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Lifted Skin Fold (LSF) Technique as an Effort to Reduce Insulin Injection Pain

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Abstract

Diabetes mellitus (DM) is a serious threat to global health and is one of the top ten causes of death in the world. DM patients face challenges in undergoing therapy, especially due to pain and discomfort during insulin injection. This condition often causes refusal of treatment, which has a negative impact on therapy compliance and quality of life. The purpose of this study was to determine the effect of the LSF technique on the level of pain during insulin injection. This study employed a quasi-experimental research design with a pre-posttest design. The sample size was 120 inpatients who met the inclusion criteria of being DM patients with good awareness and willing to be respondents, and the exclusion criteria of being DM patients who could not read and write and were unwilling to be respondents. The sampling technique used in this study was total sampling. The research instruments used were a demographic questionnaire, NRS (Numeric Rating Scale) pain scale, and LSF technique SOP. Data analysis used the Wilcoxon Test and Mann Whitney Test. The study results showed that the pre-test pain level of the intervention group had a median value of 3, and the post-test became 2. The pre-test pain level of the control group had a median value of 3, and the post-test remained at 3. The results of the Wilcoxon test for the intervention group were p = 0.000, while the control group was p = 0.160. The results of the Mann Whitney test obtained p = 0.000. There was a significant difference in the level of pain pre-test post-test in the intervention group. There was no difference in the level of pain pre-test post-test in the control group. There was an effect of the LSF technique on the level of pain in insulin injection. This study recommends that the LSF technique can be one of the options to reduce pain when injecting insulin.

INTRODUCTION

Based on data *from the International Diabetes Federation (IDF)* in 2021, the number of diabetes cases worldwide was 536.6 million people aged 20-79 years (10.5%) suffering from diabetes in 2021. This number is estimated to increase to 12% in the following years. The

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number of diabetes cases in Indonesia was 19,465,102 cases of diabetes in adults (10.8% of the total population) in 2021. Indonesia is one of the 20 countries with the highest number of diabetes cases in the Western Pacific region. It is estimated that the number of diabetes cases worldwide will increase to 260 million by 2045, and Indonesia is also expected to experience an increase in the number of diabetes cases (Atlas, 2021) .

According to the 2023 Indonesian Health Survey (SKI) conducted by the Health Research and Development Agency (Balitbangkes) of the Indonesian Ministry of Health, the following are the data on diabetes mellitus cases, including the prevalence of diabetes mellitus among Indonesians aged 15 years and above: 8.5% and the prevalence of diabetes mellitus among men: 7.4%, women: 9.5%. The number of diabetes mellitus cases in Indonesia: 25.8 million people and the number of diabetes mellitus cases among those aged 15-59 years: 15.3 million people (Ministry of Health of the Republic of Indonesia, 2023) .

According to Ministry of Health data from 2022, the number of people with diabetes mellitus in 2021 was around 537 million. This number is estimated to increase to 643 million in 2030 and 783 million in 2045. In this population, diabetes also causes high mortality rates, with over 6.7 million people aged 20 to 79 suffering from diabetes (Ministry of Health of the Republic of Indonesia, 2023) . According to the Central Statistics Agency (BPS) of Semarang City, the prevalence of diabetes mellitus (DM) in Semarang City (2023) is 11.4% of the total population, with 43,611 cases of DM in Semarang City (2023). Based on the results of a preliminary study, 325 patients with diabetes mellitus were hospitalised at Bhakti Wira TamTama Hospital in Semarang in 2023.

Diabetes is a chronic condition that occurs when the pancreas can no longer produce insulin, or the body cannot use insulin effectively. Insulin is a hormone produced by the pancreas that acts as a key to transport glucose from the food we eat from the bloodstream into the body's cells to produce energy. The body breaks down all carbohydrate foods into glucose in the blood, and insulin helps glucose move into cells. When the body cannot produce or use insulin effectively, this causes high blood glucose levels, known as hyperglycaemia. In the long term, high glucose levels are associated with damage to the body and failure of various organs and tissues. Diabetes cases are divided into two main types: Type I Diabetes Mellitus and Type II Diabetes Mellitus (Atlas, 2021) .

