The Effect of Website "Remaja Cegah DBD" on the Prevention Behaviour of Dengue Haemorrhagic Fever Among Students at Junior High School in Makassar City, Indonesia

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Abstract: *Background*: Dengue Haemorrhagic Fever (DHF) is an acute infectious disease caused by the dengue virus. It occurs frequently children and adolescents. In 2023, the incidence of DHF in Makassar City was 26 per 100,000 population. Preventive efforts, such as increasing community awareness through health education at the school level, need to be initiated.

Objectives: The aim of this study was analyze the effect of the "Remaja Cegah DBD" (Youth Prevents DHF) website on dengue prevention behavior among students at Public Junior High School (SMPN) in Makassar.

Methods: This study was a quasi-experimental design with a non-randomized pre-test and post-test control group design involving 122 students, the main intervention group consisted of 61 respondents at SMPN 8, and the comparison intervention group included 61 respondents at SMPN 6. Data were collected from August 22 to September 6, 2024. Data analysis was conducted using univariate and bivariate methods, including Paired t-test, Wilcoxon test, Independent t-test, and Mann-Whitney test, with Stata Program version 14.

Results: There was a significant difference in DHF prevention knowledge before and after the website intervention (p=0.000). There was also a significant difference in attitudes (p=0.000) and practices (p=0.000) before and after the website intervention. Furthermore, there were significant differences in prevention behavior between the main intervention group (website) and the comparison group (leaflet), with statistical test results for knowledge (p=0.000), attitude (p=0.000), and practice (p=0.0016).

Conclusion: Website was more effective as an educational prevention of DHF among adolescents or students in Makassar City, compared to leaflet-based media.

Keywords: Adolescent, Dengue Hemorrhagic Fever, knowledge, attitude, practice, student, website.

1. INTRODUCTION

Dengue Hemorrhagic Fever (DHF) is one of the public health problems whose number of cases tends to increase, with its spread becoming increasingly widespread. This disease affects all age groups, but primarily targets children [1]. Data from the Directorate General of Disease Prevention and Control of the Ministry of Health of the Republic of Indonesia indicated that the incidence rate of DHF per 100,000 population increased from 27 in 2021 to 52.1 in 2022. In 2023, there were 95,893 DHF cases reported across 472 regencies/municipalities in 34 provinces. The highest proportion of DHF cases occurred in the 14–44-year age group (37.45%), followed by 5–14 years (33.97%) and 1–4 years (14.88%). Regarding the case fatality rate, the 5–14-year age group had the highest proportion of deaths (34.13%), followed by the 1–4-year age group (28.57%) [2].

South Sulawesi is a province with an average DHF incidence of more than 19 per 100,000 population. The DHF incidence in South Sulawesi was 41 per 100,000 in 2021 and 39 per 100,000 in 2022. DHF remains a significant public health issue in Makassar City. In 2023, the incidence rate in Makassar was 26 per 100,000, placing the city among the top 10 regencies/ municipalities in South Sulawesi with the highest DHF incidence. The mortality rate due to DHF in Makassar has shown an increasing trend, with 0.17% in 2021, 0.19% in 2022, and 0.6% in 2023 exceeding the national dengue control target of reducing the case fatality rate to 0.5% by 2025 [3].

The interaction between humans and infected *Aedes aegypti* mosquitoes remains one of the primary factors in the transmission of the dengue virus [4]. Research by Bibah *et al*. (2017) indicated an association between knowledge and DHF incidence, with respondents who had poor knowledge being five times more likely to contract DHF. Similarly, Linawati Novikasari (2018) found that respondents with poor knowledge were 4.5 times more likely to have children experience DHF compared to those with good knowledge [5].

Knowledge and attitudes are key supporting factors in controlling DHF. People who are knowledgeable about DHF are more likely to engage in preventive measures and seek timely treatment for themselves, their families, and others. Attitude refers to a person's internal response to a stimulus rather than overt behavior. A positive attitude (acceptance, response, appreciation, and responsibility) represents an initial step in preventing the spread of DHF [6].

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A study on knowledge and attitudes regarding DHF prevention behaviors in the Cikole community, Sukabumi City (2019), found that media exposure about DHF information influenced knowledge, attitudes, and prevention behavior. Subjects exposed to prevention information were categorized as having good (43.4%) or moderate (47.7%) prevention behavior. The information in this study came from websites, social media, newspapers, television, posters, or radio [7]. Health websites can contribute to public health promotion and disease prevention efforts [8].

Efforts to combat DHF include prevention, case detection, treatment, reporting, epidemiological investigation, and disease surveillance, including health education. Community-level prevention includes the eradication of mosquito breeding grounds (PSN), such as draining water storage containers at least once a week, tightly covering them, burying used containers that can collect water, applying larvicides, raising larva-eating fish, and other larva control measures [9].

A study in Malaysia involving 300 participants showed that 65.4% of individuals with good DHF prevention behavior also had good knowledge. Thus, public awareness campaigns and health education in schools are recommended to improve community attitudes and practices and reduce the incidence of DHF [10].

According to the Indonesian Ministry of Health, adolescents are individuals aged 10–18 years, comprising nearly 20% of the population. Adolescence is a developmental stage involving biological, psychological, and social changes. Adolescents are the dominant age group using the internet, especially those in secondary schools. Since they are frequently exposed to mass media, preventive efforts targeting Generation Z, the top technology users and internet consumers, are needed [11].

Adolescence is also a critical period as unhealthy habits and risky behaviors often begin during this stage. However, it is also a window of opportunity to promote protective health behaviors, as habits formed during adolescence tend to persist into adulthood. Therefore, public health interventions should target this life stage to prevent or halt risky behaviors, knowing that improving adolescent health today ensures a better future for the next generation [12].

The internet is currently one of the most effective channels for disseminating information. The high penetration of internet users worldwide, including in Indonesia, has paved the way for the growth of e-health. New methods are emerging to improve healthcare services through technology and the internet—such as remote consultations and online health education [13].

