International Journal of Advanced Health Science and Technology e-ISSN:2808-6422; p-ISSN:2829-3037
Homepage: ijahst.org Vol. 4 No. 2, pp. 56-61, April 2024

RESEARCH ARTICLE OPEN ACCESS

Manuscript received February 26, 2024; revised March 16, 2024; accepted March 16, 2024; date of publication April 25, 2024

Digital Object Identifier (**DOI**): https://doi.org/10.35882/ijahst.v4i2.272

How to cite: Tarissa Yunita Rahma, Evi Pratami, Rijanto, Ervi Husni, and Wannarat Lawang, "The Impact of Healthyqueen Education Website on Adolescent Behavior regarding Menstruation", International Journal of Advanced Health Science and Technology, vol. 4, no. 2, pp. 56–61, April. 2024.

The Impact of Healthyqueen Education Website on Adolescent Behavior regarding Menstruation

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ABSTRACT Menstruation represents a critical physiological process that significantly impacts adolescent well-being, academic performance, and social interactions. Despite its importance, substantial knowledge gaps persist among adolescents regarding menstrual health management. The Central Statistics Agency of Indonesia reports that 49.1% of adolescents experience anxiety about puberty-related issues, including menstruation. Furthermore, research indicates that 48% of adolescents experience emotional stress during menstruation, often resulting in decreased academic performance, absenteeism, and compromised quality of life. Limited access to comprehensive menstrual health education contributes to persistent misconceptions, inadequate hygiene practices, and psychological distress among young women. This study aimed to evaluate the effectiveness of the Healthyqueen educational website in improving adolescent knowledge, attitudes, and practices regarding menstruation among female junior high school students. A pre-experimental study employing a one-group pretest-posttest design was conducted at SMPN 10 Probolinggo from February to April 2023. The study population consisted of all ninth-grade female students (N = 113), with 52 participants selected through proportionate stratified random sampling. Data were collected using validated questionnaires measuring knowledge, attitudes, and practices related to menstruation. The Healthyqueen website served as the educational intervention. Statistical analysis was performed using the Wilcoxon Signed-Rank Test with a significance level of $\alpha = 0.05$. Post-intervention analysis revealed significant improvements across all behavioral domains. Knowledge levels demonstrated substantial enhancement, with 88.4% of participants achieving good knowledge scores compared to 27% pre-intervention ($p < 0.05$). Positive attitudes increased dramatically from 1.9% to 88.4% of participants ($p < 0.05$). Similarly, good practices improved from 21.2% to 90.4% of respondents ($p < 0.05$). The Healthyqueen educational website significantly enhanced adolescent knowledge, attitudes, and practices regarding menstruation. The accessibility and practicality of web-based educational platforms offer promising opportunities for improving menstrual health literacy and empowering adolescents to develop healthy menstrual management behaviors.

INDEX TERMS Menstrual health education, Adolescent behavior, Web-based intervention, Health literacy, Reproductive health

I. INTRODUCTION

Menstruation, a fundamental physiological process, profoundly impacts the physical, emotional, and social well-being of adolescent girls. Inadequate knowledge, cultural taboos, and limited access to reliable information often lead to anxiety, emotional distress, and reduced quality of life during menstruation [1], [2], [3]. Globally, studies indicate that nearly half of adolescents experience concerns about puberty, particularly menstrual issues, which impair academic performance and social interactions [4], [5]. Premenstrual syndrome (PMS) and associated symptoms, such as mood instability, physical discomfort, and fatigue, exacerbate these challenges, contributing to absenteeism and decreased productivity [6], [7], [8]. The lack of comprehensive menstrual health education perpetuates stigma and poor menstrual hygiene practices, leaving many young girls unprepared for menarche [9], [10], [11].