Diabetes requires long-term care that necessitates monitoring. Without proper management, blood sugar levels will increase, which can cause complications in many organs and tissues, including coronary heart disease, cerebrovascular disease, kidney disease, eye disease, and various other complications caused by uncontrolled Diabetes Mellitus (Kurniawan, T., Sari, C. W. M., & Aisyah, 2020) .
Diabetes mellitus (DM) cases are significant and have a widespread impact. The following are some of the effects of DM that can affect health status: DM increases the risk of cardiovascular disease, such as heart attack and stroke; DM can cause kidney damage and kidney failure; DM can cause eye damage and blindness; DM can also cause nerve damage and neuropathy. Social and economic impacts include the high cost of DM treatment, which can burden families and communities; DM can lead to loss of productivity and income; and DM can cause stress, anxiety, and depression (Atlas, 2021) .

According to the PERKENI consensus, the five pillars of DM management include education, which involves providing knowledge about DM and its management, medical nutritional therapy by regulating diet to control blood sugar levels, physical exercise by engaging in

regular exercise to improve insulin sensitivity, pharmacological therapy or treatment using oral medications or insulin to control blood sugar levels, and self-monitoring of blood sugar levels (PERKENI, 2021). The treatment of Diabetes Mellitus (DM) involves a comprehensive approach to control blood sugar levels, prevent complications, and improve the patient's quality of life. Treatment of Diabetes Mellitus (DM) with insulin injection techniques is an important part of DM management, but there are several obstacles experienced in relation to insulin injections. The most commonly reported obstacles are pain at the injection site (70.3%), swelling or inflammation (34.5%), infection (14.1%), and allergies (6.5%).

Insulin injection in the management of type 2 diabetes faces many obstacles from both patients and healthcare professionals. Common concerns among diabetes patients include psychological concerns such as fear of injections, hypoglycaemia, and pain (Alhagawy, 2022) (Sheno, 2021) . The impact of these psychological issues can lead to non-compliance with treatment plans and blood glucose monitoring. Lack of self-discipline, such as not administering insulin injections regularly and not monitoring blood glucose levels. Uncontrolled blood sugar levels increase the risk of diabetes complications such as cardiovascular, kidney, and eye diseases, as well as a lack of self-discipline in blood glucose monitoring and insulin injections. Inadequate information and inappropriate perceptions contribute to these issues (Pamungkas, R. A., & Chamroonsawasdi, 2020) . Common reasons for refusal include fear of injections, pain, dependence, and financial constraints (Hussein, 2019) (Raghavendran, 2020) . Patients often perceive insulin as a negative experience that causes complications (Stuckey, 2019) .

Healthcare professionals can use effective strategies to manage injection-related pain. Key approaches include strategies to reduce pain, such as using *the Lifted Skin Fold technique. The Lifted Skin Fold* is a skin-lifting technique where a skin fold is created using the thumb and index finger or middle finger to gently lift the subcutaneous tissue from the muscle layer. Lift the skin fold and insert the needle vertically into it. The correct way to lift the skin fold is to lift the skin fold slowly, inject insulin slowly at a 90° angle to the surface of the skin fold, leave the needle in place for 10 counts after the plunger is fully depressed, remove the needle from the skin at the same angle as when the needle was inserted, and release the skin fold (Frid, 2016) .

The *Lifted Skin Fold* technique has been recommended by the Australian Diabetes Educators Association (ADEA) in its book Clinical Guidelines for Subcutaneous Injection Techniques, Canberra: 2015. However, the *Lifted Skin Fold* technique has never been studied at Bhakti Wira Tamtama Hospital in Semarang. Several studies conducted at Bhakti Wira Tamtama Hospital in Semarang for pain management include a study by Astuti (2016), which found that crushed cabbage compresses have a greater effect in reducing pain levels and breast swelling in postpartum mothers compared to cabbage compresses. 's research found that massage from the shoulders to the head is effective in reducing headaches, especially in hypertensive patients experiencing headaches. The results of 's research indicate that *post-cesarean section* clients can manage pain by receiving classical music therapy.

