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The effect of flipbook-based health education on pregnant women's knowledge of gestational diabetes mellitus

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Abstract

Background: During pregnancy, physiological and metabolic changes occur, including increased insulin resistance driven by pregnancy hormones. One critical metabolic disorder that may arise is Gestational Diabetes Mellitus (GDM). GDM increases the risk of maternal complications such as preeclampsia and cesarean delivery, as well as long-term risks of developing type 2 diabetes mellitus. Fetal and neonatal consequences include macrosomia, respiratory adaptation difficulties, and neonatal hypoglycemia. Preventive strategies for GDM complications rely heavily on the health literacy of pregnant women. Digital flipbooks have emerged as an effective educational medium to significantly enhance understanding of maternal health topics.
Purpose: To determine the effect of flipbook-based health education on improving pregnant women's knowledge of Gestational Diabetes.
Method: This study employed a quantitative pre-experimental design using a One-Group Pretest-Posttest Design. A sample of 30 pregnant women was selected via purposive sampling. Data collection was carried out from June 5 to June 22, 2026. The intervention consisted of a 20-minute health education session using a digital flipbook. Data were analyzed using the non-parametric Wilcoxon Signed-Rank Test.
Results: Educational intervention using the flipbook significantly increased pregnant women's knowledge of Gestational Diabetes Mellitus, with the proportion of good knowledge rising from 36.7% pre-test to 73.4% post-test (p-value = 0.001, $\alpha < 0.05$).
Conclusion: Health education delivered through flipbook media is effective in significantly enhancing pregnant women's knowledge regarding Gestational Diabetes Mellitus.
Recommendation: Healthcare providers, particularly midwives and health service managers at primary health centers (Puskesmas), should integrate digital flipbooks as an interactive educational medium or supplementary tool to standard counseling for maternal health promotion and preventive care.

Keywords: Education; Flipbook; Gestational Diabetes Mellitus; Knowledge Introduction.

DISCUSSION

Although pregnancy is a natural physiological process for women, comprehensive monitoring remains essential to ensure maternal and fetal safety and to foster a positive pregnancy experience (World Health Organization, 2016). Physiological and metabolic adaptations occur during pregnancy, including progressive insulin resistance influenced by placental hormones. Without timely detection, these changes can lead to severe metabolic dysfunction (Cunningham et al., 2021).

One of the most common metabolic disorders during pregnancy is Gestational Diabetes Mellitus (GDM), defined by the World Health Organization (2024) as any degree of glucose intolerance with onset or first recognition during pregnancy. The American Diabetes Association 2021 notes that GDM-related metabolic complications span a broad spectrum, ranging from maternal preeclampsia and elevated rates of cesarean delivery to long-term development of type 2 diabetes mellitus. Impacts on neonates are equally severe, encompassing

macrosomia, birth trauma, respiratory distress syndrome, and neonatal hypoglycemia (American Diabetes Association, 2021).

Globally, diabetes mellitus continues to show an alarming rise. The International Diabetes Federation (2021) reported approximately 537 million adults living with diabetes worldwide, projected to reach 783 million by 2045. Nationally, the Indonesian Health Survey documented a diabetes prevalence of 1.7%, up from 1.5% in Riskesdas 2018 (Kementerian Kesehatan RI, 2023). In Aceh Province, registry data from the Provincial Health Office recorded 197,781 individuals living with diabetes, demonstrating a significant local disease burden (Aceh Provincial Health Office, 2023).

Efforts to prevent GDM complications depend heavily on the health literacy of pregnant women. Knowledge is a critical determinant shaping individual health attitudes and preventive behavior (World Health Organization, 2025). Pregnant women with sound knowledge of GDM are significantly better equipped to undergo early screening, recognize warning signs, and maintain healthy lifestyle modifications throughout pregnancy (World Health Organization, 2016).

Health education is a core strategy for improving maternal knowledge, but its success relies heavily on the educational media employed. Visually engaging, intuitive media tailored to the target audience enhance information retention. Flipbooks have emerged as an exceptionally effective medium; recent studies demonstrate that flipbook-based health education yields significantly higher knowledge gains regarding maternal anemia and stunting prevention compared to traditional lecture methods (Haninggar et al., 2025; Simarmata et al., 2026). Digital flipbooks leverage visual structure and multimedia components accessible via mobile devices, fostering self-paced learning.

Another research confirmed that health education using flipbooks significantly increased maternal knowledge through interactive presentation compared to static materials. Furthermore, multimedia elements improve engagement and facilitate independent information processing. However, the application of interactive flipbooks specifically for gestational disease risk education remains limited in primary healthcare settings. Given the critical importance of early maternal risk awareness, an innovative and practical educational tool is needed (Jajuli et al., 2023)

RESEARCH METHOD

This quantitative study utilized a pre-experimental approach with a One-Group Pretest-Posttest Design (O1 → X → O2). This design was implemented to evaluate changes in pregnant women's knowledge levels before and after receiving health education delivered via digital flipbook media.

