

# COMPARISON OF BLOOD GLUCOSE LEVELS OF PATIENTS WITH DIABETES MELLITUS ON UNPRESSED FINGERS AND GETTED TO THE TELAGA BIRU MEDICAL CENTER GORONTALO DISTRICT

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## ABSTRACT

Examination of blood glucose levels using the POCT method using capillary blood helps diabetes mellitus patients monitor glucose levels. But often the insufficient stabbing causes the blood to come out a little so that the staff performs massage which can affect blood glucose levels. This study aims to determine the differences in the results of examination of blood glucose levels of patients with diabetes mellitus on fingers that are not massaged and massaged at Telaga Biru Public Health Center, Gorontalo District.

This research is an experimental study with a Pre Experiment Design type One group Prettest-Posttest Design with a total of 21 samples taken capillary blood to check blood glucose levels on the fingers that are not massaged and massaged.

The results obtained were analyzed using the Faired Sample t-Test. The results showed that the mean blood glucose level on the fingers that was not massaged was 321 mg/dL, while the mean blood glucose level on the fingers that was massaged was 299 mg/dL. The results of the Faired Sample t-Test showed a significant value of  $0.000 < 0.05$ . There was a significant difference in the results of examining blood glucose levels on fingers that were not massaged and massaged by diabetes mellitus patients at Telaga Biru Health Center, Gorontalo District. Laboratory personnel are expected to perform deep punctures on the fingers so that the blood that comes out is enough for the POCT method of blood glucose testing.

**Keywords:** blood glucose, capillary blood, POCT method, diabetes mellitus.

## INTRODUCTION

The current technological development is very fast, technological advances have entered various fields ranging from economics, education and also in the health sector. In the health sector, technological advances have a good impact, for example in information technology which can improve the quality of existing services in hospitals. But on the other hand, this technology advances

too adversely affects changes in people's lifestyles such as the habit of consuming fast food which is high in calories, carbohydrates, fat and protein, but low in fiber and nutrients. Such a lifestyle can increase the risk of insulin resistance which has an impact on increasing blood glucose levels in the blood circulation, causing diabetes mellitus [11].

Diabetes Meliitus (DM), commonly known as diabetes, is a metabolic disorder

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characterized by a continuous increase in blood sugar levels, especially after eating [4]. Types of Diabetes Mellitus, namely type 1 diabetes. This type of diabetes occurs when the pancreas is unable or unable to produce insulin. As a result, the body has insufficient or no insulin. Glucose becomes accumulated in the blood stream because it cannot be transported into cells.

Type 1 diabetes is also called insulin-dependent diabetes because sufferers are very dependent on insulin by injecting it in the body to meet insulin in the body. Type 1 diabetes is usually an autoimmune disease, which is a disease caused by an immune or immune system disorder and results in damage to pancreatic cells [22].

In type 2 diabetes the pancreas can still make insulin, but it is of poor quality so that it cannot function properly as a key to enter glucose into cells. As a result, blood sugar increases. Patients usually do not need additional insulin injections in their treatment, but require drugs to improve insulin function, lower sugar, improve sugar processing in the liver, and others [22].

Diabetes in pregnant women is diabetes that appears only during pregnancy is called gestational diabetes or gestational diabetes. This situation occurs due to the formation of several hormones in pregnant women that cause insulin resistance. Diabetes can only be recognized after the fourth month of pregnancy and over, mostly in the third trimester (the last three months of pregnancy). After delivery, blood sugar generally returns to normal [22].

There is also diabetes that is not included in the above group, namely secondary diabetes or the result of other diseases, which interfere with insulin production or affect insulin work.

The causes are inflammation of the pancreas (pancreatitis), disorders of the adrenal or pituitary glands, use of

corticosteroid hormones, use of several antihypertensive and anti-cholesterol drugs, malnutrition and infection [22].