Online media including WhatsApp, websites, video conferencing platforms like Google Meet or Zoom, and social media such as Facebook, Instagram, Twitter, and YouTube can be used as health education tools for adolescents to improve their knowledge, attitudes, and behaviors [14].

People can now communicate and share information easily, without limitations of time and space. Among various internet services, websites have become an important tool. Digital information via websites is easily accessible on desktop and mobile devices. As technology simplifies the development and management of websites, they are becoming a primary source of information for the public [15].

A popular promotional medium with unlimited reach is the internet. A study by the Ministry of Communication and Information involving 400 adolescents aged 10–19 years across urban and rural areas in Indonesia revealed that 98% knew about the internet, and 79.5% were active users. At SMPN 1 Bukittinggi, the GABUJ E-Health program was implemented as a website-based adolescent health service that allows adolescents to safely and independently access health services anywhere. This school-based health service website supports promotive and preventive efforts and aligns with the goals of the Adolescent Care Health Service Program (Pelayanan Kesehatan Peduli Remaja) [16].

Adolescents are a highly active and tech-savvy generation. Websites, as easily accessible digital platforms, offer numerous benefits that can assist adolescents in various aspects of life. Health websites have become a reliable source of health information. Website-based interventions have proven effective in encouraging health behavior changes among adolescents [17].

A study by Sarah Nur Tri Andini *et al*. (2023) involving 64 adolescents in Semarang demonstrated an increase in knowledge after exposure to health education videos. Therefore, there is a need for a website featuring comprehensive DHF prevention information, including text, images, and videos, specifically targeted at adolescents [18]. Internet media serves as a relevant and strategic means for developing public health information systems in the digital era, as demonstrated by the implementation of the SI-DBD application in dengue case reporting [19].

2. MATERIALS DAN METHODS

2.1. Research Design

This study was an analytic experimental research using a quasi-experimental design. Specifically, it was a pretest-posttest control group design, in which two groups are selected, given a pretest, followed by an intervention, and concluded with a posttest. There are two intervention group at Public Junior High School/SMPN 8 Makassar and SMPN 6 Makassar.

2.2. Population and Sample

The population in this study consisted of Grade VIII students from Junior High School/SMPN 8 Makassar and SMPN 6 Makassar, with a total of 949 students across both schools. The sample in this study consisted of adolescents, specifically 8th-grade students from Junior High School in Makassar. The minimum required sample size was calculated using the formula introduced by Stanley Lemeshow. Based on this formula, the minimum sample size for each group was 55 respondents. To account for an estimated 10% dropout rate, an additional sample was included, resulting in 55 + (55 × 10%) = 60.5, which was rounded up to 61 respondents per group. Therefore, the final sample comprised 61 students from SMP Negeri 8 Makassar (the main intervention group) and 61 students from SMP Negeri 6 Makassar (the comparison intervention group), yielding a total of 122 respondents for the study. There was no randomization process in the allocation of participants into the intervention and control groups. The group assignment was based on school designation, with students from SMPN 8 Makassar assigned to the intervention group and students from SMPN 6 Makassar assigned to the control group. Students were selected from the same grade level (Grade VIII) and from classes with similar average academic performance in each school. Both schools had the same accreditation status (Accreditation A) and were located in different sub-districts of Makassar City, ensuring a considerable distance between the two locations.

2.3. Data Analysis

The assessment used a Likert scale, with knowledge categorized as high or low, attitude as positive or negative, and practice as good or poor. Data were analyzed using univariate and bivariate methods with the assistance of STATA 14. The univariate analysis aimed to describe each variable studied, while the bivariate analysis assessed the relationships between two variables. The data were normally distributed, therefore, a paired *t*-test was performed, the data were not normally distributed, therefore, a wilcoxon test was performed and the data were normally distributed, therefore an independent *t*-test was performed.