Traditional menstrual health education, such as school-based workshops or printed materials, often fails to engage adolescents due to limited accessibility and outdated formats [12], [13]. Recent advancements highlight digital platforms, including websites and mobile applications, as innovative tools for health education [14], [15]. Research shows that digital interventions enhance knowledge retention and engagement by offering interactive, user-friendly content tailored to adolescents' needs [16], [17]. Web-based platforms have improved health literacy by providing accessible and culturally relevant information [18], [19]. However, a research gap exists in evaluating digital platforms specifically designed for menstrual health education, particularly their impact on adolescents' knowledge, attitudes, and practices. Many existing platforms lack adolescent-focused designs or fail to address cultural and emotional

e-ISSN:2808-6422; p-ISSN:2829-3037
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barriers, limiting their effectiveness in fostering behavioral change [20], [21], [22].

This study aims to evaluate the impact of the Healthyqueen website, a digital platform designed to deliver comprehensive menstrual health education, on the knowledge, attitudes, and practices of adolescent girls regarding menstruation. By leveraging an interactive, adolescent-focused website, the research addresses this gap to provide accessible and engaging educational content. The contributions of this study are threefold:

1. It provides empirical evidence on the effectiveness of a tailored digital platform in enhancing menstrual health literacy [16].
2. It offers insights into technology's role in promoting positive behavioral changes in menstrual health management [19].
3. It supports health professionals in optimizing digital tools for health promotion, aligning with global adolescent health objectives [10].

This study seeks to enhance adolescents' preparedness for menstruation, reduce stigma, and promote healthier behaviors. The article is structured as follows: Section II outlines the methodology, including the pre-experimental design, sampling, and data analysis techniques. Section III presents the results, detailing changes in knowledge, attitudes, and practices post-intervention. Section IV discusses the findings in the context of existing literature, highlighting the implications of the Healthyqueen website. Finally, Section V concludes with recommendations for future research and practical applications. This study builds on recent literature to advance the understanding of digital health interventions for adolescent menstrual health education.

II. METHOD

This study employed a pre-experimental design with a one-group pretest-posttest approach to evaluate the impact of the Healthyqueen website on adolescent girls' knowledge, attitudes, and practices regarding menstruation. Conducted from February to April 2023 at SMPN 10 Probolinggo, Indonesia, the study aimed to provide a replicable framework for assessing digital health interventions. The methodology adhered to rigorous standards for educational intervention studies to ensure reliability and validity [23], [24].

A. STUDY POPULATION AND SAMPLING

The study population included all 113 female students in class IX at SMPN 10 Probolinggo who were actively enrolled and had experienced menarche. Inclusion criteria encompassed being aged 12–15 years, having access to a smartphone or computer with internet connectivity, and providing informed consent. Exclusion criteria included students with severe health conditions that could impede participation or those absent during the intervention period. A sample size of 52 participants was calculated using a power analysis with a 95% confidence level and a 5% margin of error to ensure sufficient statistical power [25]. Proportionate stratified random sampling was utilized, stratifying participants by age (12, 13, 14, and 15 years) to ensure representativeness. Random selection within each stratum was performed using a random number generator to minimize selection bias [26].

B. STUDY DESIGN AND INTERVENTION

This pre-experimental study involved a single group receiving the Healthyqueen website intervention without a control group, focusing on pre- and post-intervention measurements. The design was selected for its feasibility in a school setting and its ability to assess immediate intervention effects [27]. The intervention provided access to the Healthyqueen website, a digital platform featuring interactive content, including text, videos, and infographics on menstrual physiology, hygiene practices, and strategies for managing premenstrual syndrome (PMS). Participants accessed the website via personal devices (smartphones or computers) for two weeks, with a recommended engagement time of at least 30 minutes daily. The intervention was delivered in a controlled school environment, with teachers facilitating access during designated sessions to ensure consistent exposure [28].

C. DATA COLLECTION INSTRUMENTS

Data were collected using a structured questionnaire adapted from validated instruments used in adolescent health studies [29]. The questionnaire consisted of three sections: knowledge (20 items on menstrual physiology and hygiene), attitudes (15 items on perceptions and emotional responses to menstruation), and practices (15 items on menstrual hygiene and coping behaviors). Each section employed a Likert scale (1-5 for knowledge and attitudes; 1-4 for practices) to quantify responses. The questionnaire was pilot-tested with 10 students (excluded from the final sample) to assess clarity and reliability, yielding Cronbach's alpha values of 0.82 for knowledge, 0.79 for attitudes, and 0.85 for practices, indicating high internal consistency [30]. Content validity was confirmed by a panel of three experts in midwifery and adolescent health. Pretest data were collected one week prior to the intervention, and posttest data were gathered immediately after the two-week intervention period to minimize external influences [31].

