How the "CEGAH DM" Website Affects Teens Knowledge and Attitude on Type 2 Diabetes at Senior High School and Senior High School in 2024

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ABSTRACT:
Introduction:Diabetes mellitus is a chronic metabolic disease characterized by elevated blood glucose levels, which can lead to serious damage to vital organs such as the heart, kidneys, and nerves. In South Sulawesi Province, the prevalence of diabetes has been increasing in recent years, with Makassar city recording the highest number of diabetes cases, reaching 15,217 cases (31.8%) in 2023.
Objectives:This study aims to analyze the influence of the "Cegah DM" website media on changes in adolescents' knowledge and attitudes towards Type 2 Diabetes Mellitus.
Methods: This study implemented an analytic experimental method, specifically a Quasi-Experimental Design. The study used a Pretest-Posttest Control Group Design involving 110 participants selected through purposive sampling. Data analysis was conducted using the Wilcoxon test, independent t-test, and Mann-Whitney test with Stata version 14 software.
Results: There was a significant difference in improving knowledge regarding preventing diabetes mellitus after educational intervention (p=0.000). Additionally, there was a significant change in attitudes towards diabetes prevention following the educational intervention (p=0.000). Furthermore, a difference was observed in the behaviour between the main intervention group and the comparison group regarding changes in knowledge and attitudes after the educational intervention, with knowledge (p=0.000) and attitudes (p=0.000) showing significant changes.
Conclusions: Using a website-based educational model has a greater impact on preventing Type 2 Diabetes Mellitus than leaflets among adolescents at SMA Negeri schools in Makassar. Future researchers are encouraged to develop the website into an easily accessible and downloadable application, enabling users to access the materials anytime without needing an internet connection. The findings suggest the importance of developing an application to store data and content, allowing offline access to information and offering comparisons with other digital media.

1. Introduction

The rapid advancement of technology has resulted in a decline in physical activity, as technology has made tasks faster and more convenient. This shift has led to the adoption of a sedentary lifestyle, characterized by a lack of physical activity, which has contributed to the transition from infectious diseases to degenerative diseases, one of the most prominent being diabetes mellitus, the prevalence of which has been increasing year by year. As a developing country, Indonesia faces a triple burden of disease, including communicable diseases, non-communicable diseases, and re-emerging diseases (1). The morbidity and mortality rates associated with non-communicable diseases, such as diabetes mellitus, are of particular concern as these conditions progress gradually. Diabetes has become a significant public health issue in many countries, including Indonesia. It can lead to fatal outcomes, as well as the development of other related health conditions (2).

Diabetes is a chronic metabolic disorder characterized by elevated blood glucose levels, which, over time, can lead to serious damage to vital organs such as the heart, blood vessels, eyes, kidneys, and nerves. There are several types of diabetes mellitus, including Type 1 and Type 2. Diabetes has become a significant global health burden due to its high prevalence, disability, and mortality rates. It is estimated to be the eighth leading cause of death and disability worldwide (3).

The International Diabetes Federation (IDF) predicts a similar increase in the number of diabetes cases in Indonesia, from 9.1 million in 2014 to 14.1 million by 2035. According to statistics from the Indonesian Central Bureau of Statistics (BPS), in 2003, the number of people aged 20 years and older in Indonesia is projected to reach 133 million. Considering the population growth trends, it is estimated that approximately 194 million people will be aged 20 years and older by 2030. The 2018 Basic Health Research report by the Ministry of Health revealed that the average prevalence of diabetes mellitus in urban areas for individuals aged 15 years and older reached 5.7% (4). Diabetes remains a significant threat to global health, particularly

in terms of preventive efforts and interventions. It is estimated that by 2030, diabetes will become the seventh leading cause of death worldwide. The prevalence of diabetes has shifted in recent decades, with the disease, which was initially more prevalent in developed countries, now showing a faster increase in developing countries over the past three decades (5).

Diabetes in adolescents is a non-communicable disease that requires focused attention due to the rapid increase in the number of cases among children. Data from 2023 reveals that 1,645 children in Indonesia were diagnosed with diabetes, resulting in a prevalence rate of 2 per 100,000 children. Among those affected, 46% were aged 10-14 years, while 31% were aged 14 years and older (6). The 2023 Indonesian Health Survey data indicates that 11.7% of the population in Indonesia is affected by diabetes mellitus. This figure represents an increase from the 2018 report, which indicated that only 10.9% of the population was diagnosed with diabetes mellitus (7).

