Original Article

The Effect Of Virtual Reality On Pain In Diabetic Foot Ulcer Patients

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ABSTRACT

Background: *Diabetes Mellitus (DM) is a heterogeneous group of disorders characterized by increased blood glucose levels or hyperglycemia which can cause complications such as Diabetic Foot Ulcer. Debridement can cause the patient to experience pain. A nursing intervention that can be used to reduce pain during the debridement of diabetic ulcers is a distraction. VR (Virtual Reality) become a popular distraction device to reduce pain. The purpose of this study was to analyze the effect of Islamic audio-visual therapy by using virtual reality on pain in the treatment of diabetic ulcers.*

Methods: *This type of research uses a quantitative research type with Quasi-experimental with the One Group Pre-Post Test Design approach. The population in this study were diabetes mellitus ulcer pain patients at the Semarang Foid Clinic with a total of 26 patients with a total sample using 26 samples. The instrument used was the pain observation sheet. Data analysis used the Wilcoxon test.*

Results: *the majority were male 65.4%, the majority had a high school education 42.3%, the majority suffered 1-2 months 73.1% and the majority had a grade I Diabetes Mellitus ulcer 65.4%. The results of p-value 0.001 <0.05 can be interpreted that there is an effect of Islamic audio-visual therapy on pain in diabetic ulcer care.*

Conclusion: *This study provides an effect of Islamic audio-visual therapy by using virtual reality on pain in diabetic ulcer care. VR has an effective effect on lower pain in DFU patients. In future research, more detailed criteria are required, such as patients with similar diseases, same age group, and more participants to study.*

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Introduction

Diabetes mellitus is a major burden on disease globally, one of the chronic illnesses with the highest rate (Sørensen, 2022). One of the most significant side effects of individuals with poorly managed diabetes mellitus is diabetic foot ulcers. (Oliver & Mutluoglu, 2019). The prevalence of diabetes is still rising, diabetes affects 90 million adults, or 1 in 11 of them. It is projected that by 2030 there will be 113 million adults living with diabetes, and by 2045 there will be 151 million. In 2021, 747,000 deaths worldwide will be

attributed to diabetes, with over one-half of all adults with the disease going undiagnosed (IDF, 2021). Indonesia ranks fifth among countries with the largest number of people with diabetes, and an estimated 19.5 million people suffer from diabetes in 2021 if it continues, the number is projected to reach 28.6 million in 2045. the prevalence in Central Java province itself with Diabetes Mellitus in 2019 was 13.30%, namely 411,750 people, which decreased from 2018 from the original number of 971,518 or 34.50% (Dinkes Jateng, 2019)

Diabetes Mellitus is often referred to as The Great Imitator, because this disease can cause complications in other organs, can cause various complaints, and can disrupt the lifestyle and quality of life in a person. The most important chronic complications are cardiovascular, stroke, diabetic foot ulcer, and diabetic nephropathy (Desrian., 2022). Diabetic foot ulcers (DFU) are caused by worsening blood circulation so that blood flow does not flow to the ligaments efficiently, and also high sugar levels cause numbness due to nerve damage to the ligaments. (dr Haposan, 2020). Ineffectively treated DFU will worsen and may lead to infection and amputation. Patients who have had an amputation will decrease quality of life, more social burden, and a shorter life expectancy (Lin et al., 2020).

One of the treatments that can be done for DFU care is debridement, which is also known as the removal of necrotic tissue in DM wounds that can cause pain. (Dian, 2021). In a global survey, 21.1% of patients with chronic wounds (such as venous and mixed ulcers and DFUs) said that pain happened during most or all dressing changes, and 31.6% said they had to spend more than an hour trying to relieve the pain following the dressing change (Price et al., 2008).

Many patients experience pain, and persistent pain can have physical and psychological effects on the patient. It is important to support and encourage patients to express discomfort since their reactions to pain are frequently shaped by social, cultural, and spiritual norms (Pranata et al., 2021). Inadequately managed pain has significant adverse consequences on a person's quality of life in terms of physical, social, psychological, and financial well-being. (Sulistyo, 2017). Pain that is not managed properly will be able to cause problems of increased sympathetic nerves that cause an increase in pulse, increased blood pressure, increased heart pump contractility, decreased quality of life and productivity and there will be a decrease in the duration of healing in patients, the duration of hospitalization will be prolonged, (Judha., 2017).