Symptoms of diabetes include polyuria (a lot of urine) is a common symptom in people with diabetes. Usually, the amount of urine is caused by too much sugar in the blood (glucose), so that the body must immediately remove excess sugar through the kidneys along with urine [5].

Polydipsia (drinking a lot) is the result of the body's reaction to a lot of urine excreting. This symptom is actually the body's attempt to avoid dehydration. The main complaints and symptoms of diabetes are polyuria and polydipsia [5].

Polyphagia (eating a lot) is another symptom that can be observed, this symptom occurs, caused by reduced sugar reserves in the body despite high blood sugar levels. Because of the inability of insulin to distribute sugar as a source of energy in the body, it makes the body feel weak as if it is lacking energy [5].

Weight loss occurs as a compensation for dehydration and you have to drink a lot, it could be that you start eating a lot, indeed at first you gain weight but over time the muscles don't get enough energy to grow so that muscle tissue and fat must be broken down to meet energy needs. The effect is weight loss although that's a lot [5].

Blurred eyes occur because high blood sugar will draw fluid out of the eye lens as a result, the eye lens becomes thin, so the sufferer's eye has difficulty focusing. Furthermore, the vision becomes blurred [5].

Nerve damage caused by high blood glucose will damage the walls of blood vessels, which in turn disrupt the nutrition of the nerves. Because the sensory nerve is damaged, the symptom that arises is a tingling sensation. Furthermore, there can be pain in the limbs of the calves, legs, hands and arms [5].

There are 422 million people with diabetes in the world and 8.5% of deaths in 2014 were caused by adults aged 18 years and over, and in 2015 it was estimated that 1.6 million deaths were caused by diabetes [22]. The national prevalence of diabetes mellitus in Indonesia is 1.1% with the prevalence of diabetes mellitus in people aged over 15 years who live in urban areas [23].

The report on the results of Basic Health Research (Riskesdas) in 2018 shows that the prevalence of diabetes mellitus in Indonesia for all ages is 1.5%. The prevalence of diabetes mellitus diagnosed by doctors in 2018 Gorontalo and Aceh (1.7%), Central Java, Banten, and North Kalimantan (1.6%), Central Sulawesi (1.5%) and North Sumatra (1.4%) West Sumatra (1.2%) and in the East Nusa Tenggara (0.6%) (Riskesdas, 2018) [19].

Based on data from the Provincial Health Office of Gorontalo in 2018, there were 90 people with diabetes mellitus in Pohuwato Regency, 49 people in Boalemo Regency, 13 people in North Gorontalo Regency, 412 people in Gorontalo District, 303 people in Gorontalo City and 206 people in Bone Bolango Regency. From the data obtained from the Gorontalo Provincial Health Office, Gorontalo district ranks first in cases of diabetes mellitus [3].

Gorontalo District Health Office data population with diabetes mellitus patients in 2019, Tilango Puskesmas totaled 99, Puskesmas Biluhu 39, Puskesmas Bilato 21, Puskesmas Boliyohuto 100, and Puskesmas Telaga Biru totaling 101 residents [3].

High blood glucose levels can be seen by performing laboratory tests. Currently, a device that can be used to perform a rapid blood glucose check is found, called a blood glucose meter or Point of Care Testing (POCT). The accuracy of glucose test results with a glucometer is adjusted

to the GLP (Good Laboratory Practice) stages namely pre analytic, analytic and post analytic. The pre-analytic stage is the stage of determining the quality of the sample to be used in the examination, an error in the pre-analytic stage can contribute around 61%, while the error in the analytic stage is 25% and an error in the post-analytic stage is 14% [13].

Point of Care Test of this glucose is one of the most important technological advances in monitoring blood glucose levels in patients to determine the success of treatment. Point of Care Test of glucose has often been used in health installations, emergency departments and even in patient homes. The selection of tools using the Point of Care Testing method is a simple laboratory examination method. The POCT examination can be carried out outside the laboratory with fast results, but has less precision and accuracy when compared to the reference method and has limited measurement capability [14].

