Relationship Between Medication Adherence and Blood Sugar Levels Among Diabetes Mellitus Outpatients

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ABSTRACT

Diabetes Mellitus (DM) is a disease with progressively increasing prevalence every year and often leads to complications when not properly managed. Control or success of treatment is influenced by adherence of patients to the treatment process. This study aimed to analyze relationship between medication adherence and fasting glucose levels among DM outpatients. A correlation study was conducted using a cross-sectional approach on a sample of 300 respondents selected by probability sampling technique from the entire population. The instrument used was the MMAS-8 Test (Morisky Scale Medication Adherence Scales-8) and examination of fasting sugar levels. Meanwhile, data analysis was conducted with the Spearman Rho test. The results showed that the highest treatment adherence was in the moderate category by 130 (43.3%) and a decrease in fasting sugar levels was observed among 230 (76.7%) respondents. A significant relationship was found between medication adherence and fasting glucose levels with a p-value = <0.001 and r: -0.597. Based on the results, there was a negative relationship between medication adherence and fasting blood sugar. The higher medication adherence, the better the fasting sugar levels in DM outpatients.

INTRODUCTION

The global population suffering from Diabetes Mellitus (DM) in 2030 is expected to reach approximately 366 million in Indonesia according to the World Health Organization (WHO). Moreover, the International Diabetes Federation (IDF) estimated that the prevalence of DM will increase with the rising age of the population affecting 19.9% or 111.2 million among people aged 65-79 years. The prevalence is expected to reach 578 million in 2030 and 700 million in 2045.[1]

DM is a type of non-communicable disease with a progressively increasing prevalence every year. This disease is better known as a silent killer because it is not often noticed by sufferers until complications arise.[1] DM has the highest prevalence at the age of 55 to 64 years and tends to be higher in women.[2] Indonesia is ranked the seventh country with the most DM sufferers in the world after China, India, America, Brazil, Russia, and Mexico.[1] Furthermore, DM is the third most common cause of death accounting for 6.7% mortality below stroke (21.1%) and coronary heart disease (12.9%). At the regional level, Central Java ranks eleventh among cities with a 2.1% prevalence of DM.[1] Based on the 2018 Riskesdas results, the prevalence in Boyolali Regency is 2.2% with an estimated sufferers of 18,325 in 2021.[3]

As a metabolic disease, DM is characterized by hyperglycemia or an increase in blood sugar above normal, glucose secretion in the urine due to lack of insulin secretion, decreased insulin action, or both. Type II DM is caused by a lack of insulin production by pancreatic beta cells or the inability of the body to optimize use.[4] Insulin is a hormone that functions to control blood sugar balance. DM management demands consider-able time and patience due to the chronic nature, requiring medical support and family assistance.

One of the risks of DM is an unhealthy lifestyle, in this context, lifestyle describes the pattern of behavior in the patient's daily life that influences physical condition. This includes diet, weight control, sleep habits, and regular exercise. Lifestyle can be used as a window into the personality of each individual, with a healthy lifestyle mitigating an increase in DM.[5]

The World Health Organization (WHO) defines adherence to long-term medication as "the extent to which a person taking medication, following a diet, or making lifestyle changes, conforms to agreed recommendations from health care providers".[6] Compliance stems from the basic word 'obedient' which means complying with an order given by someone.[7,8] Strict adherence to taking medication prevents chronic DM disease,[9,10] while non-adherence is currently an important problem. Factors contributing to medication adherence include gender, level of knowledge, number of drugs taken in a day, family support, and support from health workers.[11] Low levels of education and knowledge are related to low adherence, including daily health status.[12] Another factor is controlling body weight through diet.

Adherence to long-term therapy for chronic diseases in developed countries averages 50%.[13] Health workers must also monitor patients to ensure an appropriate level of adherence with medication which correlates with fasting blood sugar. The monitoring must be carried out repeatedly or periodically.[14]

In Indonesia, adherence to taking medication varies among DM patients, with the low-level category being more dominant.[15] Several studies have found that patients with controlled blood sugar tend to have good medication adherence,[5,16] contributing to the quality of life.[17]

PKU Aisyiyah Hospital of Boyolali is a trusted healthcare facility for the examination and treatment of DM patients. As a private hospital competing with state facilities, the right strategy is needed in providing services to gain customer trust and satisfaction. Based on data from the Medical Records in 2021, the total number of DM patients who visited every month for treatment was estimated at 300 (PKU Aisyiyah Boyolali Hospital Medical Records data, 2021). The patients also required proper management to prevent further non-communicable diseases such as heart, stroke, kidney failure, and others.