Nursing interventions performed to reduce pain during the debridement of diabetic ulcers are the provision of pharmacological and non-pharmacological therapies. Non-pharmacological therapy can be done independently by nurses such as pain management. There are several pain management that can be done by nurses including cold and warm compresses (Halm & Lindquist, 2022), hypnosis, deep breath relaxation (Abo El Ata et al., 2021), finger grip relaxation, Spiritual emotional freedom therapy (SEFT) and distraction techniques (diversion) which can be in the form of providing audio-visual therapy (Moradipoor et al., 2022; Pebrianti, S., Nugraha, A., & Shallahudin, 2020).

Distraction is one way to reduce pain in patients. With the continuous development of virtual reality (VR) technology, new treatment modalities are designed through a combination of general cognitive therapy and gamification. Immersion virtual reality (VR) as an extraordinarily successful non-

pharmacological pain management method. VR has been demonstrated to reduce anxiety and pain (Hoffman et al., 2020). Virtual reality technology provides a more realistic setting, making medical applications more realistic and comfortable (Bone et al., 2023)

Virtual Reality (VR) technology involves a device that has the ability to simulate a virtual environment with audio-visual design features that look attractive so that it seems to look real. (Gustomi., 2017). VR technology combined with surah Ar-Rahman 78 verses can increase endorphin levels, reading the Koran which is chanted in slow motion, and full of appreciation can create a relaxation response. The belief that the Al-Quran is a holy book that contains the word of God and is a guide to life for humans, listening to the Al-Quran brings the subject closer to his God and leads the subject to remember him(Aufa, 2022).

The results of preliminary studies conducted at the Foid Clinic Semarang obtained data on patients who came to check their wounds in 2022 around 237 people with an average monthly visit of ± 30 patients. The results of interviews with 8 respondents, 4 of them respondents with diabetic ulcers complained of moderate pain continuously causing disrupted activity, 3 respondents complained of severe pain in their diabetic ulcers continuously until they could not do their daily activities, could not sleep because of the pain, felt frustrated because they were given a disease like this. Based on the phenomenon, the researcher is interested in examining the effect of providing audio-visual therapy on diabetes mellitus ulcer care actions in DM patients. This study aims to analyze the effect of Islamic audio-visual therapy by using virtual reality on pain in the treatment of diabetic ulcers.

Methods

Quantitative research with a Quasy-Experimental One Group Pre-Post Test Design approach. The population in this study were diabetes mellitus ulcer pain patients at the Semarang, Central Java with a total of 26 participants with a sample size using total sampling of 26 samples. The inclusion criteria are: Participants who are cooperative, aged 35 - 65 years, Islamic religion, and The degree of diabetes mellitus ulcers grade 0 & 1. The exclusion criteria are patients with cognitive, hearing, and vision impairment.

Audio-visual therapy was performed on all participants. Before wound care cleansing, the researcher gave informed consent, asked for demographic data, observed the participant's pain level, and recorded it in the observation sheet. The instrument used was a pain observation sheet. Each respondent was given audio-visual therapy using VR using surah Ar-Rahman 78 verses for 15 minutes with 50% light setting with medium volume. Researchers re-observed the respondent's pain level and recorded it in the observation sheet. Data analysis using the Wilcoxon test by SPSS. This research has received ethical approval from the Faculty of Nursing and Health Sciences Universitas Muhammadiyah Semarang No 110/KE/07/2023.

Results

Table 1. Frequency Distribution and Characteristics of Respondents

Characteristics of Respondents	Frequency	(%)
Age		
35-45	7	26,9
46-55	10	38,5
56-65	9	34,6
Gender		
Male	17	65,4
Female	9	34,6
Education		

Characteristics of Respondents	Frequency	(%)
Elementary	2	7,7
Junior high school	7	26,9
Senior high school	11	42,3
Bachelor	6	23,1
Duration DM		
1-2 Months	19	73,1
>2 Months	7	26,9
Ulcer Degree		
Grade I	17	65,4
Grade II	9	34,6

Table 4.1 shows that of the 26 respondents, the majority of respondents were aged 46-55 years 38.5%, the majority were male 65.4%, the majority had a high school education 42.3%, the majority suffered 1-2 months 73.1% and the majority had a grade I Diabetes Mellitus ulcer 65.4%. The majority of respondents were male 65.4%, the majority had a high school education 42.3%, the majority had suffered for 1-2 months 73.1% and the majority had grade I Diabetes Mellitus ulcers 65.4%.