Data from the Health Department of South Sulawesi Province indicates a significant increase in the number of individuals diagnosed with diabetes mellitus over the past three years. In 2020, there were 81,342 cases of diabetes mellitus, which rose to 92,171 cases in 2021 and reached 121,737 cases in 2022. Geographically, Jeneponto Regency has the highest prevalence rate of diabetes mellitus, with 1.00%. Makassar City ranks second with a prevalence rate of 0.73%, followed by Takalar Regency at 0.70%. In 2023, Makassar City recorded the highest number of diabetes mellitus cases, with 15,217 reported cases (31.8%) of the total (8).

Adolescents, particularly those in the millennial generation, are at risk of developing non-communicable diseases (NCDs), which can pose a significant burden on the country. However, this risk can be mitigated through early preventive measures. The 2018 Basic Health Research report indicates that the prevalence of diabetes mellitus (DM) in Indonesia among individuals aged 15 years and older is 10.9%, while blood sugar tests show that 2.0% of adolescents aged 15-24 have elevated blood sugar levels. These data highlight that diabetes mellitus is a prevalent condition in the modern era, affecting not only the elderly but also young adults (9).

Data from the Health Department of Makassar City indicates that among the 15 sub-districts in the city, the highest prevalence of diabetes mellitus among adolescents is found in Tamalate Sub-district (38.20%), followed by Manggala Sub-district (14.60%) and Makassar Sub-district (13.48%). Tamalanrea Sub-district ranks fourth, with a prevalence rate of 6.74%, placing it among the top five sub-districts with the highest number of adolescent diabetes cases in 2023. Notably, no adolescent diabetes cases were reported in this area in previous years. Furthermore, Senior High School 21 Makassar is located within the working area of the Tamalanrea Community Health Center, which has the highest number of adolescent diabetes cases among the five Community Health Centers in the Tamalanrea Sub-district, with a prevalence rate of 83.33%. The second-highest prevalence is at Bira Community Health Center (16.67%), while the remaining Community Health Centers report no cases of adolescent diabetes (0%) (10).

Diabetes mellitus in adolescents is a serious health issue that has been increasingly prevalent due to modern lifestyles characterized by unhealthy habits. Given the significant adverse effects that diabetes can cause, it is crucial to enhance preventive efforts through education on healthy eating habits and the importance of physical activity(11).

According to the Data Report, 4.95 billion internet users worldwide in January 2022 represent a 4% increase from 4.76 billion users in January 2021. Awareness of this issue is crucial for the community, particularly among the younger generation, to prevent the onset of such diseases at an early age. Adopting a healthy lifestyle during adolescence contributes to developing a healthier generation and helps prevent degenerative diseases such as Type 2 Diabetes Mellitus. (12)(13).

2. Objectives

This research aims to analyze the influence of the "Cegah DM" website media on changes in adolescents' knowledge and attitudes towards Type 2 Diabetes Mellitus and provide alternative methods for delivering information to the younger population, especially adolescents, enabling them to adopt healthy lifestyle practices that can reduce risk factors and ultimately lower diabetes mellitus.

3. Methods

Research Design

This study employed an analytical experimental design, specifically a Quasi-Experimental Design. The study utilized a Pretest-Posttest Control Group Design, in which two groups were selected, given a pre-test, subjected to an intervention, and then assessed with a post-test. The intervention group in this study consisted

of high school students from SMA 21 Makassar, who received education through the CegahDM website. The comparison intervention group comprised students from SMAN Negeri 6 Makassar, who were provided with a diabetes prevention leaflet.

Population and Sample

The population for this study consisted of 12th-grade students from Senior High School 21 Makassar and Senior High School 6 Makassar, with a total of 718 students in the 12th grade across both schools. The sample included 110 respondents, with 55 students from Senior High School 21 Makassar and 55 students from Senior High School 6 Makassar.

Data Analysis

Data analysis was conducted through univariate and bivariate analyses using STATA 14 software. The univariate analysis aimed to describe each variable under investigation, while the bivariate analysis examined the relationships between two variables. The Wilcoxon test, Paired t-test, and Mann-Whitney test were employed in the analysis.

