

The Effect of Depression, Anxiety, and Stress on Blood Sugar in the Elderly Based on the Aspect of Islamic Psychology

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Abstract—Diabetes mellitus has been treated using drug therapy and a strict diet as food intake. However, there has not been much treatment related to the effect of psychological factors as the cause of physical illness. According to the Qur'an, the emergence of Diabetes Mellitus is caused by two main things, namely psychological condition (response to stress, anxiety, and depression) and poor dietary factors. The psychological condition in the Qur'an is referred to as *ba's*, which can affect blood sugar level and insulin metabolism. Overeating can also cause a person to be unable to use glucogen and the fat stored in the body as an energy source. This research aims to find out the correlation between depression, anxiety, and stress toward blood sugar in the elderly. This research uses correlational quantitative method design, and the data is collected using DASS test to measure the level of depression, anxiety, and stress with validity of 0.266-0.769 and reliability of 0.939. Meanwhile, the blood sugar level is measured through rapid blood glucose test using blood sugar strips. This study uses a purposive non-random sampling technique with the criteria of being active elderly participants at the Integrated Health Service Post and willing to become research participants by firstly giving informed consent. The results show that there is a very strong correlation between depression, anxiety and stress on blood sugar level in the elderly with a correlation of 0.888 which means that the higher the level of depression, anxiety, and stress in the elderly, the higher blood sugar level in the elderly.

Keywords—*Depression, Anxiety, Stress, Diabetes Mellitus*

I. INTRODUCTION

Based on data from Diabetes Atlas, the 6th edition published by the International Diabetes Federation (IDF) in 2014, of a total of 425 million people worldwide, about 8.8% of adults aged 20-79 years have diabetes. The latest data from Basic Health Research (Indonesian: *Riset Kesehatan Dasar*, abbreviated as *Riskedas*) reveal that in 2018 the prevalence of diabetes in Indonesia generally increased significantly over the past five years. In 2013, the prevalence of diabetes in adults reached 6.9% and in 2018 it continued to surge to 8.5%.

Indonesia ranked fourth after India, China, and the United States in terms of the world's highest prevalence of diabetes. In fact, the number of people with diabetes continues to increase every year. WHO data (2012) estimate that the number of people with type-2 diabetes mellitus (DM) in Indonesia will have increased significantly to 21.3 million by 2030.

Diabetes mellitus (DM), better known as the sweet urine disease, is a condition in which metabolism is disrupted as a result of the body's inability to produce or supply insulin, causing an increase in blood sugar levels that exceed the normal level. The diagnosis of DM is established after examining blood sugar levels, and it cannot be made based on the presence of glucosuria. The diagnosis has to be made based on the examination of blood sugar, preferably the enzymatic examination of sugar with venous plasma blood, or using different diagnostic criteria figures based on WHO standards, while to monitor the outcome of the treatment a capillary blood sugar examination using a glucometer can be performed (Derek et al., 2017).

The discussion of diabetes always relates to blood sugar. One is said to have diabetes if his/her blood sugar level is above normal. Diabetes mellitus is a chronic metabolic disorder characterized by an increase in blood glucose, causing hyperglycemia. Diabetes mellitus results from an imbalance between the supply of glucose and the need to use it in cells in support of metabolism and cell growth. In the event of the reduced supply or lack of insulin, glucose will be retained in the blood and this causes an increase in blood sugar, while cells will lack glucose, which is vital for the survival and function of cells (Izzati & Nirmala, 2015). Diabetes mellitus can cause various kinds of serious complications in body organs such as eyes, kidneys, heart, and blood vessels. To prevent more serious complications, it is necessary to conduct an early diagnosis of DM to allow early intervention (Tandra, 2007).

Diabetes mellitus is a disease that interferes with metabolism in the body, making it unable to metabolize carbohydrates, fats, and proteins due to lack of insulin. Generally, diabetes mellitus is classified into two: type 1 and type 2. The first is a type of diabetes that relies on insulin while the latter does not. Diabetes mellitus is characterized by an increase in the blood glucose level above normal (Janitra and Sandika, 2018).

According to ADA (2012) and PERKENI (2011), one is diagnosed as having diabetes if the examination result of fasting blood plasma glucose (a condition of no calorie intake for a minimum of 8 hours) is higher than or equal to 126 mg/dl or the examination result of plasma glucose 2 hours after loading is higher than or equal to 200 mg/dl or the examination result of random plasma glucose is higher than or equal to 200 mg/dl with accompanying classic complaints such as polyuria, polydipsia, polyphagia, and weight loss due to unknown causes (Riskedas, 2018).