Table 1. Pain scale in diabetes mellitus ulcer patients before and after treatment measures using audio-visual therapy

	Min – Max	Mean	SD	P-value
Before intervention	4-8	5	0,857	0,001
After intervention	1-5	2	1,023	

Table 2 shows that the pain scale respondents before the intervention had a mean value of 5.00 and a standard deviation of 0.857 while the pain scale after the intervention had a mean value of 2.00 and a standard deviation of 1.023. The results of the data normality test in this study using Shapiro Wilk obtained non-normally distributed data, so using the Wilcoxon test non-parametric test. The results of statistical tests using the Wilcoxon test showed a p-value of 0.001 <0.05, which means that there is an effect of providing Islamic audio-visual therapy on pain.

Discussion

This study show that the majority of respondents 46-55 age 38.5%. This study is in line with Banik (2020) which states that there is a relationship between age and the incidence of diabetic ulcers. Diabetes mellitus patients aged 45-55 years are prone to diabetic foot ulcers. Increasing age causes changes in carbohydrate metabolism and changes in insulin release that are influenced by glucose in the blood and the inhibition of the release of glucose into cells because it is influenced by insulin. The increasing age of a person, the greater the occurrence of DM and even ulcers (Vas, 2017) .

The majority were male 65.4%. This study is in line with research conducted by (Fernando., 2018) that there is a significant relationship between gender and diabetic ulcers. Men are more at risk of diabetic wounds. Based on hormonal factors, estrogen possessed by women helps in maintaining blood sugar stability and storing fat reserves but will experience a decrease in function after menopause so there will be a risk of diabetic wounds (Meng et al., 2022).

The majority of respondents have a high school education 42.3%. Research conducted by Lubis (2017) also shows the same results, namely the percentage of the last education level of respondents who are mostly high school graduates. The study concluded that the level of education can affect a person's knowledge in implementing healthy living behavior. (Sjattar et al., 2019). The majority of respondents experienced DFU 1-2 months

73.1%. Long-suffering from DM has the opportunity to experience diabetic foot ulcers, which are caused by uncontrolled blood sugar levels (Zantour et al., 2020)

The pain scale before the intervention had a mean value of 5.00 and a standard deviation of 0.857 while the pain scale after the intervention had a mean value of 2.00 and a standard deviation of 1.023. This study relevant to Dyah (2018) that there were differences in pain levels during wound care for DM wound patients in the control group before and after being given murrotal therapy. Research conducted by Abdurrochman (2018) mentioned that when the respondents listened to the recitation of the holy verses of the Qur'an, it appeared in the EEG (electroencephalogram) recording of delta waves in the frontal and central regions on both the right and left sides of the brain when dominated by delta waves, it means being in peace, tranquility, and comfort.

Pain during the wound care process is classified as moderate acute pain that will disappear after wound care. Pain during the wound care process begins when the dressing is removed and cleaned. The need for comfort is a condition that makes a person feel comfortable, protected from psychological threats, and free from pain, especially pain. (Pebrianti, 2020). One way to reduce pain is with distraction techniques, which is a method to relieve pain by diverting the patient's attention to other things so that the patient will forget about the pain experienced (Pebrianti et al., 2020).

Distraction techniques are used to reduce the pain scale in patients with diabetes mellitus ulcers using Islamic audio-visual therapy. Audio-visual therapy works best for a short period of time, as well as for intensive pain that only lasts a few minutes. One effective distraction technique is audio-visual therapy (listening to the recitation of the holy verses of the Qur'an), which can reduce physiological pain, stress, and anxiety by distracting a person from pain. Qur'anic audio-visual therapy provides benefits and a panacea for a person experiencing distress, despair, and anxiety. The Qur'an provides peace to the systems and elements of the human body. Islamic audio-visual therapy is a recitation of the Qur'an recited by Qori' or Qori'ah in accordance with tartil and tajweed which flows beautifully packaged in audio media such as cassettes, CDs, or digital data (Handayani, 2019).

The recitation of the Qur'an of Suarah Ar-Rahman physically contains the element of the human voice, the human voice is an amazing healing instrument and the most accessible tool. Sound can lower stress hormones, activate natural endorphins, increase feelings of relaxation, and distract from fear, anxiety, and tension, improving the body's chemical system and thereby lowering blood pressure and slowing breathing, heart rate, pulse, and brain wave activity. One effective distraction technique is audio-visual therapy (listening to the recitation of the holy verses of the Qur'an), which can reduce physiological pain, stress, and anxiety by diverting one's attention from pain. So distraction through the method of listening to the sound of the strains of the holy Qur'an can provide a sense of comfort so that respondents do not focus on pain(Wiji, 2017).