The accuracy of glucose test results with a glucometer is adjusted to the GLP (Good Laboratory Practice) stages, namely pre analytic, analytic and post analytic. The pre-analytic stage is the stage of determining the quality of the sample to be used in the examination, an error in the pre-analytic stage can contribute around 61%, while the error in the analytic stage is 25% and an error in the post-analytic stage is 14% [13].

The pre-analytic stage that is often carried out by the laboratory is taking capillary blood. Capillary blood draw or Skin puncture is a puncture technique to obtain capillary blood which is usually performed on the finger or heel area for certain examinations that require a small amount of blood. It is usually used in newborn, pediatric and adult patients for whom venipuncture is not feasible [16].

The puncture site for capillary blood collection is at the edge of the tip of the middle or ring finger. Do not perform a

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puncture in the middle of the fingertip as it can hit the bone and the vascularisation is not good [10].

Stabbing is also not performed on a finger that has previously been stabbed in the fingertip, which does not allow for the stabbing, such as in infants or in patients with burns, so the puncture is done on the heel. In general, the location of the puncture in people is carried out on the finger. The location of the insertion in the ear is usually used only for screening tests and for the location of patients with neonates and pediatric disease, it is usually a heel retrieval [25].

This capillary blood draw is usually done at the tip of the finger or the earlobe but usually in small children or babies it is done on the heel. Capillary blood draw is used for tests that require a small blood sample, for example, such as checking blood glucose levels using a glucometer [16].

When taking capillary blood, laboratory personnel usually do a massage on the finger so that the blood that comes out is enough for blood glucose tests, but according to correct laboratory practice guidelines, the SOP for capillary blood collection must be done with a deep enough puncture so that the blood is easy to pass and enough blood is obtained examination. A finger massaged to get enough blood can affect the test results, because the blood that is forced out has mixed with the tissue fluid so that the blood becomes thin and causes errors in the examination [24].

Based on the fact, when doing clinical practice, when taking capillary blood for glucose testing, there were several laboratory workers who did massage to get enough blood. This makes the blood glucose results obtained inaccurate. Quality inspection results can be obtained if the use of tools, methods, reagents, work procedures and human resources (HR) is in accordance with the

results of inspection standards. Demands for good quality laboratory examination results do not only come from requests from doctors or clinicians, but also directly from the community [7].

Based on the above background, the researcher was interested in conducting a study on the comparison of blood glucose levels of people with diabetes mellitus on the massaged and not massaged fingers at the Telaga Biru Health Center, Gorontalo District.

### **RESEARCH METHODS**

This type of research is quantitative research, namely research that emphasizes information expressed in the form of numbers, where these numbers represent a certain variable and the data analysis is carried out using statistical techniques. The research method used is comparative (comparative). This research uses Pre Experiment Design. Pre Experiment Design is a systematic study to test the hypothesis of a causal relationship. The form of this research design is also experimental research that manipulates the independent variables to influence the dependent variable.

This study used One group Prettest-Posttest. The effect or effect of a treatment was decided based on the difference between pretest and posttest. In this design, there is a pretest before being treated, thus the treatment results can be found to be more accurate because it compares with the conditions before being treated. One group Prettest-Posttest with a total of 21 samples where capillary blood was taken on the fingers that were not massaged and then the blood glucose levels were checked using the Nesco MultiCheck POCT method. The results obtained were analyzed using the Faired Sample t-Test Paired Sample t-Test.

Paired Sample t-Test that is, the test conducted to determine the effectiveness of the treatment, marked by the difference in the average before and after being

given the treatment. where the significance level used in this study is 5% (0.05).

This study uses nonprobability sampling method with accidental sampling technique, which is a sampling technique based on chance, anyone who accidentally meets the researcher is used as a sample regardless of age or gender [21].

The use of accidental sampling technique in this study was because the researchers only saw a difference in the results of blood glucose levels on the fingers that were not massaged and massaged in diabetes mellitus patients regardless of age or gender.