2.4. Interventions

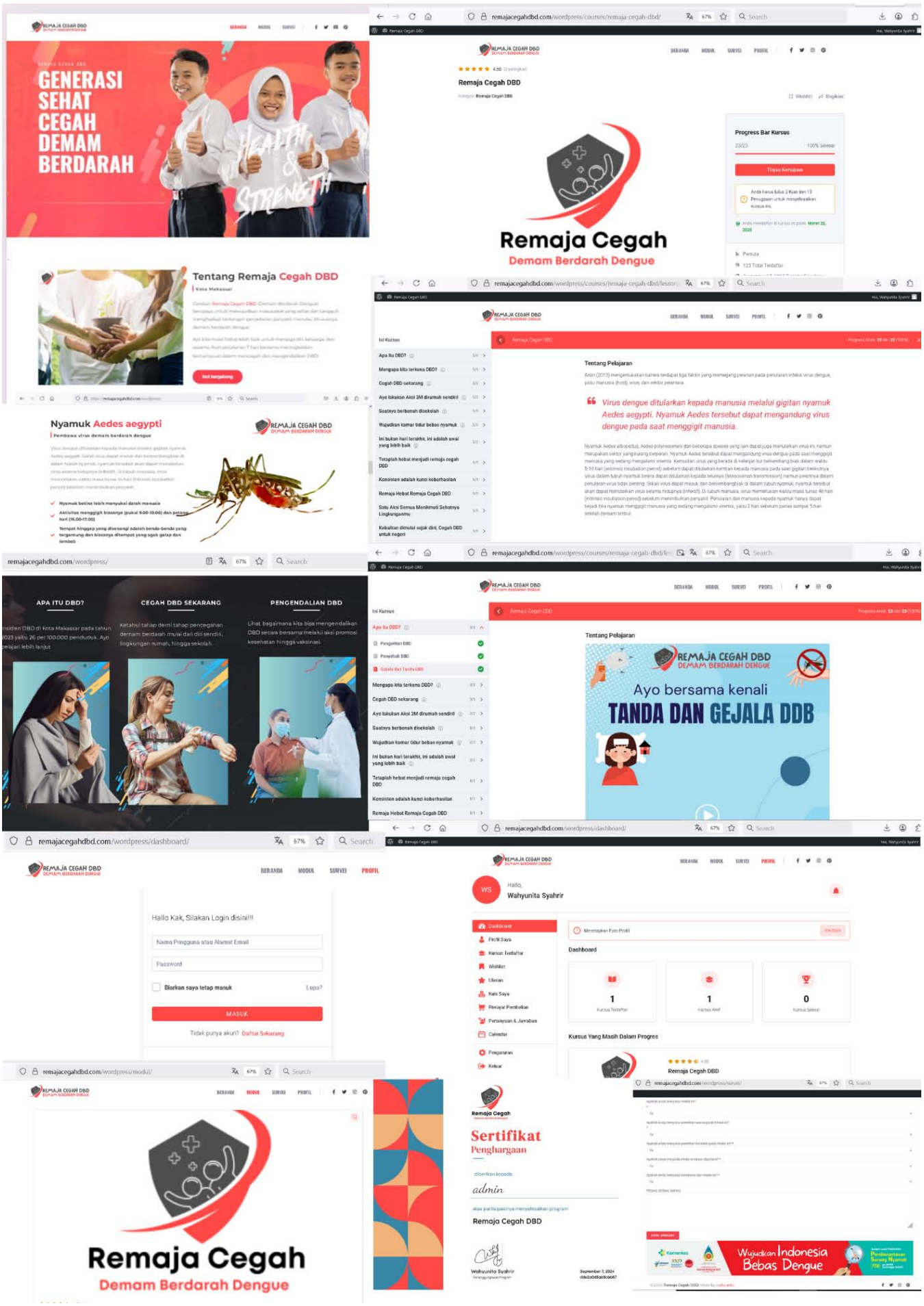
The main intervention group at SMPN 8 Makassar was provided with a website *"Remaja Cegah DBD"* can be accessed via the link *https://remajacegahdbd.com/wordpress/* (Picture **1**) content delivery with text, videos and interactivity. Respondents can access the learning materials on the website by registering with their email and creating a password. After logging in, they can begin the learning process. The content of the website includes text-based explanations about dengue fever, its causes, and modes of transmission. It also features images showing the Aedes aegypti mosquito, as well as videos containing information about the signs and symptoms of dengue and methods of prevention. The comparison intervention group at SMPN 6 Makassar was provided with leaflet health education (Picture **2**), the content of the leaflet includes text-based explanations about dengue fever, its causes, and modes of transmission and methods of prevention. It also features images showing the Aedes aegypti mosquito, the signs and symptoms of dengue.

3. RESULT

The characteristics of respondents, Table **1** below, shows based on gender and age in both the primary intervention and comparison intervention groups. The majority of respondents in both groups were female, with 62.3% in the primary intervention group and 65.6% in the comparison group. Most respondents were 13 years old, accounting for 83.6% in the primary group and 85.2% in the comparison group. All respondents in both groups had previously heard about Dengue Hemorrhagic Fever (DHF), with 100% (61 respondents) in each group. The primary source of information on DHF for most respondents was the internet, cited by 57.4% in the primary intervention group and 32.8% in the comparison group.

Table **2** shows that the mean knowledge score in the primary intervention group before treatment was 9.63 (SD=1.89) and increased to 13.44 (SD=1.51) after treatment. The mean attitude score rose from 27.11 (SD=3.31) to 32.03 (SD=3.14). The mean practice score increased from 6.72 (SD=1.51) to 8.72 (SD=1.12).

Table **3** shows that the mean knowledge score in the comparison group increased from 9.81 (SD=1.34) before treatment to 11.14 (SD=1.13) after. The attitude score improved from 28.19 (SD=2.58) to 29.29



Picture 1: Screenshots of the "Remaja Cegah DBD" website.

Picture 2: Leaflet (Source: Ministry of Health of the Republic of Indonesia, 2024).

Table 1: Frequency Distribution of Respondents General Characteristics at Public Junior High Schools in Makassar City, 2024

Respondent Characteristics	Main Intervention Group		Comparison Intervention Group	
	n	%	n	%
Gender				
Male	23	37.7	21	34.4
Female	38	62.3	40	65.6
Age (years)				
13	51	83.6	52	85.2
14	10	16.4	9	14.7
Heard Information				
Yes	61	100	61	100
Source of Information				
Health Workers	17	27.9	18	29.5
School	5	8.2	19	31.1
Internet	35	57.4	20	32.8
Family	4	6.5	4	6.5
Total	61	100	61	100

Source: Primary Data, 2024.

Table 2: Mean Distribution of Knowledge, Attitude, and Practice in the Primary Intervention Group before and after the Intervention at Public Junior High Schools in Makassar, 2024

Main Intervention Group	Variable	Min	Max	Mean	SD
Knowledge	Pretest	4	13	9.64	1.89
	Posttest	10	16	13.44	1.51
Attitudes	Pretest	19	35	27.11	3.31
	Posttest	25	39	32.03	3.14
Practice	Pretest	3	10	6.72	1.51
	Posttest	5	10	8.72	1.12

Source: Primary Data, 2024.

Table 3: Distribution of Mean Scores of Knowledge, Attitudes, and Practices in the Comparison Intervention Group before and after the Intervention at SMPN Makassar in 2024

Comparison Intervention Group	Variabel	Min	Max	Mean	SD
Knowledge	Pretest	7	12	9.81	1.34
	Posttest	7	13	11.14	1.13
Attitudes	Pretest	21	33	28.19	2.58
	Posttest	22	35	29.29	2.80
Practice	Pretest	2	10	6.93	1.55
	Posttest	2	10	7.91	1.48

Source: Primary Data, 2024.

(SD=2.80), and the practice score from 6.93 (SD=1.55) to 7.91 (SD=1.48).