Ethical Approval

This research has been approved by the research ethics commission of the Faculty of Public Health, Hasanudin University with number: 2020/UN4.14.1/tP.01.02/2024 and No Protocol: 26824032253.

4. Results

Table 1 shows the results the characteristics of the respondents in both the main intervention group and the comparison intervention group. It shows that most respondents in both groups were female, with 67.2% in the main intervention group and 74.5% in the comparison intervention group. Regarding age, the largest proportion of respondents were 17 years old, comprising 67.2% in the main intervention group and 69.0% in the comparison intervention group.

Table 1: Distribution of Respondent Demographic Characteristics

Characteris	Main Interver Gı		Comparison Intervention Group	
	n	%	n	%
Gender				
Male	18	32,7	14	25,5
Female	37	67,3	41	74,5
Age (years)				
16	5	9,1	5	9,1
17	37	67,3	38	69,1
18	13	23,6	12	21,8

Source: Primary Data, 2024

Table 2 shows the scores of the main intervention and comparison intervention groups after receiving educational intervention. The data reveals that the average knowledge score for the main intervention group prior to the intervention was 75.36 (SD = 14.65), which increased to 91.27 (SD = 10.23) after the intervention. Similarly, the average attitude score in the main intervention group before the intervention was 76.43 (SD = 10.37), which increased to 87.47 (SD = 10.08) after the intervention. In contrast, the average knowledge score for the comparison intervention group before the intervention was 71.09 (SD = 14.89), which increased to 80.45 (SD = 14.11) following the intervention. The average attitude score for the comparison intervention group prior to the intervention was 71.94 (SD = 12.74), which rose to 79.09 (SD = 10.57) after the intervention.

Table 2: Distribution of Mean Scores for Knowledge and Attitudes Before and After Education in the Main Intervention and Comparison Intervention Groups, 2024

Intervention	Variabel	Min	Max	Mean	SD
Main Intervention Knowledge	Pretest	40	100	75,36	14,65
	Post test	55	100	91,27	10,23
Main Intervention Attitude	Pretest	50,5	97,5	76,43	10,34
	Post test	57	100	87,48	10,08
Comparison Intervention Knowledge	Pretest	40	100	71,09	14,89
	Post test	50	100	80,45	14,11
Comparison Intervention Attitude	Pretest	50	97.5	71,94	12,74
	Post test	50	100	79,09	10,57

Source: Primary Data, 2024

Table 3shows the results ofthe comparison of knowledge using the Wilcoxon test between the main intervention and comparison intervention groups before and after the educational intervention. The statistical analysis of the knowledge variable yielded a p-value of 0.000 for the main intervention group, where $p < 0.05$. This indicates that more respondents experienced a positive increase in knowledge ranks compared to negative ones. Similarly, for the comparison intervention group, a p-value of 0.000 ($p < 0.05$) was obtained, showing that both the main and comparison intervention groups experienced significant improvements in their knowledge of diabetes mellitus after being provided with interventions through the website and educational materials (leaflets).

Table 5 compares attitudes using the Wilcoxon test between the main intervention and comparison intervention groups before and after the educational intervention. The statistical analysis for the attitude variable yielded a p-value of 0.000 for the main intervention group, where $p < 0.05$, indicating that more respondents exhibited a positive change in their attitude ranks compared to negative ranks. For the comparison intervention group, the p-value was 0.001 ($p < 0.05$), suggesting that both the main and comparison intervention groups experienced significant improvements in their attitudes toward diabetes mellitus after receiving the website intervention and leaflet-based education.

Table 4 also shows the analysis of the differences in knowledge and attitudes related to diabetes mellitus prevention between the main intervention groups and comparison intervention groups after the interventions. The average attitude score difference after education for the main intervention group was 91.27, while for the comparison intervention group, it was 80.45. A p-value of 0.000 ($p < 0.05$) indicates a significant difference in knowledge between the main and comparison intervention groups before the education. Furthermore, the average attitude score difference after the intervention for the main intervention group was 87.47, while for the comparison intervention group, it was 79.09. The p-value of 0.000 ($p < 0.05$) confirms a significant difference in attitudes between the main and comparison intervention groups following the educational interventions.