The success of treating non-communicable diseases is not only influenced by the quality of health services, and support from the family, but also by patient adherence. This factor plays a crucial role in the failure to control blood glucose in DM patients. The PKU Aisyiyah Hospital has not yet reached the target for DM control, showing the need for efforts to monitor glycemic control.[16] Medical personnel have been given special assignments to provide education

related to treatment, specifically for new DM patients and treatment education to enhance adherence.[17]

This study aimed to analyze relationship between medication adherence and fasting sugar in DM outpatients. The results will be used as a portrait of the performance of health workers, specifically in relation to service and developing follow-up plans for both families and patients.

MATERIAL AND METHOD

This correlation study was conducted with a cross-sectional approach at the PKU Aisyiyah Boyolali Hospital Outpatient Center from June to September 2021. The population comprised type II DM patients who were allowed to go home after receiving education about medications. Nurses also checked compliance with treatment and medication as well as fasting blood sugar during one month of control in April 2021. The sample included 300 patients selected using probability sampling, with data retrieved from the Medical Records.

The inclusion criteria were 1) type II DM patients with fasting blood sugar ≥ 126 mg/dl in outpatient room, and 2) received oral drug therapy. On the other hand, the exclusion criteria included 1) patients not fasting at the time of checking the fasting blood sugar, and 2) not present for control in the following month.

The instrument used for medication adherence measurement was MMAS-8 (Morisky Scale Medication Adherence Scales-8) consisting of eight questions with firm answer types of "Yes" and "No" in the form of closed-ended questions. Another instrument was the examination of fasting blood sugar levels in the Hospital Laboratory. MMAS-8 has been tested for validity and reliability in many cases, including a study in 2016 that measured adherence to anti-cholesterol medication.[18] The results showed moderate internal consistency (Cronbach's α=0.759) with good test-retest reliability (Spearman coefficient=0.860). Another study in 2021 measured adherence with chronic pain treatment and found that the Cronbach's α coefficient was 0.625, suggesting the internal consistency was relatively satisfactory. The Pearson correlation coefficient was 0.845 ($p<0.001$), showing high convergent validity.[19]

The MMAS-8 instrument was used when patients visited for control one month later, with the assistance of family who ensured all question items were answered. Fasting blood sugar checks were carried out by hospital laboratory staff.

The analysis used the Spearman Rho Test statistical correlation test at a significant 5%. Ethical approval was received from the ethical committee with number: 135/LPPM/ITS.PKU/ IX/2021 dated 24 September 2021.

RESULTS

The distribution of characteristics includes age, gender, occupational status, and education. Table 1 showed that the highest age range was 56-65 years with 110 (36.70%) respondents, followed by > 65 years, 46-55 years, and 36-45 years with 90 (30%), 80 (26.70%) and 20 (6.70%) respondents respectively. The majority were women with 180 (60%), while men were only 120 (40%). The most predominant occupation was housewives with 120 (40%) respondents, followed by private sector, teachers, civil servants, retirees, and farmers with 50 (16.70%), 40 (13.30%), 40 (13.30%), 40 (13.30%) and 10 (3.30%) respectively. The highest level of education was Elementary School with 90 (30%) respondents, followed by Senior High School with 80 (26.70%), University with 80 (26.70%), and Junior High School with 50 (16.70%) respondents.

Table 1. Characteristics of Respondents

Characteristics	n= 300	%
Age (Year)		
36-45	20	6.70
46-55	80	26.70
56-65	110	36.70
> 65	90	30
Sex		
Male	120	40
Female	180	60
Occupational Status		
Work	140	46.70
Not Work	160	53.30
Education		
Elementary School	90	30,00
Junior High School	50	16.70
Senior High School	80	26.70
University	80	26.70

Source: Primary Data, 2021

Treatment adherence distribution obtained using the Morisky Medication Adherence Scale (MMAS-8) is shown in Table 2. Based on the results, the highest distribution was in the middle category with 130 (43.30%) respondents followed by the high category with 120 (40%).