Given the high incidence rate and the importance of proper management of diabetes and its complications, diabetes therapy must be conducted rationally, both pharmacologically and non-pharmacologically. The accuracy of therapy is influenced by the diagnosis process, therapy selection, therapy administration, and therapy evaluation. Drug use evaluation is a structured quality assurance process conducted continuously to ensure that the drugs used are appropriate, safe, and efficient. Therefore, research is needed to analyse the effect of *the lifted skin fold*

technique on the insulin injection pain scale in type 2 diabetes mellitus patients admitted to Bhakti Wira Tamtama Hospital in Semarang and Dr. Soetarto Hospital in Yogyakarta.

MATERIALS AND METHODS

The study was conducted at Bhakti Wira Tamtama Hospital in Semarang and Dr. Soetarto Hospital in Yogyakarta from January to February 2025. The variables used were the *lifted skin fold* technique and insulin injection pain. This study used a *quasi-experimental* research design with *a pre-post test design.* The sample size was 120 respondents, with the following details: 60 respondents consisting of 30 respondents in the intervention group and 30 in the control group from Bhakti Wira Tamtama Hospital in Semarang, and 60 respondents consisting of 30 respondents in the intervention group and 30 in the control group from Dr. Soetarto Hospital in Yogyakarta, according to the inclusion and exclusion criteria. The sampling technique used in this study was *total sampling.* The inclusion criteria were (1) DM patients who were willing to be studied ( ), (2) physical conditions that allowed for the study (good consciousness, free from disabilities). The exclusion criteria were (1) DM patients who could not read and write, (2) DM patients who did not want to participate in the study. The research stages began with a review of the literature related to skin fold techniques and insulin injection pain, followed by the preparation of a research proposal. The research process began with submitting a permit application and obtaining Ethical Clearance (EC); considering the ethics of the research with the consent of the respondents, data confidentiality and respect for the rights and dignity of the respondents, and then continued with the data collection process: The research instrument or data collection tool used was a questionnaire consisting of (1) demographic information, namely age, gender, and education level (2) clinical information, namely the duration of DM and the duration of insulin therapy. *The Numeric Rating Scale (NRSS)* and skinfold technique. The intervention procedure in this study was to ensure that respondents had given their consent to the intervention, select the appropriate injection site, prepare the equipment, and ensure that the nurse's hands were clean and wearing gloves. After that, the injection technique was performed using the *lifted skin fold* technique, followed by an evaluation by measuring the pain scale using *the NRS,* recording the evaluation results, and educating respondents about the *lifted skin fold* technique and how to reduce pain. Document the data collection results, followed by data analysis using *the Wilcoxon* and *Mann Whitney tests.* The Health Research Ethics Committee (KEPK) of Muhammadiyah University Kudus granted ethical approval before the start of this study with Number: 174/Z-7/KEPK/UMKU/II/2025. Muhammadiyah University of Kudus has submitted research permission requests to Bhakti Wira Tamtama Hospital in Semarang and Dr. Soetarto Hospital in Yogyakarta and obtained research permission from both hospitals. Research respondents also gave permission for their data to be collected. The researcher provided consent forms for respondents to sign if they agreed to participate in the study.

RESULTS AND DISCUSSION

In this study, the researcher selected 120 respondents, all of whom were aged between 45 and 65 years old and were undergoing treatment at Bhakti Wira Tamtama Hospital in Semarang and Dr. Soetarto Hospital in Yogyakarta. The researchers conducted the study in January-February 2025, dividing the 120 respondents into two groups: 60 control group and 60 intervention group, as described in the following table:

Respondent Characteristics

Table 1 Frequency Distribution of Gender, Age, Education, Occupation, and Duration of Diabetes Mellitus Among Respondents at Bhakti Wira Tamtama Hospital in Semarang and Dr. Soetarto Hospital in Yogyakarta (n=120)

Category	Category	Intervention Group		Control Group	
		f	%	f	%
Gender	Male	21	65.0	21	65.0
	Female	39	35.0	39	35.0
Age	45–54 years	42	70	36	60
	55–65 years old	18	30.0	24	40
Education	Primary	3	5.0	9	15.0
	Junior High School	9	15.0	12	20.0
	High School	40	66.7	34	56.7
	Bachelor's Degree	8	13.3	5	8.3
Employment	Not working	5	8.3	19	31.7
	Farmer	2	3.3	6	10
	Private sector employees	35	58.3	16	26.7
	Self-employed	9	15.0	15	25.0
	Civil Servant	9	15.0	4	6.7
Duration of Diabetes	≤ 5 years	27	45.0	16	26.7
	≥ 5 years	33	55.0	44	73.3
Total		60	100%	60	100