The instrument used in this study was the Nesco Multi Check glucometer which is used as a measuring tool to determine the results of blood glucose levels by taking capillary blood on the fingers that were not massaged and the fingers that were massaged in diabetes mellitus patients.

The tools and materials used in this study were lancets, autoclicks, capillary blood samples, alcohol swabs, dry cotton swabs and glucose strips. The work procedure in the first pre-analytic stage describes the research to be carried out on the respondent, gives informed consent to the respondent, prepares the tools and materials used, takes capillary blood samples on the fingers that are not massaged and massaged, sampling and examination are carried out at the Telaga Biru Health Center Laboratory of Gorontalo District

The analytic stage is the stage of working on the sample / specimen. The chip for checking glucose is attached to the glucometer Nesco Multi Check, put the glucose strip on the appliance Nesco Multi Check, the pierced finger is cleaned with disinfectant or alcohol cotton and then left to dry, puncture the lancet over the finger, arrange for a transverse

puncture (capillary blood collection is done on the same finger, given the untreated and massaged treatment), wait for the blood to flow freely from the puncture site, wipe the first drop from the finger, the next drop that comes out is used for examination, the instrument will sound and the glucose level measurement result will be displayed on the screen.

The post-analytic stage is the final stage that is carried out to enforce the results of the tests performed, read the examination results that appear on the screen and record blood glucose levels.

## RESEARCH RESULT

Examination of blood glucose levels in patients with diabetes mellitus totaled 21 respondents. There were 7 blood glucose levels in the fingers that were not massaged 200-299 mg / dL, 11 people had blood glucose levels 301-399, 2 people had blood glucose levels 400-499 mg / dL and 1 person had blood glucose levels 500-599 mg / dL .

Examination of blood glucose levels on the fingers massaged 200-299 mg / dL 14 people, blood glucose levels 301-399 mg / dL 4 people, blood glucose levels 400-499 mg / dL 3 people.

Patients with diabetes mellitus, amounting to 21 respondents at the pretest (fingers that were not massaged) showed an average range of 321 mg / dL, with the lowest blood glucose levels of 206 mg / dL and the highest 507 mg / dL. Whereas in the posttest (massaged fingers) showed an average of around 299 mg / dL with the highest glucose levels 468 mg / dL and the lowest 201 mg / dL. For more details, it is presented in table 1 as follows:

**Table 1. Results of Average Glucose Levels Blood fingers that are not massaged and massaged**

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Blood glucose levels	amount	Minimum (mg / dL)	Maximum (mg / dL)	Average (mg / dL)
Pretest	21	206	507	321
Posttest	21	201	468	299

Source: Primary Data, 2020.

Examination of blood glucose levels of diabetes mellitus patients on fingers that were not massaged (pretest) and fingers massaged (posttest) from 21 respondents, there were 17 female respondents (81.0%) and 4 men (19.0%). Data on the distribution of respondents according to gender is presented in table 2 as follows:

**Table 2. Distribution of Respondents by Gender**

Gender	Examination of Blood Glucose Levels (Pretest and Posttest)	
	N	(%)
Male	4	19.0
Women	17	81.0
Total	21	100.0

Source: Primary Data, 2020.

The Shapiro Wilk test data is said to be normally distributed if the significant value > the significance level (5% or 0.05) [19]. The results of the normality test for blood glucose levels on the fingers that were not massaged (pretest) were 0.190 > 0.05 and the blood glucose levels on the massaged fingers (posttest) were 0.034 > 0.05. Then the data obtained is also normally distributed. The results of the normality test are seen in table 3 as follows:

**Table 3 Normality Test Results.**

Blood Glucose Levels	Significant	Level of Signification	Information
Pretest	0.19	0.05	Normal
Posttest	0.034	0.05	Normal

Source: Primary Data, 2020.

In the Paired Sample t-Test the data is said to have a significant difference if the significant value (2-Tailed) < significance level (5% or 0.05) [20].

