee (MHREC) Faculty of Medicine, Public Health and Nursing, Universitas Gajah Mada with No Ref: KE/FK/0017/EC/2018. If the respondent was willing to participate, and had read and understood the information contained in the information sheet, then the respondent was required to sign the informed consent form. All information relating to the identity of the study subjects will be kept confidential and was only known by the researcher.

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Data and Material Availability

For readers who want to access data and materials can contact the author via email husmarininovi@yahoo.com

Conflict of Interest

None

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