

Capillary blood glucose measurements at lateral and median fingertips in patients with type 2 diabetes mellitus in Malang: comparison of pain levels



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ABSTRACT

Introduction: Self-monitoring of blood glucose is one of the ways to treat type 2 diabetes mellitus, which is a chronic disease that affects many people. Blood glucose is measured by taking a sample from a capillary blood vessel, such as a finger. To decrease the pain, it is vital to learn more about the exact position of the puncture on the finger. The aims of this study is compare the location of the capillary blood collection at the median and lateral fingertips to the level of pain experienced by patients.

Methods: With a sample of 50 participants, the lateral area of the finger and the median finger were separated into two groups. The Visual Analog Scale is the tool used to assess pain (VAS).

Results: The lateral group's mean pain level was low. The median group had the greatest pain scale among 50 responders whose pain level was assessed using the VAS instrument. Based on the Mann-Whitney test results, there were differences in the level of pain in blood glucose in the lateral and median fingers ($p = 0.036$).

Conclusion: The lateral and median fingertips in the capillary blood sample have different levels of pain. Although the location lateral to the fingertip is a less painful site for capillary blood collection than the median fingertip location, it still needs to be validated in bigger clinical trials.

Keywords: Type 2 diabetes mellitus, pain level, lateral fingertips, median fingertips.

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INTRODUCTION

Diabetes mellitus is a metabolic condition defined by a persistent rise in blood sugar levels caused by a disruption in pancreatic insulin secretion, decreased insulin action, or both.¹ Type 2 diabetes is the most common type of diabetes globally and is caused by modifiable risk factors.² Defective insulin secretion by pancreatic cells and a failure of insulin-sensitive tissues to respond effectively to insulin cause type 2 diabetes mellitus.³

A diagnostic test that uses a small amount of blood to quickly check a patient's health status, such as a blood glucose test.⁴ Regularly monitoring blood glucose levels in people with type 2 diabetes is important for diabetes management.⁵ In the usual management of diabetic patients hospitalized, capillary blood glucose monitoring offers an average value of blood glucose; in emergencies, it becomes

a rapid assessment of blood sugar, enabling patients to monitor blood sugar levels independently.⁶ Various procedures, such as hexokinase and glucose oxidase, can check blood glucose levels.⁷

In practice, people with diabetes frequently complain about the level of pain experienced during capillary blood collection when measuring blood glucose with a glucometer⁸, establishing the site of capillary blood collection is critical. According to a preliminary study conducted by researchers at the Malang Hospital, capillary blood was obtained from 9 individuals. At the time of lancet pricking, all locations of lancet puncture were conducted at the median fingertip with varying levels of discomfort; 3 patients were in the mild pain group and six patients were in the moderate pain category.

Both the location and technique of

capillary blood samples can result in false test findings, discomfort, and tissue injury if done wrong.⁹ If less painful, sampling at a specific location also improves patient compliance with self-monitoring of blood glucose.¹⁰ Self-monitoring of blood glucose using a blood sample on a finger has helped in diabetes management.¹¹ Self-monitoring of blood glucose is an important method to improve glycemic control in diabetes mellitus patients receiving insulin therapy.¹² Self-monitoring of blood glucose provides information about an individual's dynamic blood glucose profile. This information can assist with scheduling appropriate meals, activities, and medications.¹³

Based on the findings, the researcher considers it necessary to compare the location of the capillary blood collection at the median and lateral fingertips to the level of pain experienced by patients. This

is often done in checking blood glucose while in patients with type 2 diabetes mellitus.

METHODS

Research design

The research design used in this study was a quasi-experimental method with a posttest-only, non-equivalent control group design. The sample was taken using the Consecutive sampling technique. In this study, there were two groups, namely the capillary blood collection group at the lateral fingertip and the capillary blood collection group at the median fingertip. After the intervention is carried out, a posttest will be conducted to determine the difference in pain levels in capillary blood collection in the lateral and median fingertips.

The research sample used in this study were patients with type 2 diabetes mellitus who regularly came to the hospital in Malang. The sampling technique used was consecutive sampling with a total sample of 50 people and divided into 2 groups. Each group contained 25 patients.

Data Collection

The procedure steps¹⁴ in this study are as follows:

1. Prepare tools and materials
2. Nurses wash hands with 5 steps
3. Explain the method for the action to be conducted and ask for informed consent.
4. The Hamilton Rating Scale For Anxiety (HARS) test is used to assess the exclusion criteria for responders who have moderate, severe, or very severe anxiety levels.
5. Describe how VAS (Visual Analog Scale) is used to assess pain levels
6. Ensure that the patient is in the most comfortable position possible.
7. Put the blood sugar stick on the glucometer and the lancet on the lancet pen while wearing gloves.
8. Using a 70% alcohol swab, clean the puncture area.
9. Place the lancet already attached to the pen at the lateral/median fingertip region.
10. Using a visual analog scale, assess the patient's pain level and keep track of the results.

