



## Evaluation of Blood Sugar Levels in Diabetes Mellitus Patients with Gangrene Complications in Hospital at Palu City

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### Abstract

From year to year, the amounts of gangrene patients continue to gradually increase. This is due to lack of consistent routines in checking blood sugar levels which result in blood sugar levels being uncontrolled. In gangrene patients who do not receive treatments, this will lead to amputation and can reduce the patient's quality of living. This study aims to determine the blood sugar levels in patients with diabetes mellitus with gangrene complications in hospitals in Palu City. The method used in the study is cross-sectional with prospective data collection, in which for examination of GDP is implemented using the auto check tool. The results of this study utilized the wilcoxon test to see a decrease in blood glucose levels before and after receiving antidiabetic and insulin therapy. The total research samples consisted of 30 patients within 1 month monitoring duration. From the results of research conducted for 3 months, it showed a significant decrease in fasting patients' blood glucose levels, with an average value before and after using antidiabetic therapy indicated as 285.87 mg / dl and 173.07 mg / dl. It is then concluded that there is a decrease in blood sugar levels in patients who suffer from diabetes mellitus with gangrene complications due to the use of antidiabetic therapy, namely insulin.

**Keywords:** *Blood Sugar Levels; Diabetes Mellitus; Gangrene; Insulin.*

### Introduction

Diabetes Mellitus (DM), or more widely known in Indonesia as diabetes, is a metabolic disease caused by the lack of insulin or the body's inability to utilize insulin, which made the glucose levels or blood sugar levels not controlled [1]. Gangrene or foot ulcer is a complication of diabetes mellitus caused by damage on the necrosis tissue damage by emboli of large arteries in the body which stopped the process of blood supply [2].

WHO revealed that in 2004, the number of world's population suffering from diabetes had reached 200 million lives. Orderly, it is stated that India with the most amount of patients suffering from diabetics (31.6 million people), followed by China (20.7 million people), and proceeded by the United States (17.7 million people), are three countries with the greatest diabetes sufferers in the world [3]. In 2012, an estimated amount of 29 million Americans aged over than 20 years

old will take percentage of 12-14% of the population suffering from diabetes. As an addition, more than a quarter have actually not been diagnosed. An additional 86 are also at high risk for developing DM. Nurses hold a very important role among other medical staffs. Nurses take over as an educator in educatih diabetic patients to monitor blood sugar levels properly as an effort to prevent early complications of diabetes mellitus. Moreover, they also hold the role in counseling to provide information about the treatments, controls and taking care of diabetic foot ulcers. All of these are done with the aim of the problem to evaluate blood sugar levels in patients with diabetes mellitus with gangrene complications.

### Methods

The type of research used in this study is cross-sectional research which is a form of observational study (non-experimental). The data is collected prospectively from patients

who suffer from diabetes mellitus with complications of gangrene in Palu City hospitals. This type of research was carried out by examining fasting patients' blood sugar levels 2 times: before and after being given antidiabetic therapy. The stages of the study consisted of submitting informed consent, designing inclusion criteria namely adult patients aged 25 years and above, patients who were willing to participate in the study, patients who stayed in the hospitals during the treatments and those who did not patients with diabetes mellitus with complications of gangrene and other disease complications, as well as exclusions for those who passed away after undergoing treatments in and outside the hospitals in Palu City.

The last criteria stood for patients who did not use drugs that may increase blood sugar levels and examinations of blood sugar levels by bio-physiological measurements using an auto check glucometer. At last, the quantitative descriptive data is analyzed using the Wilcoxon test.

## Results

Based on the results of research conducted at hospital in Palu during January 2019-February 2020, 35 patients were diagnosed with diabetes mellitus and gangrene complications. From the samples, 30 patients met the inclusion criteria while 5 patients

met the exclusion criteria. Three patients were not willing to be respondents and to sign informed consents, whereas two patients were also using drugs that can increase blood sugar levels, namely Calcium Channel Blocker (CCB) hypertension drug, which is categorized as amlodipine drugs.

## Discussion

Table 1 indicated that the demographic characteristics of diabetic mellitus patients with gangrene complications consisted of 21 female, which is a larger amount compared to 9 male patients. This is consistent with the statement initialized by Meidikayanti & Wahyuni [4] that the main cause of many women who had been affected by type 2 diabetes is due to a decrease in estrogen hormones, especially during menopause. Both estrogen and progesterone hormones have the ability to enhance the response of insulin within blood. When menopause occurs, the response to insulin decreases due to low amount of estrogen and progesterone.