Based on the table above, the results of the comparative analysis on blood glucose levels in the fingers that were not massaged and the fingers that were massaged were 0.000 < 0.05, from the results obtained, the null hypothesis (H0) was rejected and hypothesis one (H1) was accepted. The test results are presented in table 4 as follows:

**Table 4. Faired Sample t-test results**

Blood Glucose Levels	Significant (2-Tailed)	Level of Signification	Ket.
Experiment	0,000	0.05	Significant

Source: Primary Data, 2020

## DISCUSSION

This study took the comparison of blood glucose levels on the fingers that were not massaged and the fingers that were massaged at the Telaga Biru Health Center, Gorontalo District. Respondents in this study were patients with diabetes mellitus with a total of 21 respondents consisting of 17 people (81.0%) women and 4 people (19.0%) men. Sampling was carried out using accidental techniques where anyone who happened to meet the researcher was used as a sample. The respondent was then tested for blood glucose levels on the fingers that were not massaged (pretest) and the other fingers were massaged first (posttest), then blood glucose levels were checked using a glucometer with the POCT method of the Nesco Multi Check brand.

Glucometer is a tool that functions to determine the level of glucose in the blood. Glucometry is a technique for obtaining values of glucose concentration in peripheral or central blood. Measurement values expressed in mg / dL or mmol have important clinical values to detect metabolic disorders such as diabetes mellitus, denutrition, and several other disorders such as hyperosmolar coma, malabsorption syndrome, and hypoglycemia, which is a

condition where glucose levels are lower than normal levels. [6].

Glucometer is a blood glucose examination tool that is close to the patient, can be used outside the laboratory or used by diabetics themselves which aims to control blood sugar levels. To control blood sugar with a glucometer using a capillary blood sample. The use of this glucometer has been widely used in addition to being easy and practical to use, the results of blood glucose tests can be known in a fast time.

Glucometer has a working principle of biosensor. Biosensor was first introduced by Clark and Lyson in 1962. Biosensor is a combination of bioreceptors and transducers. Bioreceptors are tools used to sense the presence of concentrations of biological elements, for example, enzymes, antibodies, living cells, and other tissues. The transducer device functions to convert biochemical signals into electrical signals which will then be read on the glucometer screen [6]. Biosensor strip test with two electrodes and glucose oxidase enzyme using dry reagent with electrochemical detection techniques. Blood is added to the strip, in seconds the tool will output the result that appears on the screen.

Some of the advantages of a glucometer include high precision, no need for pipetting, using capillary blood, a relatively cheap price and easy to use. The use of a glucometer uses a small sample so that it does not make the patient lack a lot of blood. the advantage of using this glucometer is that the test results do not take a long time, the test results can be known in just seconds [6].

Disadvantages of Glucometer, Some of the disadvantages of glucometer include limited measurement intervals, measurement inaccuracy, lack of compatibility with control samples, temperature effects lead to incorrect results, higher costs of consumables,

sufficient blood samples are used, alcohol can cause measurement inaccuracy and test strips that have been opened more than 3 months will cause inaccurate results [6].

The use of glucometer is also usually carried out by officers who do not have a laboratory background, usually by other officers so that the method of examination and examination results is still very doubtful.

Examination of blood glucose levels on the fingers that were not massaged and the fingers that were massaged were 21 samples, there were 20 samples that showed a decrease in blood glucose levels on the massaged fingers. However, in one sample, there was an increase in blood glucose levels in the massaged finger. When taking blood, the patient's fingers looked pale so that the blood was small, this was suspected because the blood flow in the blood sampling area was not smooth. The non-smooth flow of blood indicates a pale stab area. The method when this happens is to drink water and wrap the fingers with a warm, wet cloth for a few minutes before the prickling is performed [10].

