JDHT Journal of Dental Hygiene and Therapy
Volume 6, Nomor 2 Tahun 2025, pp. 135-139
ISSN (online): 2723-1607 DOI: 10.36082/jdht.v6i2.2564

THE EFFECTIVENESS OF DENTAL HEALTH MONITORING WEBSITES IN INCREASING THE KNOWLEDGE OF DIABETIC MELLITUS PATIENTS

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Info Article

Article History:

Received: 12 August 2025
Revised: 29 Sept 2025
Accepted: 6 Oct 2025
Available Online: 15 Oct 2025

Keywords:
Dental Health, Diabetes Mellitus, Website

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Published by Health Polytechnic of the Ministry of Health Jakarta I

Abstract

The prevalence of DM continues to increase globally, placing a significant burden on public health systems and individual quality of life. This is supported by the increase in diabetes mellitus in Indonesia, which originally in 2013 had a prevalence of 6.9% to 10.9% in 2018. One of the important aspects of DM management that is often overlooked is the patient's understanding of its complications on dental and oral health. In today's digital era, the use of information technology, especially through online platforms, offers great potential as an effective health education medium. The purpose of this study was to test the effectiveness of a website-based intervention in improving the knowledge of DM sufferers about the relationship between DM and dental health. This study uses a Pre-experiment research method with a one group pre-post test design. The large number of respondents used the Slovin formula and got a total of 35 respondents. This research using questionnaires to measure responden's knowledge. The data analysis test uses the Wilcoxon test. The results of the study showed a significant difference between the knowledge of people with diabetes mellitus before and after the implementation of the Dental Health Monitoring Website as evidenced by a significance value of < 0.05 (p-value: 0.00). Positive knowledge will increase the motivation of people with diabetes mellitus to be able to maintain health and increase life expectancy. This study shows that the use of dental health monitoring websites is significantly effective in increasing the knowledge of people with diabetes mellitus.

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Introduction

Diabetes mellitus (DM) is a chronic metabolic disease characterized by persistent hyperglycemia due to defects in insulin secretion, insulin action, or both (Wasludin & Lindawati, 2019). The prevalence of DM continues to increase globally, placing a significant burden on public health systems and individual quality of life. This disease affects about 21 million people or about 7% of the world's population, of which about 6.2 million are undiagnosed with diabetes mellitus. These numbers increase substantially with the rise in obesity. It is predicted that one in three individuals born in 2000 will suffer from diabetes mellitus (Bauman, 2010). Based on reports from *International Diabetes Federation* (IDF) In the 2019 Atlas, Indonesia is ranked 7th in the country with adults suffering from diabetes mellitus in 2019, 2030 and 2045 (Magliano et al., 2019). This is supported by the increase in diabetes mellitus in Indonesia, which originally in 2013 had a prevalence of 6.9% to 10.9% in 2018 (Kementerian Kesehatan Republik Indonesia, 2022). The increase in patients with diabetes mellitus will continue to increase if it is not seriously controlled

One of the important aspects of DM management that is often overlooked is the patient's understanding of its complications on dental and oral health (Larvin, Kang, Aggarwal, Pavitt, & Wu, 2022). The relationship between DM and dental health is bidirectional (Shrivastava, Uppal, Popli, & Sircar, 2022). Pathophysiologically, persistent hyperglycemia in people with DM triggers changes in the extracellular matrix, including collagen, through a non-enzymatic glycation process. The formation of advanced glycation end products (AGEs) can disrupt vascular integrity and affect cellular function, including the immune response (Jiang et al., 2022). This condition makes DM sufferers more susceptible to infections, especially periodontal infections (Winda & Arinawati, 2025). Periodontal diseases, such as gingivitis and periodontitis, in people with DM often have an earlier onset, faster progression, and higher severity than non-DM population.

In contrast, periodontal infections can also affect glycemic control. Periodontitis is a chronic inflammatory disease characterized by the destruction of the tooth's support tissue due to an immune response to pathogenic bacteria. Pro-inflammatory

cytokines, such as TNF-α, IL-1β, and IL-6, which are released in large amounts from inflamed periodontal tissue can enter the systemic circulation (Borgo Sarmento et al., 2023). These cytokines are known to increase insulin resistance, disrupt glucose metabolism, and worsen glycemic control. Therefore, periodontitis is considered a potential macrovascular and microvascular complication in DM, and conversely, DM is a major risk factor for the development and severity of periodontal disease.