Other influential factors are women's body mass index which is often not ideal. This can reduce the sensitivity of insulin response. This is what makes women more often affected by diabetes than men. From the results of research conducted, it is also proven that female patients are more likely to develop diabetes due to hormones, heredity, and higher obesity rates in women.

**Table 1: Data on demographic characteristics of patients suffering from diabetes mellitus with gangrene complications**

No	Characteristics	Number Of patients (n=30)	Percentage (%)
1	<b>Gender</b>		
	Female	21	70
	Male	9	30
2	<b>Age</b>		
	25-44 years old	2	6,7
	45-65 years old	25	83,3
	Over 65 years old	3	10,0
3	<b>Education Background</b>		
	Elementary School	13	43,3
	Middle School	8	26,7
	Bachelor/Master's Degree	4	13,3
	Never gone to School	5	16,7

Patients who suffered from diabetes mellitus with gangrene complications were found to be over than 60 years old. This data is aligned with the statements of the American Diabetes Association (ADA) that those who are above 45 years old have a potency of developing risk factors for type 2 diabetes mellitus [5]. According to Rudi & Kwureh [6], a patient's age is very closely related to the increase in blood glucose levels, so that when

one's age increases, then the prevalence of diabetes and impaired glucose tolerance gets higher. The aging process that takes place after 30 years of age results in anatomic, physiological and biochemical changes. Change starts at the cellular level, continues at the tissue level and finally at organ level that can affect homeostatic function. Components of the body that can undergo changes are pancreatic beta cells that

produce insulin hormones, target tissue cells that produce glucose, the nervous system, and other hormones that affect glucose levels. From the results of research conducted, it is found that those who are over than 60 years old is more susceptible to diabetes because in elderly patients, their bodies tend to not able to control blood sugar levels properly.

Other than that, people of those ages also rarely do activities that can reduce blood sugar levels, and they tend to live a bad lifestyle. This research, having conducted at hospitals in the city of Palu, showed that there were more patients with diabetes mellitus who belonged to the category level of academic backgrounds of an elementary education level with the total amount of 13 patients, then followed by those who have achieved the level of education in high schools as many as 8 patients, then patients who had never attend school were 5 patients.

This has similarities with research done by Tamara et al [7], which stated that the majority of respondents were still at a low level of education background. From the results of research conducted, it concluded that one's level of education background is significantly influential with the incidence of diabetes mellitus. Patients with low levels of education background tend to have less knowledge about diabetes mellitus, even so

until to the point that they develop a risk of complications from gangrene. Table 2 shows the data of diagnosis of medical record. It is obtained that the largest numbers of diagnosis in patients with diabetes mellitus with gangrene complications were as many as 26 patients, while patients with anemia complications were 3 patients.

The diagnosis of diabetes mellitus is established on the basis of examining one's blood glucose levels. Fasting patient's plasma glucose examination shows more than or equal to 126 mg/dL, normal patient's plasma glucose examination more than or equal to 200 mg/dL, plasma glucose examination when more than or equal to 200 mg/dL and HbA1c examination of more than or equal to 6.5% [8].

DM without a good self-management will develop into a disease that occurs annually and will cause complications such as gangrene. Gangrene most commonly affects the extremities, including one's fingers and toes. It can also occur in muscles and internal organs. Gangrenous injury is a condition that begins with the presence of tissue hypoxia on an area which the amount of oxygen in the tissue is reduced. This will affect the vascular and cellular activities of the tissue, hence resulting in tissue damage.

**Table 2: Diagnosis of patients suffering from diabetes mellitus with gangrene complications**

Diagnosis	Numbers Of Patients (n=30)	Percentage
DM + Gangrene	26	86,6
DM + Gangrene + Bronchitis	1	3,3
DM + Gangrene + Anemia	3	10

Table 3 indicated that the highest grade IV patients were amounted to 16 patients with injuries on the toes or the front parts of the body, then followed by grade V type with the numbers of 11 patients who had injuries covering a wider area (up to the arches and back of the legs). On the other hand, those

who belonged to grade III were as many as 3 patients who had deep wounds to the feet with cellulitis or abscess formation. This is different from the research conducted by Santoso & Pawiono [9], which discovered that the highest grade of gangrene on patients is grade 3 with a percentage of 33%.