Table 3: Analysis of Knowledge Differences Before and After Education in the Main and Comparison Intervention Groups, 2024

Group	Rank	Obs	Sum Ranks	Z	P- Value
Main Intervention Pretest-Post test	Positive	29	1189	5,364	0,000
	Negative	0	0		
	Zero	26	528		
Comparison Intervention Pretest-Posttest	Positive	22	970	4,376	0,000
	Negative	1	42		
	Zero	29	351		

Source: Primary Data, 2024

Source: Primary Data, 2024

Table 4: Analysis of Attitude Differences Before and After Education in the Main and Comparison Intervention Groups, 2024

Group	Rank	Obs	Sum Ranks	Z	P- Value
MainIntervention Pretest-Post test	Positive	27	1122	4,901	0,000
	Negative	1	40		
	Zero	27	378		
Comparison Intervention Pretest-Post test	Positive	20	890,5	4,045	0,001
	Negative	1	54,5		
	Zero	34	595		

Source: Primary Data, 2024

Table 5: Analysis of the Mean Differences and Knowledge Scores After Education in the Main and Comparison Intervention Groups, 2024

Group	Variable	Min	Max	Mean ± SD	p-value
Main Intervention	Knowledge Pretest	55	100	91,27 ± 10,23	0,000
Comparison Intervention	Knowledge Pretest	50	100	80,45 ± 14,11	
Main Intervention	Attitude Pretest	57	100	87,47 ± 10,08	0,000
Comparison Intervention	Attitude Pretest	50	100	79,09 ± 10,57	

5. Discussion

Differences in Knowledge Changes Regarding Diabetes Mellitus Before and After Education in the Main Intervention Group and Comparison Intervention Group

The results of this study indicate that diabetes mellitus prevention education, using both websites and leaflet media, significantly improved the respondents' average knowledge scores from pre-test to post-test. In the main intervention group, which utilized the website as the educational medium, the increase in knowledge was more pronounced compared to the comparison group, which used leaflets. Although the leaflet-based education also significantly improved scores, its effectiveness was not as substantial as the education provided via the website. Statistical tests confirmed that the website was more effective in enhancing respondents' knowledge, thus supporting the hypothesis that there is a significant difference in the effectiveness of the two media, with the website showing superior results.

A website is a specific application that operates on a browser-based platform or operating system. In this context, a website refers to an online page containing information accessible worldwide as long as an internet connection exists. Websites typically contain various formats, including text, images, tables, graphs, citations, videos, music, and other visual elements designed to engage website visitors. Websites serve various functions, such as promotion, marketing, education, and communication. They are among the most popular promotional media today due to their extensive reach in both time and space. To utilize websites effectively as a medium for information dissemination, specific strategies must be applied to ensure that promotional efforts through the website achieve optimal results (14).

Another study by Knock, titled *"Disseminating Health Information Websites to Adolescents Using Three Approaches with Social Media Outreach,"* highlights the increasing amount of time adolescents spend on social media in the digital era, positioning it as an effective platform for delivering health information. The study results demonstrate that combining the three dissemination methods created a significant synergistic effect. Specifically, social media platforms, particularly Instagram, were more effective in directing users to health-related websites than X (formerly known as Twitter) (15).

According to Maptukhah and Anita's study on the Effectiveness of Education Through Leaflet Media on Increasing Adolescent Girls' Knowledge of the Risks of Early Marriage, the statistical test results yielded a p-value of 0.000 ($p<0.05$). Based on this, education through leaflet media has a significant effect on the level of knowledge of adolescent girls regarding the risks of early marriage in the village of Saga, Balaraja(16).

Another study conducted by Lestari and Haryani showed that the Wilcoxon test results yielded a p-value of 0.000 ($p<0.05$), which indicates that the null hypothesis (H_0) is rejected. The alternative hypothesis (H_a) is accepted. This finding suggests that the use of leaflet media for education has a significant effect on increasing the knowledge of female students (17).

Both website-based education on Diabetes Mellitus prevention and leaflet-based education have effectively enhanced knowledge. Websites utilizing various formats, such as text, images, tables, graphs, quotes, videos, and music, present information engagingly, facilitating message delivery. In contrast, leaflets containing concise, clear, colourful content with illustrations can stimulate adolescents' curiosity and aid in comprehending the material.