Table **4** shows that the mean knowledge score in the primary intervention group using the *"Remaja Cegah DBD"* website increased from 9.63 to 13.44, with a mean difference of 3.81 and the data were normally distributed, therefore, a paired *t*-test was performed with p-value of 0.000<0.05, indicating a statistically significant difference in knowledge before and after the website-based intervention. The comparison group using leaflets, the knowledge score increased from 7.75 to 10.25, with a mean difference of 1.13 and the data were not normally distributed, therefore, a wilcoxon test was performed with p-value of 0.000<0.05, also indicating a significant improvement.

Table **5** shows that the attitude score in the primary intervention group increased from 27.11 to 32.03, with

Table 4: Differences in Knowledge about Dengue Hemorrhagic Fever (DHF) before and after the Intervention in the Primary and Comparison Intervention Groups at Public Junior High Schools in Makassar, 2024

Group	Variable	Mean	Standard Deviation	Δ Mean	P- Value
Main Intervention Group	Pretest Knowledge	9.63	1.89	3.81	0.000
	Posttest Knowledge	13.44	1.51		
Comparison Intervention Group	Pretest Knowledge	9.81	1.34	1.33	0.000
	Posttest Knowledge	11.14	1.13		

Source: Primary Data, 2024.

Table 5: Differences in Dengue Hemorrhagic Fever (DHF) Prevention Attitudes before and after the Intervention in the Primary and Comparison Intervention Groups at Public Junior High Schools in Makassar, 2024

Group	Variable	Mean	Standard Deviation	Δ Mean	P- Value
Main Intervention Group	Pretest Attitude	27.11	3.31	4.92	0.000
	Posttest Attitude	32.03	3.14		
Comparison Intervention Group	Pretest Attitude	28.19	2.58	1.10	0.008
	Posttest Attitude	29.29	2.80		

Source: Primary Data, 2024.

Table 6: Differences in Dengue Hemorrhagic Fever (DHF) Prevention Practices before and after the Intervention in the Primary and Comparison Intervention Groups at Public Junior High Schools in Makassar, 2024

Group	Variable	Mean	Standard Deviation	Δ Mean	P- Value
Main Intervention Group	Pretest Practice	6.72	1.50	2.00	0.000
	Posttest Practice	8.72	1.12		
Comparison Intervention Group	Pretest Practice	6.93	1.55	0.98	0.000
	Posttest Practice	7.91	1.48		

Source: Primary Data, 2024.

Table 7: Analysis of Mean Differences and Knowledge Gain after Education in the Main and Comparison Intervention Groups, 2024

Group	Variable	Min	Max	Mean ± SD	Δ Mean	p-value
Main Intervention Group	Posttest Knowledge	10	16	13.44 ± 1.51	2.3	0.000
Comparison Intervention Group	Posttest Knowledge	7	13	11.14 ± 1.13		
Main Intervention Group	Posttest Attitude	25	39	32.03 ± 3.14	2.74	0.000
Comparison Intervention Group	Posttest Attitude	22	35	29.29 ± 2.80		
Main Intervention Group	Posttest Practice	5	10	8.72 ± 1.12	0.81	0.0016
Comparison Intervention Group	Posttest Practice	2	10	7.91 ± 1.48		

Source: Primary Data, 2024.

a mean difference of 4.92 and the data were normally distributed, therefore, a paired *t*-test was performed with p-value of 0.000<0.05, showing a significant change in attitude after the website-based intervention. In the comparison group, the attitude score increased from 28.19 to 29.29, with a difference of 1.10 and the data were normally distributed, therefore, a paired *t*-test was performed with p-value of 0.008<0.05, indicating a statistically significant change following leaflet-based education.

Table **6** shows that the practice score in the primary intervention group increased from 6.72 to 8.72, with a mean difference of 2.00 and the data were not normally distributed, therefore, a wilcoxon test was performed with p-value of 0.000<0.05, demonstrating a significant improvement in preventive practices. In the comparison group, the score rose from 6.93 to 7.91, with a difference of 0.98 and the data were not normally distributed, therefore, a wilcoxon test was performed with p-value of 0.000<0.05, indicating a significant change in behavior following the intervention using leaflets.

Table **7** shows a post-intervention mean knowledge score of 13.44 in the primary group and 11.14 in the comparison group, with a mean difference of 2.3 and the data were normally distributed, therefore an independent *t*-test was performed with p-value of 0.000<0.05, indicating a significant difference between groups. The attitude scores post-intervention were 32.03 in the primary group and 29.29 in the comparison group, with a mean difference of 2.74 and a p-value of 0.000<0.05, indicating a significant difference. The practice scores were 8.72 for the primary group and 7.91 for the comparison group, with a difference of 0.81 and p-value of 0.0016<0.05, also indicating a statistically significant difference.

4. DISCUSSION

The results of this study align with several established statistical models in health behavior research. Specifically, the findings support key components of the Health Belief Model (HBM), which suggests that knowledge, perceived severity, and cues to action significantly influence individuals' health behaviors. In this study, respondents who had prior exposure to information from credible sources (e.g., schools and health workers) were more likely to demonstrate high levels of knowledge, positive attitudes, and good prevention practices regarding dengue fever. This finding is consistent with previous research using the HBM, where increased exposure to health information positively correlated with preventive behavior Furthermore, our results correspond with the Theory of Planned Behavior (TPB), which emphasizes the role of attitudes, subjective norms, and perceived behavioral control in shaping intentions and actions. The observed positive attitudes among adolescents, particularly those exposed to school-based education, may reflect strong normative beliefs and perceived efficacy in preventing dengue. Therefore, the data not only reinforce these theoretical frameworks but also highlight the relevance of digital and school-based health education interventions in influencing adolescent behavior.