**Table 3: Grades of gangrene in pasien who suffer from diabetes mellitus with gangrene complications**

Grades of gangrene	Number of patients (n=30)	Percentage (%)
0	-	-
I	-	-
II	-	-
III	3	10
IV	16	53,3
V	11	36,6

The process of diabetic gangrene in the foot begins from the soft tissue edema of the foot.

Formations of fissures take place between the toes or dry areas of feet, or the formation

of callus. The affected tissue initially changes color to bluish and feels cold to the touch. Then, the tissue will die, blacken and begin to stink.

Pain at the time of injury will not be felt by patients whose sense of sensitivity has disappeared. To add, injuries that occur can be in the form of thermal injuries, chemical injuries or traumatic injuries. The first signs of gangrene are pus discharge and redness due to cellulitis. From the results of research conducted, it displayed that the highest grade of gangrene, that is grade IV, is due to the fact that patients do not control blood sugar levels properly, so that the severity of the wound increases. Table 4 shows an overview of the use of antidiabetic therapy prescribed by doctors. The results obtained from 30 cases showed that the amounts of patients who underwent the use of single therapy were 8 patients and combination therapies were 22 patients.

The data obtained shows that the most widely used drug is insulin. The combination therapy that is more widely used is insulin rapid acting- long acting with as many as 22 patients. Likewise, a research conducted by Gamayanti, Ratnasari, & Bhargah [10] explored that the more widely used insulin therapy is rapid acting-long acting.

The administration of the combination is based on the history of patients' drug use. Rapid acting is short-term acting insulin whereas long acting is long-term acting insulin, and when compared to the use of insulin, this type will produce a faster onset and long duration of action so that it can mimic the body's normal insulin profile [11]. From the results of research conducted, it is concluded that the use of insulin rapid acting-long acting to accelerate the process of reducing blood sugar levels can help making it easier to take further action on the wound.

**Table 4: Profile on the use of antidiabetics on diabetes mellitus patients with gangrene complications**

Therapy Regiments	Methods of Treatments	Drugs Names	Amount (n=30)
Single	oral	Metformin	1
		Glimepirid	1
	Insulin	Lantus	1
		Novomix	2
		Novorapid	2
combination	Insulin	Novorapid – Levemir	12
		Novorapid – Lantus	10
	Insulin Combined With oral	Metformin – Novorapid	1

Table 5 displayed the average value of GDP in patients who suffered from diabetes mellitus with gangrene complications before and after using anti-diabetic drugs for 1 month. In this category of patients, there is a decrease in the levels of GDP from baseline 285.87 mg/dL to 173.07 mg/dL where the difference was 112.8 mg/dL with an increase in percentage of 39.45%. In this study, before the analysis test is carried out first, a normality test is taken.

The normality test used is the Shapiro Wilk test because the number of samples in this study is less than 50. After doing the normality test, it is obtained that the significance value is less than 0.05 which means the data are not normally distributed. Then, the analysis test was carried out using the Wilcoxon test. The Wilcoxon statistical method is a non-parametric statistical test to determine whether there is an average difference in the two pairs of samples for data that are not normally distributed.

**Table 5: Evaluation of blood sugar levels in patients suffering from diabetes mellitus with gangrene complications**

Categories of GDP value levels	GDP value levels	Shapiro Wilk Normality Test	Statistic Methods	Value of significance (p)
Baseline	285,87	0,003*	Uji Wilcoxon	0,000 sig.
Evaluation	173,07			

Note \*: Significance level is not distributed normally (<0, 05)  
 Sig.: Significance Level (<0, 05)

Based on the results of the analysis using SPSS with the Wilcoxon test, it is obtained that the results of GDP levels was a value of p 0,000 or p less than 0.05. Therefore, it can be concluded that there is a significant

decrease in GDP levels of those using antidiabetic drugs with more insulin. These results are in line with the research conducted by Sari, et al [12], which stated that the results that significantly reduce blood sugar levels is by those using insulin.

This study is also supported with the research conducted by Hariyati et al [13] that elaborated the percentage of achievement of blood glucose levels in patients with type 2 diabetes mellitus with ulcers/gangrene reached 80% and those who did not achieve it was 10% using insulin therapy.

## Conclusion

All in all, by overlooking the research conducted, it can be concluded that there is a significant decrease on the evaluation of blood sugar levels in patients who suffered from diabetes mellitus with gangrene complications in hospitals in the city of Palu, with a value of  $p = 0,000$  for those using antidiabetic therapy, that is insulin combination of rapid acting - long acting.

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