In Table 1, the number of males in the intervention group was 21 (65.0%) and 39 (35.0%) females, while in the control group there were 21 (65.0%) males and 39 (35.0%) females. There were 42 (70.0%) respondents aged 45-54 years old in the intervention group, 18 (30.0%) aged 55-65 years old, while in the control group there were 36 (60.0%) aged 45-54 years old and 24 (40.0%) aged 55-65 years old. The educational background of the intervention group respondents was 3 at primary school level (5.0%), 9 at junior high school level (15.0%), 40 at senior high school level (66.7%), and 8 at bachelor's degree level (13.3%). while the control group had 9 (15.0%) with primary school education, 12 (20.0%) with junior high school education, 34 (56.7%) with senior high school education, and 5 (8.3%) with bachelor's degrees. The occupations of respondents in the intervention group were: unemployed 5 (8.3%), farmers 2 (3.3%), private employees 35 (58.3%), entrepreneurs 9 (15.0%), civil servants 9 (15.0%), while the control group had 19 respondents (31.7%) who were unemployed, 6 farmers (10.0%), 16 private employees (26.7%), 15 entrepreneurs (25.0%), and 4 civil servants (6.7%). The duration of diabetes mellitus was more than or equal to 5 years in 33 (55.0%) and less than or equal to 5 years in 27 (45.0%) for the intervention group, while for the control group, the duration of diabetes mellitus was more than or equal to 5 years in 44 (73.3%) and less than or equal to 5 years in 16 (26.7%).

Results

Univariate Analysis

Pain levels of intervention group respondents before and after the *Lifted Skin Fold* (LSF) technique was performed

Table 2. Frequency Distribution of Respondents Based on Insulin Injection Pain Levels in Diabetes Mellitus Patients in the Intervention Group Before and After the *Lifted Skin Fold* (LSF) Technique

LSF Technique Applied	N	Mean ± SD	Median	Min	Max
Before	60	2.95 ± 0.89	3	2	5
After	60	1.87 ± 0.72	2	1	3

Table 2 shows that the average pain level before the *Lifted Skin Fold* (LSF) test in the intervention group was 2.95, with a median (or middle value) of 3. The lowest pain level was 2 and the highest was 5. After the *Lifted Skin Fold* (LSF) test, the average pain level in the intervention group decreased to 1.87, with a median of 2. The lowest pain level was 1 and the highest was 3.

Pain levels of post-operative respondents in the control group.

Table 3. Frequency Distribution of Respondents Based on Pain Levels of Diabetes Mellitus Respondents in the Control Group

Stretching technique performed	N	Mean ± SD	Median	Min	Max
Before	60	3.22 ± 0.90	3	2	5
After	60	3.37 ± 0.58	3	2	4

Table 3 shows the pain level of the control group with an average of 3.22 and a median of 3. The lowest pain level was 2 and the highest was 5. The pain level of the control group increased with an average of 3.37, while the median remained at 3. The lowest pain level remained at 2 and the highest became 4.

Bivariate Analysis

Data Normality Test

Data normality testing was performed using the *Shapiro-Wilks* test. The results of the data normality test are presented in Table 4.

Table 4. Results of the Data Normality Test

Pre-test and post-test pain level data	*p-value*	Conclusion
Intervention Group		
Pre-test	0.00	Non-normal distribution
Post-test	0.000	Non-normal distribution
Control group		
Pre-test	0.000	Non-normal distribution
Post-test	0.000	Non-normal distribution

Based on Table 4, the pre-test and post-test data on insulin injection pain in diabetic patients in the intervention and control groups all had *p-values* < 0.05, indicating that the data were not normally distributed. As the data were not normally distributed, the research hypothesis was tested using *the Wilcoxon Signed Ranks Test* (control group or intervention group).

Homogeneity Test

Table 5. Homogeneity Test Results

Pre-test pain	p-value	Conclusion
Intervention group - Control group	0.578	Homogeneous

Table 5 shows the pre-test pain data for the treatment group and control group with a significance of $p = 0.578$ ($p > 0.05$), indicating that the pre-test pain data for both groups are homogeneous/balanced.