The results of this study indicate that there is an effect of providing Islamic audio-visual therapy on pain in DFU. The effect of murottal therapy surah Ar-Rahman effect on DM wound scores (Setiawan et al., 2021). Endawi (2018) states that there was a decrease in pain intensity in patients given murotal therapy.

The mechanism of pain is based on multiple processes: nociception, peripheral sensitization, phenotype change, central

sensitization, ectopic excitability, structural reorganization, and decreased inhibition. Between the stimulus of tissue injury and the subjective experience of pain, there are four separate processes: transmission, modulation, and perception (Bone et al., 2023).

Pain stimuli received by nociceptors in the skin can be high or low intensity such as stretching and temperature and by tissue lesions. Lesions also activate blood clotting factors so that bradykinin and serotonin will be stimulated and stimulate nociceptors. If blood vessel occlusion occurs, ischemia will occur which will cause accumulation of extracellular K + and H + which further activates the nociceptors (Nian., 2020).

Distraction is one of the interventions to reduce pain. Islamic audio-visual therapy can increase stimulus and the effect of relaxation and calmness in oneself so that it can affect perception, information, and emotions in oneself which have an impact on the ability in the form of cognitive adaptation that can control pain to a tolerable limit. Audio visual therapy has a psychological impact in a positive direction, this is because when murottal is listened to and reaches the brain, then this murottal will be translated by the brain. Our perception is determined by all that has been accumulated, desires, needs, and pre-conceptions. Murottal therapy increases the quality of one's awareness of God will increase, whether the person knows the meaning of the Qur'an (Handayani, 2019).

This awareness will cause the totality of submission to Allah SWT, in this state the brain is on a wave at a frequency of 7-14 Hz, this is an optimal state of brain energy and can get rid of stress and reduce anxiety. The body organ that can help in the process of distraction or distraction through hearing is the ear. The ear is one of the body's most complex devices. Researchers confirm that this sense of hearing is very important for the balance of the whole body. When this sense is disturbed, most of the body devices are affected and experience imbalance as well. Therefore, the best way to maintain the body's equipment is by using the influence of sound. The sound will be responded to by the body's cells, then improve their work and restore balance (Zahrofi, 2018).

The sound of the Qur'ān represents sound vibrations or sound waves traveling to the ear, then into the brain (after first being transformed in the eardrum into vibrations or electronic signals). Then, these sound waves affect certain regions of the brain, where they then give commands to the body to respond to the sound. The therapeutic effect of listening to the verses of AlQur'an is in the form of changes in electrical currents in the muscles, changes in blood circulation, and changes in heart rate and blood levels in the skin. These changes indicate a relaxation or decrease in reflective nerve tension which results in the loosening of the arteries and increasing blood levels in the skin, accompanied by a decrease in heart rate frequency. (Endawi, 2018).

Audio-visual using VR works on the brain, it is stimulated by external stimuli (Qur'an therapy), and the brain produces chemicals called neuropeptides. These molecules will attach to their receptors in the body and will provide feedback in the form of pleasure or comfort. Al-Qur'an audio-visual therapy has an influence on reducing pain due to the ability of cognitive adaptation that is able to control pain to a tolerable limit. The Qur'an has a positive influence on psychology where it will increase a person's awareness of God (Zahrofi, 2018).

Conclusion

The provision of Islamic audio-visual therapy by using VR can reduce pain in diabetic ulcer treatment. Audio-visual therapy works on the brain, which when driven by external stimuli (AlQur'an therapy), the brain produces chemicals called neuropeptides. These molecules will attach to their receptors in the body and will provide feedback in the form of pleasure or comfort. Audio-visual Al-Qur'an therapy has an influence on reducing pain due to the ability of cognitive adaptation that is able to control pain to a tolerable limit. In future research, more detailed criteria are required, such as patients with similar diseases, same age group, and more participants to study.

Authors Contributions

The study was conceptualized and designed to explore the provision of Islamic audio-visual therapy using VR as a method to reduce pain in diabetic ulcer treatment. The authors contributed by conducting VR therapy interventions and analyzing the role of Islamic audio-visual therapy, particularly its influence on neuropeptides and cognitive adaptation mechanisms that help control pain. Data collection and analysis were meticulously carried out, with a focus on maintaining consistent criteria for patient selection and ensuring ethical compliance. Additionally, the interpretation of results highlighted the potential of Al-Qur'an therapy in improving patient outcomes. The manuscript was written and revised collaboratively, emphasizing the clinical and research implications for future studies.

Conflicts of Interest

No conflict interest

Acknowledgment

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