4.1. Differences in Changes in Knowledge of Students in Makassar before and after Education Media with Website "Remaja Cegah DBD" and Leaflet

The results of the study showed that the mean score in the main intervention group before the intervention using the "Remaja Cegah DBD" website was 9.63, and after the intervention, it increased to 13.44, with a p-value of 0.000 < 0.05. This indicates a significant effect of the website-based education on students' knowledge of dengue prevention. In the comparison intervention group, the mean score before receiving dengue prevention information via leaflet was 9.81 and increased to 11.14 after the intervention, with a p-value of 0.000 < 0.05, indicating a significant increase in knowledge after the leaflet intervention.

Statistical tests confirmed that both website and leaflet media improved respondents' knowledge, supporting the hypothesis of a difference in effectiveness between the two media, with the website demonstrating a more significant impact. The website presents information in various formats such as text, images, videos, and animations, which not only makes the content more engaging but also facilitates the understanding of complex concepts.

Knowledge is the result of knowing, which occurs after a person perceives an object through the senses are sight, hearing, smell, taste, and touch. The cognitive domain plays a crucial role in shaping a person's actions [20]. Knowledge is acquired through a learning process, either by hearing or seeing. One way to enhance knowledge is through education, which can be delivered via counseling sessions, training, posters, videos, leaflets, or booklets [21]. In addition, websites function as widely accessible online sources of information that utilize various media formats for promotion, marketing, education, and communication, requiring strategic management to achieve optimal outcomes [22].

Knowledge of dengue fever (DHF) prevention includes an understanding of the development of Aedes aegypti mosquitoes, in which rising temperatures can lead to an increase in DHF cases. Therefore, the community needs to be vigilant and proactive in preventing DHF. Effective preventive actions include maintaining environmental cleanliness, draining and covering water storage containers, and using mosquito nets or repellents according to local climate conditions [23].

An evaluative study on the GEKA.id website found it to be an effective educational tool to improve adolescents' knowledge of premarital sex prevention in Kampar Regency, Riau [11]. Web-based interventions have shown effectiveness in encouraging behavior change among adolescents, thereby contributing to adolescent health improvement [17].

A study by Knock *et al*. (2024) on the health information website iuveo.org, which targets adolescents in the United States, attracted 84.8% or 1,338 adolescent users, indicating substantial access to the platform [24]. The Development of Interactive Learning Multimedia on Health Topics Focusing on the Prevention and Control of Dengue Hemorrhagic Fever (DHF) for the Community in Ngaglik District, Sleman, Yogyakarta. The study showed that out of 48 respondents prior to receiving education through leaflet media, the majority had a low level of knowledge 36 people (75%), while 12 people (25%) had a moderate level of knowledge, and none had a high level of knowledge (0%). After receiving education through the leaflet media, the majority of respondents demonstrated a high level of knowledge 28 people (58.3%), 20 people (41.7%) had a moderate level of knowledge, and no respondents remained in the low knowledge category (0%). The average knowledge score before the intervention was 45.31 with a standard deviation of 15.892, while after the intervention, it increased to 80.63 with a standard deviation of 10.499 [25].

Research by Diana *et al*. (2023) involving 123 female students in Grade XI at MAN 1 Yogyakarta revealed that the average knowledge score before receiving a leaflet on breast self-examination (SADARI) was 8.6, increasing to 11.1 after the intervention. The Wilcoxon test yielded a p-value of 0.000 < 0.05, indicating that the leaflet was effective in increasing student knowledge [26].

Therefore, both website and leaflet media positively influenced knowledge improvement. The website, through its audiovisual elements, facilitated rapid information dissemination, while the leaflet improved knowledge through concise, clear materials and attractive illustrations, sparking adolescents' curiosity and interest in reading.

4.2. Differences in Attitude Changes Students in Makassar before and after Education Media with Website "Remaja Cegah DBD" and Leaflet

The mean score in the main intervention group before receiving education using the "Remaja Cegah DBD" website on dengue prevention was 27.11, which increased to 32.03 after the intervention, with a p-value of 0.000 < 0.05. This indicates a significant effect on dengue prevention attitudes before and after the education provided through the "Remaja Cegah DBD" website. In the comparison intervention group, the mean score before receiving information through a

leaflet on dengue prevention was 28.19, which increased to 29.29 after the intervention, with a p-value of 0.008 < 0.05. This also shows a significant effect on dengue prevention attitudes after the information was delivered using a leaflet. The results in the main intervention group show that the mean score from pre-test to post-test increased significantly after the educational intervention on dengue prevention using the "Remaja Cegah DBD" website, indicating a difference in attitudes before and after the education provided via the website.

Statistical analysis of attitudes in the pre-test of the comparison intervention group revealed attitude changes as well, although the percentage was not as significant as those in the group using the website. This suggests that while leaflet-based education also affected attitudes towards dengue prevention, achieving a more substantial change may require more comprehensive media such as videos that are easier to understand. Websites offer more comprehensive information compared to print media like leaflets. With multiple interlinked pages, users can explore relevant topics more thoroughly.

Attitude is a person's internal response to a stimulus. It reflects an individual's perception and readiness to respond to surrounding stimuli. Attitudes can be measured either directly or indirectly. The measurement is carried out by identifying respondents' opinions about a given objects [21].

A study involving 85 junior high school students in Bandung City showed an increase in attitudes toward dengue prevention (p-value < 0.05), acceptance of the dengue vaccine (p-value < 0.05), and acceptance of the dengue vaccination program (p-value < 0.05) after receiving information via e-learning. This suggests that e-learning can have a significant impact in improving public attitudes toward dengue prevention and acceptance of dengue vaccination [12].