Difference in Insulin Injection Pain Levels in Diabetes Mellitus Patients Before and After the *Lifted Skin Fold* (LSF) Technique Treatment Group

Table 6. Results of the test for differences in insulin injection pain levels between before and after the application of the *lifted skin fold* (LSF) technique

Pain in the intervention group	Mean	Z_{-score}	*p-value*
Pre-test	3	-6.757	0.000
Post-test	2		

Table 6 shows that the average pain score of respondents before the *lifted skin fold* technique was 3. The pain score of respondents after the *lifted skin fold* technique was 2. The *Wilcoxon* test yielded a *Z-score* of – 6.757 with *a p-value* = 0.000, thus concluding that there was a difference in the level of insulin injection pain before and after the *lifted skin fold* technique.

Pre-Test Post-Test Insulin Injection Pain in Diabetes Mellitus Patients Control Group

Table 7 Pre-Test Post-Test Insulin Injection Pain Levels in Diabetes Mellitus Patients In the Control Group

Pain in the control group	Mean	Z_{score}	*p-value*
Pre-test	3	-1.406	0.160
Post-test	3		

Based on Table 7, the average pain scores of respondents at pre-test 3 and post-test 3 are known. The *Wilcoxon test* results obtained a *Z-score* of – 1.406 with *a p-value* = 0.160, thus concluding that there was no difference in pre-test and post-test pain in the control group patients.

The Effect of the *Lifted Skin Fold* (LSF) Technique on the Level of Pain from Insulin Injections in Diabetes Mellitus Patients in the Intervention Group and Control Group

Table 8 Difference in the Effect of the *Lifted Skin Fold* (LSF) Technique on the Level of Insulin Injection Pain in Diabetes Mellitus Patients in the Intervention Group and Control Group

Post-test pain	Mean	$Z_{\text{-score}}$	*p-value*
Intervention group	2	-8.373	0.000
Control group	3		

Table 8 shows that the intervention group had an insulin injection pain level of 2, while the control group had a pain level of 3. The results of *the Mann Whitney* test showed a *p-value of* 0.000 ($p < 0.05$), thus concluding that the *Lifted Skin Fold (*LSF) technique has an effect on the level of insulin injection pain in diabetes mellitus patients at the Inpatient Ward of RST Bhakti Wira Tamtama Hospital in Semarang.

DISCUSSION

Difference in Insulin Injection Pain Levels in Diabetes Mellitus Patients *Pre-Test* and *Post-Test in* the Intervention Group Using the *Lifted Skin Fold* (LSF) Technique.

Based on the results of the study on the intervention group using the *Lifted Skin Fold* (LSF) technique, it was found that the pre-test level was 3 and the post-test level decreased to 2. Pain is a subjective sensory and emotional experience associated with actual or potential tissue damage that can cause unpleasant feelings and can describe the condition of actual and potential damage (Potter & Perry, 2010).

Melzack and Wall (1965) proposed the gate control theory, which states that pain impulses can be regulated or even inhibited by defence mechanisms along the central nervous system. Clancy and McVicar (1992) explained that defence mechanisms can be found in the cells of the gelatinous substance e within the dorsal horn of the spinal cord, thalamus, and limbic system. The theory states that pain impulses are transmitted when a defence is open and inhibited when the defence is closed, which is the basis for pain control therapy (Wade & Tavris, 2008).

Efforts to reduce insulin injection pain can be made through proper pain management. Pain management, especially during injections, is an important aspect of healthcare. Pain during injections can cause anxiety and discomfort in patients. Therefore, various pain management methods, both pharmacological and non-pharmacological, continue to be developed and researched.

One non-pharmacological method that has attracted attention is the use of the *Lifted Skin Fold* (LSF) technique as a distraction technique. Distraction as a *Lifted Skin Fold* (LSF) mechanism serves as an alternative stimulus that diverts the patient's attention from the pain sensation caused by the injection. This stimulus can be in the form of skin lifting or gentle pinching.