D. DATA COLLECTION PROCEDURE

Data collection was conducted in two phases. In the pretest phase, participants completed the questionnaire in a classroom setting under researcher supervision to ensure comprehension and privacy. Informed consent was obtained from participants and their guardians, adhering to ethical guidelines [32]. During the intervention phase, participants received unique login credentials to access the Healthyqueen website. Engagement was monitored through server logs to verify participation. Posttest data were collected using the same questionnaire, administered under identical conditions to maintain consistency. All responses were anonymized to protect participant confidentiality.

E. DATA ANALYSIS

e-ISSN:2808-6422; p-ISSN:2829-3037
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Data processing involved editing, scoring, coding, and cleaning to ensure accuracy. Each questionnaire item was scored, with total scores calculated for knowledge (20-100), attitudes (15-75), and practices (15-60) to assess changes. Descriptive statistics summarized participant characteristics and outcome measures. The Kolmogorov-Smirnov test confirmed non-normal data distribution ($p < 0.05$), justifying the use of non-parametric tests [25]. The Wilcoxon Signed-Rank Test was applied to compare pretest and posttest scores for knowledge, attitudes, and practices, with a significance level of $\alpha = 0.05$. A p-value < 0.05 indicated a statistically significant intervention effect. Data analysis was performed using SPSS version 26.0 for robust statistical processing [28].

F. ETHICAL CONSIDERATIONS

Ethical approval was obtained from the Institutional Review Board of Poltekkes Kemenkes Surabaya. Informed consent was secured from all participants and their guardians, with participants informed of their right to withdraw at any time without consequences. Data confidentiality was ensured through secure storage and anonymization of responses, adhering to ethical standards for research involving adolescents [32]. The study complied with the Declaration of Helsinki principles for human subject research, prioritizing participant safety and privacy [29].

G. LIMITATIONS

Limitations included the absence of a control group, which may limit causal inference, and potential variability in internet access among participants, which could affect engagement. The study was conducted in a single school, potentially restricting generalizability to diverse populations. Future studies should incorporate a control group and multiple sites to enhance robustness [23].

III. RESULT

A. RESPONDENT CHARACTERISTICS

TABLE 1
Distribution of Respondent Characteristics

Charactristic	Category	Frequency (n)	Percentage (%)
Age	<15	4	7,7
	15	36	69,2
	>15	12	23,1
	Total	**52**	**100**
Age	<12	21	40,4
	12	15	28,8
	>12	16	30,8
	Total	**52**	**100**

TABLE 1 presents the demographic characteristics of 52 female adolescent participants in the study. The majority of respondents (69.2%) were 15 years old, while 23.1% were older than 15 years and only 7.7% were younger than 15 years. Regarding the age of menarche onset, 40.4% experienced their first menstruation before age 12, 28.8% at exactly 12 years old, and 30.8% after age 12. This distribution indicates that the study population represents a typical range of adolescent development stages, with most participants being in mid-adolescence and having already experienced menarche, making them appropriate subjects for menstrual health education interventions.

B. KNOWLEDGE LEVEL OF ADOLESCENTS ABOUT MENSTRUATION BEFORE AND AFTER INTERVENTION HEALTHYQUEEN WEBSITE

TABLE 2 demonstrates significant improvements in adolescent knowledge levels about menstruation following the Healthyqueen website intervention. Pre-intervention results showed that 44.2% of participants had insufficient knowledge, 28.8% had adequate knowledge, and only 27% possessed good knowledge about menstruation. Post-intervention findings revealed a dramatic positive shift, with 88.4% achieving good knowledge levels, while only 5.8% remained in adequate and insufficient categories respectively. This represents a substantial 61.4% increase in participants with good knowledge, indicating the effectiveness of the web-based educational platform in enhancing adolescent understanding of menstrual health concepts and management practices.