Widyasari *et al*. (2023) found that exposure to information on mental health through internet media positively and significantly influenced respondents' attitudes, with a strong effect size of 61.5%. The strength of web-based media lies in its interconnected pages, often equipped with images, videos, and various files that facilitate understanding. Additionally, websites serve as repositories of learning materials, providing access to videos and documents that can be accessed by students anytime and anywhere via a domain or URL [27]. Leaflets, used as health promotion tools, also contribute to changes in respondents' attitudes because the material presented in a concise and clear format is easier to understand. Furthermore, the practicality and portability of leaflets allow respondents to continually recall the conveyed information. This is in line with a study by Karim *et al*. (2024), which demonstrated that education using leaflets influenced the attitudes of adolescent girls toward consuming iron supplements in the Tana Lili Public Health Center working area, North Luwu. The study showed that before the education (pre-test), the majority of respondents had a positive attitude towards iron supplement consumption, with 58 respondents (92.1%) showing a positive attitude and 5 respondents (7.9%) showing a negative one. After the intervention (post-test), the number of respondents with a positive attitude increased to 61 (96.8%), while those with a negative attitude decreased to 2 (3.2%). Therefore, educational interventions using the "Remaja Cegah DBD" website in the main intervention group and leaflets in the comparison intervention group both had an impact on improving attitudes toward dengue prevention [28].

4.3. Differences in Behavior Changes among Students in Makassar before and after Education Media with Website "Remaja Cegah DBD" and Leaflet

Based on the results of the study, the main intervention group that received education through the "Remaja Cegah DBD" website showed an increase from pre-test to post-test scores, indicating a difference in dengue prevention behaviors before and after the educational intervention using the website. The comparison intervention group in this study used leaflet media. The findings show an increase in the mean score of respondents' dengue prevention behaviors from pre-test to post-test. This increase occurred after the respondents received education through leaflet media. This suggests that both video-based and leaflet-based media are effective in improving dengue prevention behaviors, although there are differences in their levels of effectiveness.

This study is consistent with the research conducted by Rohani Retnauli Simanjuntak (2022), which showed an increase in the average behavior score from 9.67±2.30 to 15.75±1.35. There was an effect of the intervention on food handlers' behavior, with a p-value of 0.000 indicating p < 0.05. Similarly, research by Sewa *et al*. (2019) found that the highest average pre-test score was in the experimental group (27.9), and the highest average post-test score was also in the experimental group A (29.5), with p-values of 0.005 for experimental group A, 0.017 for experimental group B, and 0.052 for the control group [29].

Practice represents the actual action resulting from a response. After an individual becomes aware of a given stimulus and evaluates what they have learned,

the next process is to implement or practice what they know [21]. Once a person has received knowledge about a stimulus or object and formed an opinion about it, they are expected to translate that into practice. When experiences are based on knowledge, the resulting practices or behaviors are expected to be sustained. In this study, behavior refers to the application of actions related to dengue prevention and control [30].

Websites that present information accompanied by images and videos are more effective in delivering health information. This is in line with the findings of Herlinadiyaningsih (2022), who stated that video media is an appropriate and engaging method for health education because it influences the outcomes of the educational session. Video media combines moving visuals, text, and explanatory audio, making it more appealing to the target audience [31]. This aligns with the findings of Lidiasari *et al*. (2024), which showed a behavioral improvement in diarrhea prevention after health education using video media among 30 respondents. This indicates a behavioral change as a result of video-based health education [32].

Based on the results of this study, leaflet media can also improve adolescent behavior, especially in the use of sunscreen. This finding is in line with the study by Wulandari *et al*. (2020) titled "The Effect of Health Education Using Leaflet Media to Improve Knowledge and Behavior in Applying Health Protocols Among Street Vendors in Car-Free Day Temanggung," which showed that leaflet-based education can improve behavior among street vendors. Among 48 respondents, before receiving health education through leaflets, 35% had poor behavior, 40% moderate, and 25% good. After the intervention, 23% were categorized as having poor behavior, 35.3% moderate, and 41.7% good [33].

Therefore, educational interventions using the "Remaja Cegah DBD" website in the primary intervention group and leaflet media in the comparison group both had an impact on improving dengue prevention behaviors.

4.4. Differences in Knowledge, Attitudes, and Practices of Students in Makassar about Dengue Fever Prevention between the Main Intervention Group and Comparison Intervention Group

In the study conducted at SMPN 8 and SMPN 6 Makassar, the primary intervention group received education through the "Remaja Cegah DBD" website, while the comparison group used leaflet media. Before the educational intervention on dengue fever was provided, hypothesis testing indicated no significant differences in knowledge and attitudes between the two groups. This is likely because both groups shared similar baseline knowledge prior to the intervention, meaning any subsequent differences could be attributed to the type of educational media used.

After the intervention which focused on improving knowledge, attitudes, and practices (KAP) related to dengue fever, a significant difference in the mean scores was observed between the two groups. This indicates a meaningful change in the students' knowledge, attitudes, and practices regarding dengue fever in both the primary and comparison intervention groups.

One of the advantages of web-based media is its structure, which includes interlinked pages often enhanced with images, videos, or downloadable content, making information easier to comprehend. A website is a collection of pages published on the internet with a URL that can be accessed by anyone. Educational materials, such as videos and documents, can be stored and accessed by students anytime and anywhere [27].

This finding is in line with the study by Lathifa & Mahmudiono, which demonstrated a significant difference between health education delivered through web-based media compared to leaflet-based media. The treatment group (web-based) showed better nutritional knowledge than the control group (leaflet-based). It was concluded that web-based nutrition education programs are effective in improving balanced diet behaviors among high school students [34].

Another study comparing the effectiveness of website and leaflet interventions was conducted at Godean I and II Public Health Centers in Sleman Regency, Yogyakarta Special Region. The study found that web-based nutrition education (Nutres Care) had a greater impact than leaflet education on compliance with the 3J diet (type, quantity, and schedule) among patients with type 2 diabetes mellitus. A total of 54 respondents were involved. Dietary compliance was assessed using the SQFFQ. Participants received education via the Nutres Care website and leaflet, with two sessions conducted within a one-week interval. Based on the Contingency Coefficient Test, the leaflet media showed a coefficient of 0.302 (low correlation), while the website media yielded a coefficient of 0.443 (moderate correlation) [35].