The increasing number of people with diabetes mellitus is associated with several factors, including: heredity, obesity, lifestyle changes, wrong diet, drugs that affect blood glucose levels, lack of physical activity, aging, pregnancy, smoking habit, and stress (Muflihatin, 2015).

Based on the stages of development, elderhood is the last stage in the human life cycle. These stages of human development clearly show that growing old is something that is the inevitable for humans. As elderhood is the final period of the human development stages, the elderly have gone through the previous stages (Nuryoto and Afiatin, 2013). The elderly will experience some setbacks in terms of their physical and mental aspects. They also experience stress and psychological suffering such as sadness, depression, inner conflict, guilt, and an inferiority complex. Such impact will determine how the elderly adjust to their environment. Elderhood as the final stage of human development has a series of developmental tasks to fulfill in order that a positive self-image as an elderly person can be built up, which is realization of successful aging.

According to Suardiman (2011), problems generally facing the elderly can be classified into: economic problems, socio-cultural problems, health problems, and psychological problems. Budihardja (2008) adds that the elderly undergo a deterioration of cells due to the aging process which results in weak organs, physical deterioration, emergence of various diseases, especially degenerative ones. Elderhood is characterized by decreased physical function and susceptibility to various diseases. Such susceptibility results from the decreased function of various organs. Health problems are the most common problems among the elderly. In fact, they expect to lead a healthy life during their elderhood. To this end, a healthy lifestyle, nutritious and balanced diet, sports activities, and non-smoking habit are some measures to prevent health problems and diseases among the elderly. Samino (2002) states that the expectation of staying healthy is reflected in the various activities which the elderly can join, such as elderly gymnastics, health lectures, management of dietary patterns, active participation in social activities.

The ageing process is indicated by biological deterioration that can be seen from the symptoms of physical deterioration such as loose skin, wrinkles, gray hair, teeth starting to fall out, reduced hearing and vision, and fatigue (Depkes RI, 1998). Furthermore, Suardiman (2011) mentions that generally health problems are the most severe problems facing the elderly, which result from a decline in the function of various organs such as: heart, kidneys, lungs, and the immune system. Physical degradation which then results in various functional disorders and diseases among the elderly affects not only physical conditions, but also psychological ones such as the feelings of inferiority, alienation, uselessness, helplessness, sadness, loneliness, and so on which hinder their activities. If such a condition happens continuously without any effort to stop it, this will lead to depression.

In addition to physical problems, the elderly deal with psychological problems as well, which generally include feeling lonely, alienated, helpless, and useless; lacking confidence; and so on (Depkes RI, 1998). Seligman and Csikszentmihalyi (2000) assert that psychology can be used to overcome psychological and emotional problems in order to prevent depression among the elderly.

Diabetes results from psychological factors and poor diet. The psychological factors include lack of positive thinking habits. Positive thinking is the key to healthy living and it can minimize negative emotions, including depression, anxiety, and stress. Negative emotions occur because of a demand and one's responses to such a demand. Negative thinking gives rise to negative emotions that affect biological conditions in one's body. In the Qur'an, stress and negative emotions are referred to as *ba's*. Excessive negative emotions may affect blood sugar levels and metabolism of insulin.

Besides resulting from negative emotions, diabetes is also caused by poor diet, for example eating too much. As mentioned in the Qur'an in Surah Al A'raf verse 31 "Eat and drink, but do not be extravagant. Surely He does not love the extravagant. This is because excessive food can cause degenerative diseases.

Based on the above-mentioned factors causing diabetes mellitus, this research aims to determine the relationship of depression, anxiety, and stress with blood sugar levels in the elderly.

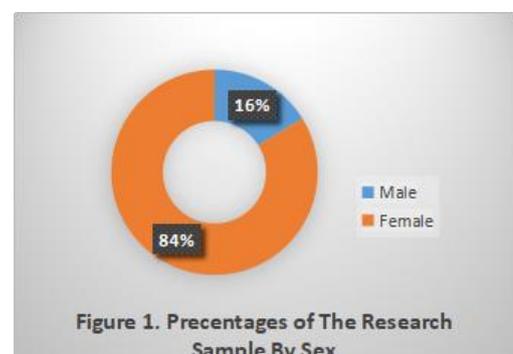
II. METHODS

This research employed a correlational quantitative research design. Its independent variables included depression, anxiety, and stress, while the dependent one was blood sugar. Depression, anxiety, and stress were measured using DASS Tests with validity ranging from 0.266-0.769 and reliability of 0.939. Validity and reliability tests were performed using corrected item-total correlation. Blood sugar was measured using a rapid blood glucose test using blood sugar strips. In this research, the population was comprised of all the elderly in the village of Kayuapak, Polokarto, Sukoharjo. This research adopted a purposive non-random sampling technique with inclusion criteria including the participants actively participate in the neighborhood health center for the elderly and are willing to participate in this research by first completing the informed consent. Data normality was tested using the Kolmogorov-Smirnov test while linearity was tested using the test of linearity. The research data were analyzed using a multiple linear regression analysis with SPSS 23.