However, the literature shows that the level of knowledge of DM sufferers regarding this critical relationship is still relatively low (Li, Wang, Huang, Li, & Qiu, 2022). This lack of understanding becomes a significant obstacle to effective self-management practices, which should include the maintenance of optimal oral hygiene and regular dental check-ups. This knowledge gap hinders the prevention efforts and early intervention that is crucial to prevent the negative cycle between hyperglycemia and periodontal inflammation.

In today's digital era, the use of information technology, especially through online platforms, offers great potential as an effective health education medium (Fadhel Nurmidin & Surya, 2025). Educational websites can present scientific information in a structured, visual, and interactive way, reaching a wider audience without geographical or time restrictions (Ramdhani, Fatmasari, & Djamil, 2023). Therefore, this study was designed to test the effectiveness of a website-based intervention in improving DM patients' knowledge of the relationship between DM and dental health.

The research, which seeks to evaluate a website-based intervention to improve diabetes DM patients' knowledge of the link between DM and dental health, is a timely and relevant inquiry. This study exists at the convergence of two significant public health domains: the complex management of chronic diseases and the burgeoning, yet challenging, application of digital health technologies. The core hypothesis is that a digital platform can serve as an effective medium for health education, thereby contributing to better long-term clinical outcomes for a specific patient population. The results of this study are expected to provide empirical evidence regarding the role of digital technology as a valid and effective tool in improving the health literacy of DM patients, which in turn can contribute to improving long-term clinical outcomes.

Method

This study uses a Pre-experiment research method with a one group pre-post test design. At the beginning of the study, the behavior of people with diabetes mellitus was measured in the form of knowledge using questionnaires. The results of the patient's knowledge questionnaire answers are used as *pretest* data, then interventions are given in the form of education and health recording using the Dental Health Monitoring Website for DM patients.

The research instrument used a questionnaire containing respondents' knowledge of maintaining dental and oral hygiene consisting of 11 questions in the form of multiple choice using a correct answer assessment scored 1. While the wrong answer is given a score of 0.

The population used in this study is patients with diabetes mellitus who are members of Prolanis in the working area of the Padangsari Health Center. The respondent selection technique uses the purposice sampling technique based on the balance of the researcher. The inclusion criteria for this study are a) willing to be used as a respondent; b) DM sufferers; c) still have teeth and do not use dentures. Exclusion criteria include a) DM sufferers who experience complications of other systemic diseases; and b) DM sufferers who use dentures. The large number of respondents used the Slovin formula and got a total of 35 respondents.

Data analysis used univariate and bivariate analysis. Univariate analysis was carried out to analyze individual variables from the survey results. In categorical data, only a frequency distribution with a percentage or proportion measure is used to summarize the data. While in numerical data, the description is based on the mean size and its distribution, i.e. the mean and standard deviation. Meanwhile, bivariate analysis uses the Wilcoxon test.

This research has received approval from the Research Ethics Commission of the Ministry of Health of the Ministry of Health with *Ethical Approval* No. 0100.EA/KEPK/2024.

Results

The researcher determined the inclusion criteria for the sample, namely people with diabetes mellitus who are 41-70 years old, have a *smartphone* and can operate it independently or accompanied by their family, are willing to be respondents and have gingivitis. Sampling using the Slovin formula was obtained with a total of 35 samples.

Table 1. Respondent Characteristics Data

No	Characteristic	n	%
1.	Gender		
	Man	8	22,9
	Woman	27	77,1
2.	Age		
	41-50 years old	10	28,6
	51-60 years old	20	57,1
	61-70 years old	5	14,3
3.	Education		
	Elementary/equivalent	3	8,6

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Junior High School/Equivalent	3	8,6
High School/equivalent	15	42,9
Diploma III	1	2,9
Diploma VI/S1	10	28,6
S2	3	8,6

The table above shows that the distribution of the frequency of people with diabetes mellitus by gender, namely women with the largest percentage is 77.1 (27 people). The frequency of people with diabetes mellitus by age, the largest percentage is 57.1% (20 people) aged 51-60 years. Meanwhile, the frequency of people with diabetes mellitus based on educational background, the largest percentage is 42.9% (15 people) with the high school category.