Based on the tests carried out, it was found that the examination of blood glucose levels in diabetes mellitus patients was 21 respondents. There were 7 blood glucose levels in the fingers that were not massaged 200-299 mg / dL, 11 people had blood glucose levels 301-399, 2 people had blood glucose levels 400-499 mg / dL and 1 person had blood glucose levels 500-599 mg / dL .

Examination of blood glucose levels on the fingers massaged 200-299 mg / dL 14 people, blood glucose levels 301-399 mg / dL 4 people, blood glucose levels 400-499 mg / dL 3 people.

Examination of blood glucose levels of diabetes mellitus patients on fingers that were not massaged (pretest) and fingers massaged (posttest) from 21

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respondents, there were 17 female respondents (81.0%) and 4 men (19.0%). The mean blood glucose level in the untreated finger was higher (321 mg / dL) than the blood glucose level in the finger that was massaged (299 mg / dL) with a difference of 21.7 mg / dL. In testing the comparative parametric results of the Paired Sample t-Test, there is a significant difference where the significant value is less than the significance level ( $0.000 < 0.05$ ), which means that there is a significant difference in the blood glucose levels of diabetes mellitus patients on the fingers that are not massaged and massaged.

The results obtained are in accordance with the theory outlined in the correct laboratory practice guidelines (SOP) for taking capillary blood with a massaged finger to get enough blood will affect the results of the examination, because the blood that is forced to come out will mix. with tissue fluids so that they become diluted and cause glucose levels to be lower than in untreated fingers.

The capillary blood collection procedure is only performed with a puncture using sterile lancet in the direction perpendicular to the fingerprint lines of the finger, a puncture is deep enough to allow the blood to come out easily, so that the blood obtained is sufficient for examination [8].

Tens of capillary blood have a simple and very small structure, so the number of cells in them is small. Capillaries generally include tissue cells, therefore capillaries are directly related to cells. The walls of the capillaries are so thin that the pressure on the capillaries forces the fluid to get out of the tissue, thus affecting the cells in these blood vessels [18].

Khasanah's research showed that the mean number of platelets using capillary blood samples (236,000 mm<sup>3</sup>) was lower

than the platelet counts using venous blood samples (266,000 mm<sup>3</sup>). which is lower [9]. In addition, Maola's research also shows that there is a difference between examining leukocytes using capillary and venous blood, where the results of the examination of the leukocyte tube dilution using capillary blood are lower than the examination of the leukocytes with dilution of the tube using venous blood. [12].

Tissue fluid makes up about 30% of body fluids, where water will be the medium in the middle of the body's cells. The exchange of water and solutes depends on several pressure forces in the form of massage such as the colloid osmotic pressure of blood which is formed by plasma proteins, then the colloid osmotic pressure of the blood will work together with the tissue pressure to attract the remaining tissue fluid in the cells into the capillary blood [11] ].

The results of examining blood glucose levels on the fingers that were not massaged and the fingers that were massaged in diabetes mellitus patients were different. According to Decroli, the blood glucose levels in the DM category were  $> 200$  mg / dL [1].

Each clinical examination has other factors affecting the results, as is the case with the POCT method blood glucose level examination. In this study, there are several confounding factors that can affect the examination of low blood glucose levels, for example the possibility of occurring due to injury or swelling of the respondent's fingers. However, the results of the research that indicated that there was a decrease in blood glucose levels on the massage finger was really due to the massage / pressure on the finger which caused a decrease in blood concentration which led to the result of the examination of low blood glucose levels. The other factors are caused by the



use of batteries that are not replaced regularly and the use of expired strips.

## CONCLUSION

Based on the research conducted, it can be concluded that The results of the mean examination of blood glucose levels on the fingers that were not massaged were 321 mg / dL and the average results of examining blood glucose levels on the fingers that were massaged were 299 mg / dL, there was a significant difference in the results of examining blood glucose levels on the fingers that were not massaged with the fingers that were massaged. massaged by diabetes mellitus patients at Telaga Biru Puskesmas, Gorontalo District.

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