III. RESULT & DISCUSSION

This research used a sample of 37 active elderly participants of the neighborhood health center with the following age categorization: Middle Age = 45-59 years old (30%), Elderly = 60-74 years old (62%), Old = 75-90 years old (8%), and Very Old = ≥ 90 years old (0%).

The percentages of the research sample by sex were 84% of females and 16% of males. This was because the majority of active elderly participants of the neighborhood health center were female as at those age ranges, most women tend to have stop working while men do not, preventing these men to actively participate in activities held by the neighborhood health center for the elderly.



Based on results of the prerequisite test prior to conducting a multiple linear regression analysis which included normality and linearity tests, it was revealed that the data were normally distributed and linear. This was evident from results of the normality test using the Kolmogorov-Smirnov test in which all variables, i.e. depression, anxiety, stress, and blood pressure, had a value of > 0.05 (i.e. depression by 0.107; anxiety by 0.2; stress by 0.2; blood sugar by 0.06), meaning that the data were normally distributed.

Based on linearity test results using the test of linearity, it was revealed that it had a significance value of $0.000 < 0.05$, meaning that the data were linear. Having fulfilled both the normality and linearity requirements, the data may undergo hypothesis testing using a multiple linear regression analysis.

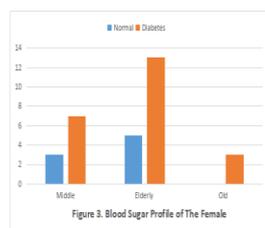
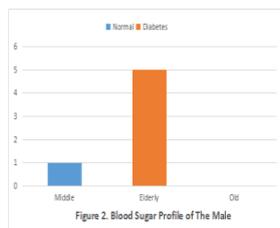
Table 1 below lists percentages of the research data included in the classification of blood sugar levels.

Table 1. Resulting Percentages of the Fasting Blood Sugar Examination

Blood Sugar Classification (Perkeni, 2011)	Fasting Plasma	
	Glucose (mg/dL)	Percentage
Normal	70-126	24 %
Diabetes	> 126	76%

The table shows that 24% of the research participants had normal blood sugar levels while 76% belonged to the diabetes classification. Hypothesis testing using a multiple linear regression analysis technique generated an R value of 0.888, meaning that depression, anxiety, stress, and blood sugar levels in the elderly are strongly correlated.

The following figure compares the blood sugar profiles between the male and female elderly participants. Based on the figure, it can be seen that most of the samples belonged to the elderly age group. For the male sample, diabetics were found in the elderly age group, while for the female sample, they were evenly distributed from the middle, elderly, and old age groups.



The psychosocial stages give birth to crises and challenges during each stage of development. The elderly, who are at the period of advanced development, are at the developmental stage of ego identity versus desperation. Once the elderly feel that they have met and fulfilled all of their life goals and plans, a significantly positive and productive

condition will be achieved. Conversely, when they feel that many things in their lives do not go according to plan and fail to realize their life goals, such conditions may drive them to depression and despair. Erikson states that the elderly are at the stage or phase of self-integrity versus despair (Santrock, 2007).

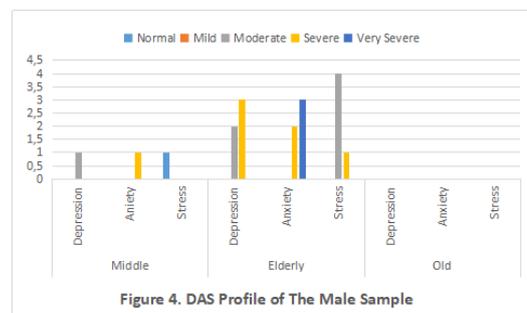
The average life expectancy of the female elderly is 4-7 years longer than that of the male elderly, which is possibly influenced by several factors such as: self-care, social support, health problems, cleanliness, lifestyle, work, and so on. The life expectancy-related gender difference in the 20th century shows that women live longer than men, with a ratio of 3:2. Furthermore, the number of the female elderly with a widowed or divorced status is higher than the number of the male elderly having the same status. (Papalia, 2010).