Both website and leaflet media had an impact on students knowledge, attitudes, and practices regarding dengue fever. While the leaflet group showed significant improvements, the magnitude of change was greater in the website group. Thus, web-based media proved to be more effective in enhancing

knowledge, attitudes, and practices among junior high school students in Makassar.

4.5. Discuss Limitations

This study has several limitations that should be acknowledged. First, the use of a non-randomized quasi-experimental design limits the generalizability of the findings. The participants were selected based on convenience from two junior high schools. Additionally, there is the potential for information bias, as the data were self-reported by respondents and may be subject to social desirability or recall bias. Furthermore, the absence of blinding among participants and data collectors could have influenced the responses or evaluation outcomes. Despite these limitations, the findings provide important insights into the effectiveness of digital health education models for dengue prevention among adolescents. Another limitation of this study is the potential for social desirability bias, as the data were collected using self-reported questionnaires. Participants may have provided answers they perceived as more acceptable or favorable, rather than reflecting their true knowledge or attitudes. Additionally, blinding was not implemented, as the data collectors were aware of the group assignments (intervention vs. control), which may have introduced observer bias during data collection.

5. CONCLUSION

Based on the research findings on the influence of the “Remaja Cegah DBD” website on changes in knowledge, attitudes, and practices related to Dengue Fever among students at the main intevention group in SMPN 8 Makassar and the comparison intervention group in SMPN 6 Makassar, it can be concluded that there were significant improvements in knowledge, attitudes, and practices before and after receiving health education interventions, both through the “Remaja Cegah DBD” website and leaflet media. However, the educational model using the website “Remaja Cegah DBD” proved to be more effective in enhancing students knowledge, attitudes, and practices regarding prevention of Dengue Fever compared to leaflet media. Therefore, junior high school students who have received information about Dengue Fever are expected to further improve their knowledge, maintain positive attitudes, and apply preventive behaviors against Dengue Fever for both themselves and their families.

ETHICAL APPROVAL

This research received ethical clearance from the Research Ethics Committee of the Faculty of Public Health, Hasanuddin University, under ethical approval recommendation number 1860/UN/4.14.1/TP.0102/2024 and protocol number 31724032228 and form informed consent.

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REFERENCES

[1] Widoyono. Tropical diseases. In: Epidemiology, transmission, prevention, and eradication. Jakarta: PT Gelora Aksara Pratama 2008; 59-67.

[2] Ministry of Health. Indonesia health survey (SKI) 2023 in figures. Vol. 1. Jakarta: Ministry of Health of the Republic of Indonesia 2023.

[3] South Sulawesi Provincial Health Office. South Sulawesi province health profile 2022. Makassar: South Sulawesi Provincial Health Office 2023; p. 19.

[4] Istiqamah SNA, Arsin AA, Salmah AU, Mallongi A. Correlation study between elevation, population density, and dengue hemorrhagic fever in Kendari city in 2014-2018. Open Access Maced J Med Sci 2020; 8(T2): 63-6. https://doi.org/10.3889/oamjms.2020.5187

[5] Erwin ASN, Noor NN, Wahiduddin, Arsin AA, Ishak H, Junus AJ. Risk factors dengue fever in an endemic area in Sikka, Indonesia: a case-control study. Natl J Community Med 2024; 15(8): 676-84. https://doi.org/10.55489/njcm.150820244213

[6] Arsin AA. The meaning and epidemiology of dengue hemorrhagic fever. In: Epidemiology of dengue hemorrhagic fever (DHF) in Indonesia. Makassar: Masagena Press 2013. p 20-40.

[7] Rakhmani AN, Zuhriyah L. Knowledge, attitudes, and practices regarding dengue prevention among health volunteers in an urban area - Malang, Indonesia. J Prev Med Public Health 2024; 57(2): 176-84. https://doi.org/10.3961/jpmph.23.484

[8] De Santis KK, Mergenthal L, Christianson L, Zeeb H. Digital technologies for health promotion and disease prevention in older people: protocol for a scoping review. J Med Internet Res 2022; 11(7): 1-10. https://doi.org/10.2196/37729

[9] Yulinda A, Fitriyah N. The effectiveness of health education with lecture and audiovisual methods to improve knowledge and attitude about BSE in SMKN 5 Surabaya. J Promosi Kesehatan 2018; 6(2): 116-28. https://doi.org/10.20473/jpk.V6.I2.2018.116-128

[10] Alhoot MA, Baobaid MF, Al-Maleki AR, Abdelqader MA, Paran LAPR, Kannaiah BAP. Knowledge, attitude, and practice towards dengue fever among patients in Hospital Taiping. Malays J Public Health Med 2017; 17(3): 66-75. https://doi.org/10.37268/mjphm/vol.17/no.3/art.223

[11] Purnaningsih N, Putra RA, Anggini A, Tamami MH, Furoida DA. Effectiveness of the GEKA.id website in increasing knowledge about free sex prevention among adolescents in PIK-R Klorofil in Kampar Regency. J Penyuluhan 2022; 18(1): 177-84. https://doi.org/10.25015/18202237679

[12] Ali M, Adlia A, Suwantika AA. The effect of e-learning on the attitude toward dengue prevention and the acceptance of dengue vaccination. Patient Prefer Adherence 2021; 15: 785-92. https://doi.org/10.2147/PPA.S296758

[13] Rahayul YP, Mambang DEP, Nasution HM. Detection of Staphylococcus aureus contamination on local crispy chicken around a university in Medan city. J Pharm Sci 2023; 6(3): 1356-62. https://doi.org/10.36490/journal-jps.com.v6i3.222

[14] Sembada SD, Pratomo H, Fauziah I, Amani SA, Nazhofah Q, Kurniawati R. Utilization of online media as a means of health education for adolescents: a literature review. Prepotif J Kesehat Masyarakat 2023; 6(1): 564-74. https://doi.org/10.31004/prepotif.v6i1.3110