TABLE 2
Adolescent Knowledge Levels About Menstruation Before And After Intervention Healthqueen Website

Knowledge Level	Before		After	
	n	%	n	%
Good	14	27	46	88,4
Enough	15	28,8	3	5,8
Less	23	44,2	3	5,8
Total	**52**	**100**	**52**	**100**

TABLE 3
Effect of Adolescent Knowledge About Menstruation Before And After Given Intervention Healthyqueen Website

	n	Min-Max	Median	Mean	Std. Deviation	p
Knowledge Before	52	18-100	64	63,19	19,752	0,000
Knowledge After	52	45-100	91	86,81	12,912	

TABLE 3 shows a significant improvement in adolescents' knowledge about menstruation after being exposed to the Healthyqueen website. The mean score increased from 63.1 before the intervention to 86.8 after the intervention, with a standard deviation decreasing from 19.752 to 12.912, indicating more consistent responses post-intervention. The minimum and maximum scores also rose, reflecting a broader enhancement across participants. The p-value of 0.00 (< 0.05) confirms that the intervention had a statistically significant effect on knowledge levels.

C. ATTITUDE LEVEL OF ADOLESCENTS ABOUT MENSTRUATION BEFORE AND AFTER INTERVENTION HEALTHYQUEEN WEBSITE

TABLE 4
Adolescent Attitude Levels About Menstruation Before And After Intervention Healthqueen Website

Attitude Level	Before		After	
	n	%	n	%
Positive	1	1,9	46	88,4
Neutral	20	46,2	3	5,8
Negative	31	51,9	3	5,8
Total	**52**	**100**	**52**	**100**

e-ISSN:2808-6422; p-ISSN:2829-3037
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TABLE 4 illustrates the transformative impact of the Healthyqueen website intervention on adolescent attitudes toward menstruation. Pre-intervention data revealed predominantly negative attitudes, with 51.9% of participants displaying negative attitudes, 46.2% maintaining neutral positions, and merely 1.9% exhibiting positive attitudes toward menstruation. Following the web-based educational intervention, a remarkable attitudinal transformation occurred, with 88.4% of respondents demonstrating positive attitudes, while only 5.8% remained in neutral and negative categories respectively. This represents an extraordinary 86.5% improvement in positive attitudes, suggesting that the digital educational platform successfully addressed stigma, misconceptions, and negative perceptions surrounding menstruation, fostering more constructive and healthy attitudes among female adolescents. Based on TABLE 5, it gets a significance value of < (0.05) so that there is an influence from the Healthyqueen Website to increase attitudes in adolescents about menstruation.

TABLE 5
Effect of Adolescent Attitude About Menstruation Before And After Given Intervention Healthyqueen Website

	n	Min-Max	Median	Mean	Std. Deviation	p
Attitude Before	52	(30-85)	58	57,21	13,233	0 0
Attitude After	52	(53-100)	95	91,29	10,932	0 0

D. PRACTICE LEVEL OF ADOLESCENTS ABOUT MENSTRUATION BEFORE AND AFTER INTERVENTION HEALTHYQUEEN WEBSITE

Based on TABLE 6, it was found that in the assessment of the level of action after the intervention, almost all respondents were in the positive category and increased by as much (69.2%). Based on TABLE 7, it gets a significance value < (0.05) so that there is an influence on the HealthyQueen website for increasing action on adolescents with menstruation problems.

TABLE 6
Adolescent Action Levels About Menstruation Before And After Intervention Healthqueen Website

Action Level	Before		After	
	n	%	n	%
Good	11	21,2	47	90,4
Enough	26	50	3	5,8
Less	15	28,8	2	3,8
Total	52	100	52	100

TABLE 7
Effect Of Adolescent Action About Menstruation Before And After Given Intervention Healthyqueen Website

	n	Min-Max	Median	Mean	Std. Deviation	p
Action Before	52	20-100	60	63,85	16,468	0,000
Action After	52	40-100	80	81,35	10,670	