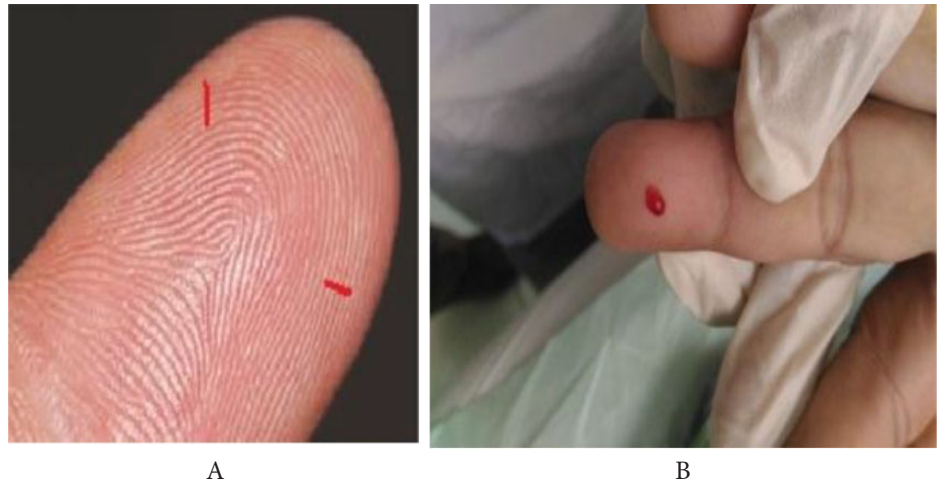


Figure 1. Fingertip region; (a) lateral fingertip region, (b) median fingertip region.

11. Place the blood sugar stick on the punctured tip of the finger to collect capillary blood material.
12. Use 70% alcohol to cover the puncture mark.
13. Fill out the observation form with the blood sugar results.
14. Inform the patient that the surgery is over and give them a souvenir.
15. Dispose of medical waste in the appropriate location.
16. Clean up your equipment and materials and wash your hands in five simple steps.

Statistical Analysis

The data collection procedure in this study was to measure the level of pain using a visual analog scale pain

measuring instrument in patients after a lancet puncture was performed in two different locations. The bivariate analysis compared the pain level in the capillary blood collection in the lateral and median fingertips, which were assessed using a visual analog scale. The type of statistical test used was Mann Whitney, which measured the significance of the differences between the 2 groups of research data with a significant degree of < 0.05 .

RESULTS

Demographic characteristics

According to table 1, the lateral group's gender characteristics revealed that most respondents were female by 16 individuals (64%), while the median group revealed

Table 1. Distribution of respondents characteristics.

Characteristics Respondents	Lateral		Median		p-value
	f	%	f	%	
Sex					1
Male	9	36	9	36	
Female	16	64	16	64	
Level of education					0.158
Elementary	5	20	10	40	
Junior school	5	20	7	28	
Senior school	13	52	8	32	
Collage	2	8	0	0	
Anxiety level					0.637
No anxiety	23	92	22	88	
Mild anxiety	2	8	3	12	
Pain experience					1
Ever	0	0	0	0	
Never	25	100	25	100	

Table 2. Frequency Distribution of Respondents Based on Pain Level.

Pain level	Lateral Frekuensi		Median Prosentase (%)	
	f	%	f	%
Mild	23	92	17	68
Moderate	2	8	8	32
Severe	0	0	0	0
Total	25	100	25	100

Table 3. Mann-Whitney statistical test results.

	p-value
The difference in the level of pain on capillary blood collection in the lateral and median fingertips	0.036

that the majority of respondents were female by 16 people (64%). Data on the educational characteristics of the lateral group obtained that the most respondents were high school education of 13 people (52%) and the median group obtained that the most respondents were elementary education of 10 people (40%). For the lateral group, the highest number of respondents with no anxiety degree was 23 people (92%) and the median group obtained the most respondents with no anxiety degree of 22 people (88%). For data on the characteristics of the experience of pain, the category data was never 100% in both groups.

Based on table 2, it was found that the data in the lateral group of respondents had the mildest pain category, namely 23 (92%) at the time of capillary blood sampling. While in the median group at the time of capillary blood sampling, most respondents had a mild pain category of 17 (68%). Based on table 3, it is known that the significance value of the Mann-Whitney statistical test results is 0.036. This result indicates a difference in pain level when taking capillary blood in the median and lateral fingertips.