The fasting blood sugar examinations were conducted and the results were classified as increase or decrease. Subsequently, statistical data on fasting blood sugar levels were obtained (Table 3). Based on Table 3, the majority of the respondents namely 230 (76.70%) had increased blood sugar levels.

Considering that normal distribution requirements were not met, the test used was the Spearman rho correlation. Table 4 shows the correlation coefficient value of r= -0.597 in the category of quite strong relationship with a p-value of <0.001. Strong treatment adherence will effectively reduce blood sugar levels.

DISCUSSION

Medication adherence is important for type II DM patients to achieve treatment goals and effectively prevent complications.[20] A high level of adherence can reduce and maintain normal blood sugar levels in the body, accelerating healing. On the other hand, low adherence leads to poor control of blood glucose levels.[16] The greater the adherence of patients to taking anti-diabetic medication, the lower the blood sugar levels in line with the normal limits, and vice versa.[20]

Table 2. Distribution of Treatment Adherence

Treatment Adherence	n = 300	%
High	120	40
Middle	130	43.30
Low	50	16.70

Source: Primary Data, 2021

Table 3. Distribution of Blood Sugar Levels Month 1 and 2

Blood Sugar Levels	n = 300	%	Mean (Min-Max)	Std. Deviasi
Increase	70	23.30	1,8 (1-2)	0,4
Decrease	230	76.70		

Source: Primary Data, 2021

Table 4. Association between Treatment Adherence and Blood Sugar Levels

	Blood Sugar Levels
Treatment Adherence	r = - 0.597 *p-value* = < 0.001 n = 300

Source: Primary Data, 2021

Adherence of patients to treatment was influenced by several factors, namely gender, therapeutic regimen, and interaction with health workers or family. Patient factors include the limitations of the body function and socioeconomic aspects while the therapeutic regimen factor refers to the number of drugs received. To enhance compliance, interventions should address the factors, with health education or counseling being key strategies. These efforts can increase knowledge, understanding, awareness, and sufficient adherence to medication.[21] Education, accompaniment, observation, counseling, and reminders about DM care have been shown to increase medication adherence.[22]

Education has an important role because diabetic patients who receive Diabetes Self Management Education (DSME) can experience improvements in metabolic control, quality of life, and a decrease in complications. DSME reportedly has a positive effect in increasing self-confidence and change in self-management behavior of type II DM patients.[6] The achievement of medication adherence is not only limited to education by medical personnel but also influenced by family support.[7]

The results support many previous studies including Ashenafi et al., (2022) where medication adherence was low and significantly associated with poor glycemic control. Several medical conditions and medications were found to be associated with adherence, as shown by p: 0002.[23] The results offer insights into how to overcome the existing program at PKU Aisyiyah Singkil Boyolali Hospital. In this context, there is a need to improve the quality of education for DM outpatients through repeated counseling during visits.[20]

Health promotion is needed for patients enter-

ing the medical rehabilitation stage after treatment with DM. Theme structure, methods, family participation, knowledge of patients, and other factors must be conveyed to hospital management. High treatment compliance will also help improve quality of life, as reported by Perwitasari (2016) stating that the quality of hospital services including counseling, education, as well as gender and age contributed significantly to influencing treatment compliance and the quality of life.[24]

CONCLUSION AND RECOMMENDATION

In conclusion, this study found that the majority of DM outpatients had moderate adherence with decreased fasting sugar levels. The results showed a significant relationship between medication adherence and fasting sugar levels. However, this study was limited by the method of filling the MMAS-8 instrument, which is not yet commonly used at PKU Aisyiyah Singkil Boyolali Hospital. Consequently, families or patients had to fill the instrument in a makeshift place leading to discomfort. Future studies should focus on the establishment of MMAS-8 in the standard operational procedure for the care of DM patients.

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AUTHOR CONTRIBUTIONS

Data collection and conceptulaization: IU, SU. Study design: IU, MH. Data collection: IU, SU. Writing and submitting manuscript: IU. Writing: AY, YK, LA, UBR, SSTH, and DNU. Editing and approval of final draft: IU, MH. The authors read and approved the final manuscript. IU = Ida Untari; SU = Sri Utami; MH = Muhammad Hafiduddin; AY = Asmirati Yakob; YK = Yuli Kusumawati; LA = Lina Alfiyani; UBR = Umi Budi Rahayu; SSTH = Sri Sat Titi Hamranani; DNU = Devid Noor Umam.

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest associated with the material presented in this paper.

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