Differences in Attitudes Regarding Diabetes Mellitus Before and After Education in the Main Intervention Group and Comparison Group

The results of this study indicate a significant increase in the mean score from pre-test to post-test in the main intervention group, which received education about Type 2 Diabetes Mellitus using the "Cegah DM" website. This suggests a change in attitudes regarding Type 2 Diabetes Mellitus before and after education using the website. In the comparison group, statistical analysis of attitudes in the pre-test revealed a difference in attitudes; however, the percentage of change was not as large as that observed in the group using the website. This implies a shift in attitudes regarding Type 2 Diabetes Mellitus before and after education using the leaflet. However, achieving a significant percentage of change in attitudes requires using more comprehensive media, such as videos that are easier to understand.

Attitude is a person's views, opinions, or feelings towards a particular object, person, or event. A person's attitude is typically expressed in terms of liking, disliking, agreeing, or disagreeing with something.

Understanding an individual's attitude can predict how they might respond or behave when confronted with a particular issue or situation (18)(19).

This study is in line with the research conducted by Alifa, which demonstrated a significant increase in respondents' knowledge yet no significant improvement in their attitudes and behaviours. It can be concluded that video and poster media effectively enhance knowledge while improving attitudes and preventive behaviours towards Diabetes Mellitus among elementary school students requires additional time and supporting media (20).

Differences in Knowledge and Attitudes of Adolescents Regarding Type II Diabetes Mellitus between the Main Intervention Group and the Comparison Group

In the study conducted at Senior High School 21 Makassar and Senior High School 6 Makassar, the main intervention group used the "Cegah DM" website, while the comparison group utilized leaflet media. Before the educational intervention on Type II Diabetes Mellitus, hypothesis testing revealed no significant changes in knowledge or attitudes among the respondents. This lack of change was due to both groups having similar baseline knowledge before the education, indicating that the differences in results after the intervention could be attributed to the varying types of interventions provided.

Following the educational intervention on knowledge and attitudes regarding Type II Diabetes Mellitus, the two groups showed a significant difference in mean scores. This suggests a notable change in knowledge and attitudes towards Type II Diabetes Mellitus in both the main intervention and the comparison group.

The advantage of using a website as a medium is that it provides various interconnected pages, often accompanied by images, videos, or other files, which facilitate understanding. A website is a collection of pages published on the internet, accessible via a URL that anyone can reach. Students can store and access learning materials, such as videos and documents, anytime and from any location (21).

In line with research by Lathifa & Mahmudiono, which indicated a significant difference between health education delivered via a website and that delivered via a leaflet, the group receiving the web-based intervention showed better nutrition knowledge than the leaflet group. Therefore, it can be concluded that web-based nutrition education programs effectively improve balanced diet behaviours among high school students (22).

Knowledge results from perception and occurs when an individual perceives a particular object. Without knowledge, a person lacks the foundation to make decisions or act on the issues they face (23). Thus, it can be concluded that leaflets and website educational media effectively improve students' knowledge about the risk factors for diabetes mellitus (24).

Both website and leaflet media influenced adolescents' knowledge and attitudes regarding Type II Diabetes Mellitus. Although the increase in knowledge and attitudes was significant in the leaflet group, it was not as substantial as in the website group. Therefore, the website media proved to be more effective in enhancing knowledge and attitudes. After the intervention, a significant difference in mean scores was observed between the two groups, indicating a larger change in the group that used the website media.

CONCLUSIONS

Based on the findings from the study on the effect of the "Cegah DM" website on changes in knowledge and attitudes towards Type II Diabetes Mellitus among adolescents at Senior High School 21 Makassar and Senior High School 6 Makassar in 2024, it can be concluded that there was a significant change in both knowledge and attitudes among adolescents before and after receiving health interventions, utilizing both the "Cegah DM" website and leaflet media. However, the educational model used on the website proved to be more influential in enhancing changes in adolescents' knowledge and attitudes towards Type II Diabetes Mellitus than the leaflet media. Therefore, students who have received information about diabetes mellitus are expected to increase their knowledge, maintain positive attitudes, and apply preventive behaviours for diabetes risk for themselves and their families.

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