DISCUSSION

Based on the results of the research, the data in table 1 can be seen that the data on the characteristics of the respondents, namely gender, age, education, degree of anxiety, and pain experience did not have significant differences between the lateral and median fingertip groups ($p > 0.05$). These results are in line with what

was expected by the researchers who aim to minimize bias in the level of pain in capillary blood sampling, measured using the Visual Analog Scale instrument. Because pain is a very subjective condition, the feeling of pain is different for each person in terms of scale or level and only that people can explain the painful experiences.¹⁵

Based on the research results conducted on patients with type 2 diabetes mellitus who had capillary blood drawn on the lateral fingertips, data were obtained where the level of pain experienced by respondents was included in the mild and moderate categories. Categories as many as two respondents with the lowest scale 0 and the highest 3. Besides getting a pain scale of 0 which was measured using the Visual Analog Scale instrument in this group, there were only 2 respondents with moderate levels of pain, which means that the capillary blood collection group on the lateral tip of the finger had a low average pain level. The low level of pain can be caused if the capillary blood sampling is carried out at the appropriate location and depth of the lancet, it will not injure the free nerve endings in the fingertips so that the level of pain can be minimized. The sensitivity of stimulation to nociceptors may not occur.¹⁶ Pain that occurs when drawing blood at the fingertip is sharp because it results from intraneural microstimulation that supports nociceptive A-fibers in sharp pain.¹⁷

Pain associated with taking capillary blood in the finger is one of the main obstacles for people with diabetes mellitus

in performing self-monitoring of blood glucose because skin punctures lateral to the fingertip have fewer nerves to improve compliance with self-monitoring blood glucose.¹⁸ Health care providers should consider these factors when discussing self-monitoring of blood glucose with people with diabetes, they should be taught techniques to make finger pricks less painful for example using the lateral side of the finger.¹⁹

Of the 25 respondents in the median group, the level of pain experienced by respondents included in the mild category as many as 17 respondents and the moderate category as many as 8 respondents with the lowest scale being 1 and the highest scale being 4. In addition, the median group there was the highest pain scale among 50 respondents. which measured the level of pain using the Visual Analog Scale instrument. Respondents' pain is generated by the activity or sensitivity of peripheral nociceptors, which are unique receptors that transmit noxious impulses.²⁰ The median fingertip has a high level of nerve density or nociceptive and this can be evidenced by the anatomical location of the median nerve which transmits sensory information to the thumb, index, middle and ring fingers in the carpal tunnel that runs along the median fingertip.²¹

Based on table 3, the significance value of the Mann-Whitney test results is 0.036. The results of this study indicate that the lateral and median capillary blood collections have different average pain levels. This is related to the pain mechanism based on multiple processes, namely nociceptive, peripheral sensitization, phenotypic changes, central sensitization, ectopic excitability, structural reorganization, and decreased inhibition.²² A study stated that pain did not occur in 90% and 94.28% of respondents who were pierced in the lateral area of the finger.²³ Previous studies compared the pain felt when taking capillary blood in the middle of the fingers and palms, most respondents in the middle of the fingers felt pain compared to taking samples on the palms.²⁴

Based on the findings of this study, it is envisaged that the precise location of capillary blood collection can be paid more attention to during the process of self-monitoring blood glucose, which is

commonly done in patients with type 2 diabetes mellitus. The location of the capillary blood sample has an impact on the results, the intensity of discomfort experienced, and the resulting tissue damage.¹⁴

This is in line with a previous study that found that the pain generated by a puncture during blood glucose tests makes Diabetes Mellitus patients reluctant to undertake blood glucose checks independently.¹⁶ As a result, the proper manner, and site of lancet insertion will aid in managing diabetic patients, one of which is blood glucose control. The researchers believe that the lateral placement of the fingertip is a less painful capillary blood collection site than the median fingertip location. However, bigger clinical trials are needed to confirm this.

This study has several limitations, such as respondents' differing responses to the giving of informed consent, requiring the use of an effective and optimum strategy and verbal communication by researchers. Elderly age is not included in the inclusion criteria of this study, so that the fulfillment of the number of samples takes a longer time because in the field there are more patients with elderly age. This study utilized a consecutive sampling technique, which ensures that individuals of the population have not had an equal chance of being chosen as samples. Suggestions for further study relating to time, sample size, and variables that influence the intensity of discomfort experienced during capillary blood collection.

CONCLUSION

The lateral group's mean pain level was low. The median group had the highest pain scale among all respondents whose pain level was assessed using the VAS instrument. Although it still needs to be validated in bigger clinical trials, the amount of pain experienced during capillary blood samples in the lateral fingertip differs significantly from the level of pain experienced during capillary blood sampling in the middle fingertip.

CONFLICT OF INTEREST

The authors declared that there were no potential conflicts of interest.

FUNDING

Any party does not sponsor the study.

ETHICS APPROVAL

This research was conducted after obtaining ethical approval from the Health Research Ethics Commission of the Malang Hospital, Faculty no. 400/188/K.3/302/2018.

AUTHOR CONTRIBUTION

AH and PTS were involved in the conception, designing, and supervising of the manuscript. PTS conduct this study. AH, PTS and ML analyze the data. All authors prepare the manuscript and agree for this final version of the manuscript to be submitted to this journal.

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