Suardiman (2011) states that among the factors that increase the life expectancy of the elderly include: normal blood pressure, not developing diabetes, low cholesterol, good health, low-fat food, and a happy marriage. Conversely, the factors that can reduce the life expectancy of the elderly include: high blood pressure, suffering from diabetes, high cholesterol, poor health, high-fat food, and getting divorced or not married.

Prolonged loneliness makes the elderly prone to depression, which is an emotional disorder characterized by the feeling of distress, sadness, despair, lack of enthusiasm, and pessimism about life. Depression in the elderly can affect cognition, behavior, and anxiety, and cause the sufferer to be a burden to others. (Hawari, 2001).

Depression, anxiety, and stress are factors influencing cardiovascular diseases and their complications, including hypertension and type-2 diabetes mellitus. Such a risk is higher among the elderly compared to the other age groups (Dominguez, Galioto, Pineo, Ferlisi, Ciaccio, Putignano, 2010).

Based on the profile of negative emotions, which are comprised of depression, anxiety, and stress, of the male sample, it is revealed that as his/her age increases the category of negative emotions one develops is more severe. In the middle age category, stress belongs to the normal category, depression belongs to the moderate category, and anxiety belongs to the severe category. In the elderly category, stress belongs to the moderate to severe category, depression also belongs to the moderate to severe category, and anxiety belongs to the severe to very severe category.



The profile of negative emotions consisting of depression, anxiety, and stress of the female elderly is higher than that of the male elderly. In the middle age and elderly

categories, depression belongs to the mild to extremely severe category, anxiety belongs to the severe to extremely severe category, and stress belongs to the normal to severe category. In the old age category, stress belongs to the moderate to severe category, depression belongs to the severe to extremely severe category, anxiety belongs to the extremely severe category, and stress belongs to the moderate to extremely severe category.

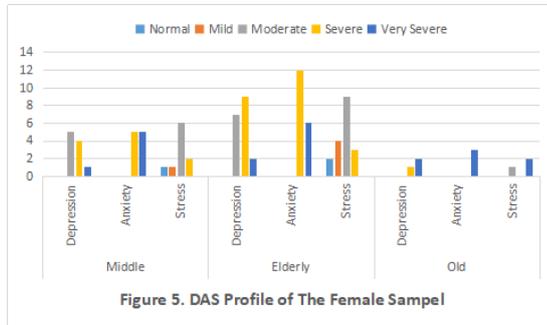


Figure 5. DAS Profile of The Female Sample

The data analysis using a multiple linear regression analysis generated a correlation of 0.888, meaning that depression, anxiety, stress, and increasing blood sugar levels are strongly correlated among the elderly. The R-squared value is equal to 0.789, meaning that the variables depression, anxiety, and stress simultaneously contribute to an increase in blood sugar levels at a percentage of 79%, while the remaining 21% is caused by other factors

This can be explained using biochemical reactions, i.e. starting from demands to which one will respond by trying to meet such demands. Such responses can be either positive or negative ones. Negative responses will result in negative emotions. These negative emotions give rise to biochemical reactions in the body. In the body, responses are produced through the neural and neuroendocrine systems. The neural system will trigger the release of norepinephrine. This hormone triggers the frequency of the heartbeat. The neuroendocrine system will trigger the release of adrenaline and cortisol. These hormones trigger one's heart rate, respiratory rate, and appetite. As a result of the reaction between norepinephrine, adrenaline, and cortisol, there is a transfer of glucose in the blood to be used as energy for the muscles. This will hamper the function of pancreases, resulting in insulin resistance and in turn making glucose unable to be transferred from the blood, which causes an increase in the blood sugar level.

Diabetics tend to have a history of chronic stress and negative emotions compared to any individuals with normal blood sugar levels. Chronic stress and the endocrine system's response to stress are significantly related to blood sugar levels, insulin resistance, and the prevalence of diabetes mellitus (Siddiqui, Madhu, Sharma, Desai, 2015). Chronic stress is associated with the onset of metabolic diseases, including diabetes mellitus (Tamashiro, Sakai, Shively, Karatsoreos, Reagan, 2011).

Increased blood sugar levels aka hyperglycemia are related to the ability to control emotions, make negative responses, and lack patience (Thoolen, Ridder, Bensing, Gorter, Rutten, 2008)

The hypothalamus gland's inability to control hormones under stressful conditions causes various changes in bodily functions at various levels such as tissue, organs or systems

and ultimately causes various diseases, one of which is diabetes mellitus (Mitra, 2008).