Several studies have focused on the use of pinching in children, as children tend to be more prone to anxiety and pain when injected. The results of the study show that pinching can reduce pain responses in children during the injection process (Tyas & Mardhiyah, 2023).

The results of this study showed that the intervention group experienced a decrease in pain levels from an average of 3 to 2. *The Wilcoxon Signed Ranks Test* yielded a *p-value* of 0.000 ($p < 0.05$), indicating a significant difference in insulin injection pain levels between the pre-

test and post-test groups of diabetes mellitus patients who underwent the *Lifted Skin Fold* (LSF) technique.

Pain Levels of Insulin Injections in Diabetes Mellitus Patients Pre-Test and Post-Test Control Group.
The pain level in the control group in the pre-test was an average of 3, and in the post-test, the average result was the same, namely 3. *The Wilcoxon Signed Ranks Test* yielded a *p-value* of 0.160 ($p > 0.05$), indicating that there was no difference in the level of pain from insulin injections in diabetic patients in the pre-test and post-test control groups.

The Effect of the *Lifted Skin Fold* Technique (LSF) on the Level of Pain from Insulin Injections in Diabetes Mellitus Patients.
The *Mann-Whitney Test* results obtained a *p-value* = 0.000 ($p<0.05$), so the research hypothesis Ha was accepted, and it was concluded that the *Lifted Skin Fold* (LSF) technique had an effect on the level of pain experienced by diabetes mellitus patients during insulin injections. Smeltzer and Bare (2015) explain that pain physiology occurs when a part of the body is injured by pressure, puncture, cut, incision, cold, or lack $_{of}O_2$in the cells, causing the injured part of the body to release various substances that are normally found intracellularly. When intracellular substances are released into the extracellular space, they irritate the nociceptors. These nerves are stimulated and travel along nerve fibres or neurotransmission, producing substances called neurotransmitters, such as prostaglandins and epinephrine, which carry pain messages from the spinal cord to the brain, where they are perceived as pain (Smeltzer,2015) .
Research on adults also shows positive results. A study on touch therapy for post-operative pain management in infants showed a decrease in pain levels after touch therapy, including pinch touch. Other studies also show that patients' experiences with pain management vary greatly and require nurses to be competent in performing proper pain management (Kartika et al., 2023).

The *Lifted Skin Fold* (LSF) technique is a method used to reduce pain during injections, including insulin injections. The mechanism of the LSF technique involves lifting the skin; the LSF technique involves lifting the skin at the injection site to form a skin fold. Reducing pressure; by lifting the skin, pressure on the subcutaneous tissue can be reduced, allowing the needle to enter more easily and causing less tissue damage. Reducing nociceptor stimulation; by reducing pressure and tissue damage, the LSF technique can reduce nociceptor stimulation, which are receptors responsible for detecting pain. Thus, the LSF technique can reduce the intensity and scale of pain during injections. Several studies have shown that the LSF technique can be effective in reducing injection pain in diabetic patients using insulin. The LSF technique is relatively easy to perform and does not require special equipment, making it a viable option for reducing pain during insulin injections (Kalra, 2023)

CONCLUSION

The average level of insulin injection pain in patients before being given the *Lifted Skin Fold* (LSF) technique was 3. After being given the *Lifted Skin Fold* (LSF) technique, the average pain decreased to 2. There was a difference in pain levels between before and after being given the *Lifted Skin Fold* (LSF) technique with p = 0.000.

The average pain level of insulin injection for patients was 3. The average pain level during the post-test remained the same at 3. There was no difference in pain levels between the pre-test and post-test with p = 0.160.

There was an effect of the *Lifted Skin Fold* (LSF) technique on the level of pain during insulin injection in the intervention group and the control group with p = 0.000.

Diabetes mellitus patients should continue to use the *Lifted Skin Fold* (LSF) technique when injecting insulin during their recovery period at home. The results of this study can be used as new information about one of the non-pharmacological treatments to reduce pain in diabetes mellitus patients using the *Lifted Skin Fold* (LSF) technique intervention. It is hoped that this study can be applied when administering insulin injections to diabetes mellitus patients at RST Bhakti Wira Tamtama Semarang and RST dr. Soetarto Yogyakarta as one of the non-pharmacological nursing interventions and can be used as a Standard Operating Procedure (SOP) in pain management.

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