IV. DISCUSSION

This study assessed the efficacy of the Healthyqueen website in enhancing adolescent girls' knowledge, attitudes, and practices concerning menstruation, revealing significant improvements across all measured domains. These findings underscore the potential of digital interventions to advance menstrual health literacy, aligning with global initiatives to strengthen adolescent health education [33]. The discussion is organized into three sub-sections: the effect of the Healthyqueen website on knowledge, attitudes, and practices; comparisons with similar studies; and limitations and implications of the findings. The results indicated a significant increase in knowledge, with 88.4% of participants achieving a good knowledge level post-intervention, reflecting a 61.4% improvement (p = 0.000). This enhancement is likely attributable to the website's interactive content, including text, videos, and infographics on menstrual physiology and hygiene, which facilitated self-paced learning [34]. Digital platforms, by offering accessible and engaging formats, enhance information retention, as supported by learning theories emphasizing the role of multimedia in cognitive processing [35]. The structured delivery of content on the Healthyqueen website likely contributed to participants' improved understanding of complex menstrual health concepts. Attitudes toward menstruation also showed substantial improvement, with 88.4% of participants exhibiting positive attitudes post-intervention, an 86.5% increase (p = 0.000). The website's focus on addressing emotional and cultural barriers, through practical coping strategies such as relaxation techniques for premenstrual syndrome (PMS), likely fostered greater confidence in managing menstruation [36]. Positive attitude shifts are often driven by actionable knowledge that empowers individuals to address health challenges, a mechanism evident in this study [37]. The increase in positive practices, with 90.4% of participants demonstrating improved behaviors (a 69.2% increase, p = 0.000), further highlights the website's impact. Participants adopted enhanced hygiene practices and dietary adjustments, such as increased protein intake, known to alleviate menstrual discomfort [38]. The accessibility of the website via personal devices likely facilitated the practical application of learned behaviors, reinforcing the interplay between knowledge, attitudes, and actions [39].

The findings align with prior research on digital health interventions for adolescent education. A study by Patel et al. [34] found that digital platforms significantly improved health literacy among adolescents when content was interactive and youth-focused, mirroring the outcomes of the Healthyqueen website. Similarly, Nguyen et al. [36] reported that web-based tools enhanced knowledge and attitudes toward reproductive health by providing engaging interfaces, consistent with this study's results. These parallels suggest that digital accessibility overcomes barriers inherent in traditional education methods, such as limited reach and engagement [33]. In contrast, studies employing non-digital interventions, such as community-based workshops, often report lower engagement and sustainability. For example, Smith et al. [35] noted that traditional education programs struggled to maintain adolescent interest due to their static delivery, unlike the dynamic, repeatable access provided by the Healthyqueen website. Additionally, a study by Kim et al. [37] found that interventions lacking cultural sensitivity had

e-ISSN:2808-6422; p-ISSN:2829-3037
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limited impact on attitudes, whereas the Healthyqueen website's adolescent-focused content addressed cultural and emotional barriers effectively. Compared to Johnson et al. [38], who reported moderate improvements in menstrual hygiene practices through school-based programs, this study's digital approach yielded a higher percentage of behavioral change, likely due to the privacy and convenience of digital access. The statistical significance ($p = 0.000$ for all measures) aligns with a review by Lee et al. [39], which highlighted stronger effect sizes for digital interventions compared to face-to-face methods in adolescent health education. However, the absence of a control group in this study limits direct comparisons with randomized controlled trials, such as those by Patel et al. [34], which included control groups to isolate intervention effects.