From religious perspectives, it is revealed that the psychological aspect is related to the peace of mind. Allah says "those who spend (benevolently) in ease as well as in straits, and those who restrain (their) anger and pardon men; and Allah loves the doers of good (to others)." (Ali Imran [3]: 134). People who refuse to forgive or are consumed by anger and revenge are found to have less strong immunity, higher blood pressure, muscle tension, and heart rate. On the contrary, forgiveness improves recovery of heart and blood vessel diseases and reduces anxiety and stress levels. From a clinical point of view, it can be concluded that excessive anxiety and stress can lead to DM as explained in biochemical reactions in the body above.

This finding is explained further in the following God's words: "O Adam's grandchildren! Wear your clothes that are good for every (entering) mosque, eat and drink, but don't overdo it. Really, Allah does not like people who are over-exaggerated." (Al-A'raf [7]: 31).

In the middle to the end of this verse, Allah indicates a very fundamental health principle, which is to manage diet. This verse was used by the Caliph Ali ibn Abi Talib to answer a Jew saying that he could not find a single verse in the Qur'an that concerned health, to which Ali ibn Abi Talib intelligently answered using a theorem from surah Al-A'raff verse 31. Diabetes mellitus (DM) is popularly known by the public as a sweet urine disease or a chronic disease characterized by an increase in blood sugar levels as a result of a disruption to the metabolic system in the body. This may be caused by the failure of the pancreas to produce insulin as needed. There are many factors triggering this disease other than unhealthy diet as it can also be viewed from the perspective of religiosity, among other things.

According to the Qur'an, diabetes can be treated by dhikr and fasting. Dhikr is a way to make one feel relaxed to reduce stress while fasting plays a role in managing diet. Stress management is vital for health, especially among diabetics. A study conducted by Duke University in Durham, North Carolina found that when one does relaxation techniques, A1C levels will tend to lower. A1C is a parameter indicating the progression of diabetes mellitus. When one feels relaxed and can manage stress, his/her blood sugar level is more stable (Wagner, Armeli, Tennen, Millan, Escamilla, 2018).

Dhikr is one of ways to cope with stress, consistent with God's words which means "(Namely) those who have believed and whose hearts are assured by the remembrance of Allah. Unquestionably, by the remembrance of Allah hearts are assured." (Ar-Ra'd [13]: 28). Assurance that comes from the heart because of dhikr turns out to have a favorable effect on the peace of mind, preventing anxiety and stress.

Dhikr can lower stress levels because it makes one calm down and suppresses the sympathetic nervous system and activates the parasympathetic nervous system. The two nerves have opposite functions. The first stimulates the function of organs while the latter inhibits the function of organs. In patients with diabetes mellitus who do not do dhikr, the blood sugar level in their body certainly cannot be controlled compared to diabetic patients who do dhikr. It is known that physiology of the human body is controlled by a

hormonal system. In the event of disruption to such a system, it will disrupt the function of the relevant organ and eventually will result in anatomical disorders if this condition continues.

During fasting, glycogen in the body will be broken down into glucose, thus reducing blood glucose levels (Musbikin, 2010). It is vital to manage diet in patients with diabetes mellitus. One way to control diet is to do fasting, both fasting during Ramadan and sunnah fasting which one can do at any time. During fasting, calories in the body will decrease and the body will break down glycogen into glucose (Salim, 2007).

This is consistent with Bener & Yousafzai (2014) that blood glucose levels in patients with diabetes mellitus fasting during Ramadan decreased significantly compared to blood glucose levels before Ramadan. Fasting can reduce blood sugar and cholesterol levels, and control blood pressure. Therefore, fasting is highly recommended for people with DM. By fasting, one can refrain from eating much food which contributes to various diseases, especially obesity, hypercholesterolemia, diabetes, and other diseases due to an excess of nutrients. Fasting helps stabilize blood glucose levels because of a more regular diet and relatively the same calorie intake every day, and helps control an increase in glucose and insulin levels in the body. Moreover, it helps lower glucose levels, blood pressure, and triglycerides as well. A decrease in blood sugar levels during fasting also results from a decrease in insulin secretion.

IV. CONCLUSION

Based on findings of this research, it can be concluded that there is a strong correlation between depression, anxiety, and stress, and blood sugar levels in the elderly. Negative emotions, i.e. depression, anxiety, and stress, simultaneously contribute to increasing blood sugar levels by 79%, while the remaining 21% is caused by other factors. Measures to prevent diabetes from the perspective of Islamic psychology include dhikr as a way to feel relaxed and manage stress, and fasting as a way to manage diet.

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