Table 2. Differences in Knowledge of Diabetic Mellitus Sufferers Before and After Using Dental Health Monitoring Websites

Variable	Statistics		
	Before	**After**	***p-value****
Knowledge			
a. Mean+SD	5,82+2,294	9,6+1,254	0,00
b. Min-Max	2-12	8-12	

Table 2 shows that there is a significant difference between the knowledge of people with diabetes mellitus before and after the implementation of the Dental Health Monitoring Website as evidenced by a significance value of < 0.05. The average results showed that the value after the implementation of the Dental Health Monitoring Website, so it can be concluded that the implementation of the Dental Health Monitoring Website was effective in increasing the knowledge of people with diabetes mellitus.

Discussion

This study was carried out on patients with diabetes mellitus who are members of the Padangsari Health Center Prolanis with a total of 35 respondents. Based on the results of the characteristic data table, the distribution of the frequency of female diabetes mellitus patients was obtained. Women have a higher risk of developing physically induced diabetes, women have a high chance of increasing body mass (Ciarambino et al., 2022). In addition, monthly cycle syndrome (*Premenstrual syndrome*), post menopause can make body fat more easily accumulated as a result of hormonal processes, causing women to be more susceptible to type 2 diabetes mellitus (Risti & Isnaeni, 2017).

The highest frequency distribution in the age group is in the age group of 51-60 years. Previous studies have reported that patients diagnosed with diabetes mellitus are most > 65 years old, but other studies have shown that people who are > 45 years old are at a higher risk of glucose intolerance causing diabetes mellitus due to degenerative factors in bodily function (Husain, Rombot, & Porajow, 2022). Other research states that currently there is an increasing number of people with diabetes mellitus and prediabetes mellitus and individuals under the age of 45 are still unaware of the symptoms of diabetes mellitus in themselves (Febriani, 2020; Komariah & Rahayu, 2020). This shows that the individual's awareness of himself who is affected by diabetes mellitus is still lacking by the fact that many individuals suffer from undiagnosed diabetes mellitus and prediabetes and the older the body will experience degenerative which causes the ease of developing diabetes mellitus.

The results of the characteristic data table obtained the highest distribution in people with diabetes mellitus based on education, namely high school education/equivalent. Individuals who have a higher level of education will usually have more knowledge about health. A person's education can also affect a person's lifestyle and diet (Pahlawati & Nugroho, 2020).

The difference that significant difference between the knowledge of people with diabetes mellitus before and after the implementation of the Dental Health Monitoring Website as evidenced by a significance value of < 0.05. Knowledge is a crucial factor in changing people's compliance behavior. Positive knowledge will increase the motivation of people with diabetes mellitus to be able to maintain health and increase life expectancy. Meanwhile, lack of knowledge can cause people with diabetes mellitus to pay less attention to health (Costa et al., 2023). Compliance can be suggested due to the influence of factors such as knowledge and perception from a person (Mardiati & Ghozali, 2021). Knowledge creates personal awareness to apply the knowledge they already have, so that individuals who have good knowledge will have greater awareness to be able to apply the knowledge they have (Ilham, 2023).

Diabetic mellitus sufferers who feel bored of life need understanding to be able to increase knowledge, so that it will change their thinking related to life expectancy. Patients with diabetes mellitus who have received dental and oral health education materials through the Dental Health Monitoring Website tend to apply their knowledge through compliance in brushing their teeth (Renata, Fatmasari, & Sukini, 2024). However, this is not in line with previous research that shows the absence of a relationship between knowledge and compliance (Risti & Isnaeni, 2017). This is due to other factors that affect including the length of time the respondents received exposure to education related to health, the length of time the

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individual participated in prolanis activities and the role of companions for people with diabetes mellitus.

Conclusions and Suggestions

This study shows that the use of dental health monitoring websites is significantly effective in increasing the knowledge of people with diabetes mellitus. There was a substantial improvement in the average knowledge score of patients after using the website, with a significance value (p-value = 0.00) proving that this increase was not a coincidence. This confirms that digital media, especially websites, are valid health education tools and have great potential to improve patient health literacy.

This study focused on a website, but other digital platforms like mobile apps offer features that could enhance the intervention's impact. A more comprehensive approach could combine the educational power of a website with the behavioral support capabilities of a mobile application.

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