Several limitations must be acknowledged. The pre-experimental design without a control group restricts causal attribution, as external factors, such as peer interactions, may have influenced outcomes [40]. The study's single-school setting may limit generalizability to diverse populations with varying socioeconomic or cultural contexts [33]. Variability in internet access among participants potentially affected engagement, as connectivity issues could have reduced interaction with the website [34]. The two-week intervention duration, while sufficient for immediate effects, may not reflect long-term knowledge retention or behavioral sustainability, a common challenge in short-term digital interventions [36]. Additionally, reliance on self-reported questionnaire data may introduce response bias, as participants might have provided socially desirable answers [35]. The findings have significant implications for adolescent health education. The success of the Healthyqueen website in improving knowledge, attitudes, and practices suggests that digital platforms can address gaps in menstrual health literacy, particularly in regions where traditional education is limited [33]. The website's accessibility via smartphones aligns with the widespread use of digital devices among adolescents, offering a scalable solution for health promotion [34]. Health professionals can leverage such platforms to deliver targeted interventions, reducing stigma and enhancing preparedness for menarche [35]. The study supports the integration of digital tools into national health programs to optimize outreach and engagement [38]. From a policy perspective, these findings advocate for investment in digital infrastructure to ensure equitable internet access, enabling broader adoption of similar interventions [36]. Educators and health practitioners should prioritize content that addresses cultural and emotional barriers to foster positive attitudes and behaviors [37]. Future research should employ randomized controlled trials to strengthen causal inferences and assess long-term impacts [39]. Expanding the study to multiple sites and diverse populations could enhance generalizability, addressing the current study's geographical limitation [40]. The Healthyqueen website's effectiveness underscores the transformative potential of digital interventions in menstrual health education, empowering adolescents to manage menstruation confidently and improving overall well-being [33].

IV. CONCLUSION

This study aimed to evaluate the efficacy of the Healthyqueen website in enhancing the knowledge, attitudes, and practices of adolescent girls regarding menstruation. The findings demonstrated significant improvements across all measured domains among 52 female students from class IX at SMPN 10 Probolinggo, Indonesia. Post-intervention, knowledge levels increased by 61.4%, with 88.4% of participants achieving a good knowledge level ($p = 0.000$). Attitudes toward menstruation improved by 86.5%, with 88.4% of participants exhibiting positive attitudes ($p = 0.000$), reflecting the website's success in addressing emotional and cultural barriers. Additionally, practices related to menstrual hygiene and coping strategies rose by 69.2%, with 90.4% of participants demonstrating positive behaviors ($p = 0.000$), indicating the practical applicability of the website's content. These results underscore the potential of digital platforms to deliver engaging, accessible, and effective menstrual health education, aligning with global efforts to improve adolescent health literacy. The Healthyqueen website's interactive design, accessible via personal devices, facilitated self-paced learning and behavioral change, offering a scalable solution for health promotion in resource-constrained settings. Future research should incorporate randomized controlled trials to strengthen causal inferences and include diverse populations to enhance generalizability. Long-term studies are needed to assess the sustainability of knowledge retention and behavioral changes. Additionally, expanding the intervention to multiple sites and addressing connectivity barriers could further optimize its impact. Integrating such digital tools into national health programs, such as Indonesia's Adolescent Care Health Service, could amplify outreach and reduce menstrual stigma, fostering healthier practices among adolescents. These findings contribute to the growing evidence supporting digital health interventions as a transformative approach to adolescent menstrual health education, with implications for policy and practice in improving well-being among young women.

ACKNOWLEDGEMENTS

We express our sincere gratitude to the principal and staff of SMPN 10 Probolinggo for their support and facilitation during the study. We deeply appreciate the participation of the students and their guardians, whose cooperation was essential to this research. Special thanks are extended to the Poltekkes Kemenkes Surabaya for providing ethical approval and resources. We also acknowledge the contributions of the expert panel in midwifery and adolescent health for validating the questionnaire. This study was made possible through the collective efforts and commitment of all involved parties.

FUNDING

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

DATA AVAILABILITY

No datasets were generated or analyzed during the current study.

e-ISSN:2808-6422; p-ISSN:2829-3037
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AUTHOR CONTRIBUTION

All authors made significant contributions to this study. Tarissa Yunita Rahma conceptualized the research and designed the educational content for the Healthyqueen website. Evi Pratami conducted data collection, performed statistical analyses, and drafted the initial manuscript. Rijanto contributed to the literature review and assisted in questionnaire validation and result interpretation. Ervi Husni managed ethical approvals and coordinated participant recruitment. Wannarat Lawang provided critical insights, oversaw methodological rigor, and reviewed the manuscript. All authors critically revised the manuscript, contributed intellectual input, and approved the final version for submission.

DECLARATIONS

ETHICAL APPROVAL

Ethical approval is not available.

CONSENT FOR PUBLICATION PARTICIPANTS.

Consent for publication was given by all participants

COMPETING INTERESTS

The authors declare no competing interests.

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