[15] Kurniawan W, Suwandono A, Widjanarko B, Suwondo A, Artama WT, Shaluhiyah Z, *et al*. The effectiveness of the One Health SMART approach on dengue vector control in Majalengka, Indonesia. J Health Res 2021; 35(1): 63-75. https://doi.org/10.1108/JHR-07-2019-0162

[16] Gita APA, Surya NT, Setyaningsih A. Android-based stunting application to accelerate early detection of stunting. J Public Health Innov 2023; 3(2): 142-50. https://doi.org/10.34305/jphi.v3i02.714

[17] de Sousa D, Fogel A, Azevedo J, Padrão P. The effectiveness of web-based interventions to promote health behaviour change in adolescents: a systematic review. Nutrients 2022; 14(6): 1-24. https://doi.org/10.3390/nu14061258

[18] Andini SNT, Juwariyah S, Supriyono M. Effectiveness of Emivo (video media education) on increasing adolescent reproductive health knowledge. Diagnosa J Ilmu Kesehatan dan Keperawatan 2023; 1(3): 100-7. https://doi.org/10.59581/diagnosa-widyakarya.v1i3.876

[19] Irsal, Maria IL, Arsin AA, Zulkifli A, Palutturi S, Amqam H, *et al*. Application of dengue hemorrhagic fever information system (SI-DBD) for recording and reporting of DHF suspects at Kota Public Health Centers in Bantaeng Regency. Int J Stat Med Res 2023; 12(ii): 65-72. https://doi.org/10.6000/1929-6029.2023.12.09

[20] Hasanah N. Relationship between knowledge and pregnant women's attitudes on the use of maternal and child health book. J Ilmiah Maksitek 2021; 6(3): 18-25. Available from: https://makarioz.sciencemakarioz.org/index.php/JIM/article/view/294

[21] Ratnawulan A. Community efforts in preventing dengue hemorrhagic fever in Bergas Lor Village, Semarang Regency. J Kesehatan 2019; 1(1): 1-77. Available from: http://lib.unnes.ac.id/40228/

[22] Surentu YZ, Warouw DMD, Rembang M. Importance of websites as tourism information media at the Department of Culture and Tourism, Minahasa Regency. J Ilmu Komunikasi 2020; 2(4): 1-17. Available from: https://ejournal.unsrat.ac.id/index.php/actadiurnakomunikasi/article/view/31117/29843

[23] Arsin AA, Istiqamah SNA, Elisafitri R, Nurdin MA, Sirajuddin S, Pulubuhu DAT, *et al*. Correlational study of climate factor, mobility and the incidence of dengue hemorrhagic fever in Kendari, Indonesia. Enferm Clin 2020; 30(Suppl 6): 280-4. https://doi.org/10.1016/j.enfcli.2020.06.064

[24] Knock M, Carpenter DM, Thomas KC, Lee C, Adjei A, Lowery J, *et al*. Disseminating a health information website to teens using a three-pronged approach with social media outreach. PEC Innov 2024; 4: 100288. https://doi.org/10.1016/j.pecinn.2024.100288

[25] Ayu C, Astuti F. Development of interactive learning multimedia on dengue prevention and control for the Ngaglik subdistrict community. J Pendidikan Teknologi dan Kejuruan 2017; 6(23): 407. Available from: https://journal.student.uny.ac.id/index.php/fiptp/article/view/7615

[26] Ayu D, Julianty E, Djuma AW, Olin W, Setia A, Artikel I. Analysis of hepatitis B virus transmission factors among household contacts in Bone Village, Kupang. J Virus Hepatitis 2023; 11(2): 206-16. https://doi.org/10.36341/klinikal_sains.v11i2.3818

[27] Y Novitasari YS, Adrian QJ, Kurnia W. Design of website-based learning media information system. J Teknol dan Sist Informasi 2021; 2(3): 136-47.

[28] Karim N, Adam A, Idris P. Effect of leaflet media education on the attitudes of adolescent girls in consuming iron tablets at Tana Lili Health Center, North Luwu. J Aafiyah Health Res 2024; 5(2): 106-12.

[29] Sudarman S, Hadi AJ, Manggabarani S, Ishak S. Effect of healthy snack behavior intervention on prevention of nutritional anemia among elementary school children in Makassar. Promot J Kesehat Masyarakat 2020; 10(1): 67-72. Available from: https://download.garuda.kemdikbud.go.id/article.php?article=2193811

[30] Ganney PS. Web programming. In: Introduction to bioinformatics and clinical scientific computing. 1st ed. Boca Raton, FL: CRC Press 2023; pp. 217-90. https://doi.org/10.1201/9781003316244-11

[31] Herlinadiyaningsih H, Arisani G. Effectiveness of video and leaflet media on knowledge and attitude levels about menstrual hygiene at MA Darul Ulum Palangka Raya. J Surya Medika 2022; 8(2): 193-207. https://doi.org/10.33084/jsm.v8i2.3886

[32] Lidiasari DA, Simamora RS, Pelawi AMP. The effect of health education with video media on diarrhea prevention behavior in children. J Publikasi Promosi Preventif 2024; 6: 1387-94. Available from: http://jurnal.globalhealthscience-group.com/index.php/JPPP

[33] Wulandari D. The effect of health education using leaflet media to increase knowledge and behavior in implementing health protocols among traders at Car Free Day Temanggung. J Ilmu Kesehatan 2020; 6-15. Available from: https://download.garuda.kemdikbud.go.id/article.php?article=2193811

[34] Lathifa S, Mahmudiono T. The effect of web-based nutrition education media on balanced nutrition eating behavior among high school students in Surabaya. Media Gizi Kesmas 2020; 9(2): 48-56. https://doi.org/10.20473/mgk.v9i2.2020.48-56

[35] Nuraini AD. The effect of web-based nutrition education (Nutres Care) compared to leaflet on dietary adherence (3J) among type 2 diabetes mellitus patients at Godean I and II Health Centers. J Gizi Klinis dan Dietetik Indones 2024; 19: 2-3. Available from: https://eprints.poltekkesjogja.ac.id/15953/

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