Under this research design, baseline measurements (pre-test) were conducted on the target variable, followed by the educational intervention (treatment), and concluded with post-intervention evaluation (post-test) to measure intervention efficacy. The study was conducted between June 5 and June 20, 2026, in the working area of the Darul Imarah Health Center, Aceh Besar Regency.

The study population comprised all 236 pregnant women registered within the working area of Darul Imarah Health Center. Non-probability sampling using a purposive sampling approach was applied based on specific inclusion criteria established to meet the study objectives. A total sample size of 30 pregnant women was enrolled in the study.

Research Instruments and Materials: Data were collected using a validated knowledge questionnaire consisting of 15 items (13 positive items: Q1-Q10, Q12-Q14, scored 1 for Correct and 0 for Incorrect; and 2 negative items: Q11 and Q15, scored 0 for Correct and 1 for Incorrect). The educational intervention material was delivered via an interactive digital flipbook covering GDM definition, risk factors, maternal-fetal complications, lifestyle management, and screening guidelines.

Data Collection & Processing Procedure: 1. Preparation Phase: Institutional clearance was granted by UPTD Puskesmas Darul Imarah. Research instruments underwent expert validation. A structured timeline was established for baseline evaluation, intervention sessions, and post-testing. 2. Data Collection Phase: Pre-test questionnaires were administered to measure baseline GDM knowledge. Participants then received a single 20-minute structured health education session using the digital flipbook. Immediately following the intervention, participants completed the post-test questionnaire to assess knowledge acquisition. 3. Data Processing &

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Analysis Phase: Questionnaire scores were compiled and summarized. Statistical analysis included univariate analysis (frequency distributions and percentages) and bivariate analysis using the non-parametric Wilcoxon Signed-Rank Test (with significance set at α = 0.05).

Ethical Considerations: This study underwent formal ethical review and was declared ethically sound by the Health Research Ethics Committee of Poltekkes Kemenkes Aceh (Approval No. DP.04.03/12.7/079/2025).

RESEARCH RESULTS

Table 1. Characteristics of Respondent (N = 30)

Variable	Results
Age (Mean±SD) (Years) (Range)	(28.5 ± 6.2) (18-45)
<20	1/3.3
20–35	23/76.7
>35	6/20.0
Education (n/%)	
Basic (Primary/Junior High School)	4/13.3
Secondary (Senior High School)	17/56.7
Higher Education (Diploma/Degree)	9/30.0
Occupational (n/%)	
Civil Servant	1/3.3
Honorary Staff	1/3.3
Teacher	3/13.3
Homemaker	25/80.1
Gestational Age (n/%)	
Trimester I	9/30.0
Trimester II	8/26.7
Trimester III	13/43.3%
Parity (n/%)	
Primigravida	10/33.3
Multigravida	20/66.7
History of Diabetes Mellitus (n/%)	
Present	1/3.3
Absent	29/96.7
Knowledge Pre-test (n/%)	
Good	11/36.7
Moderate	12/40.0
Poor	7/23.3
Knowledge Post-test (n/%)	
Good	22/73.4
Moderate	7/23.3

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Poor	1/3.3

Table 1 describes the demographic, educational, occupational, and obstetric characteristics of the 30 pregnant women who participated in this study. In terms of age, the majority of respondents were in the 20–35-year age group (23 respondents; 76.7%), while 6 respondents (20.0%) were aged over 35 years, and only 1 respondent (3.3%) was under 20 years old.

Regarding educational background, most respondents had completed secondary education (17 respondents; 56.7%), followed by higher education (9 respondents; 30.0%) and basic education (4 respondents; 13.3%). In terms of occupation, the majority were homemakers (25 respondents; 83.3%), while 3 respondents (10.0%) worked as teachers, 1 respondent (3.3%) was a civil servant, and 1 respondent (3.3%) worked as honorary staff.

Based on gestational age, 13 respondents (43.3%) were in the third trimester, 9 respondents (30.0%) were in the first trimester, and 8 respondents (26.7%) were in the second trimester. Regarding parity, most respondents were multigravida (20 respondents; 66.7%), while 10 respondents (33.3%) were primigravida. Furthermore, almost all respondents had no history of diabetes mellitus (29 respondents; 96.7%), while only 1 respondent (3.3%) reported a history of diabetes mellitus.

Statistical analysis yielded a p-value of 0.001 ($p < 0.05$). Consequently, the null hypothesis (H_0) was rejected and the alternative hypothesis (H_a) was accepted, demonstrating a statistically significant increase in pregnant women's knowledge regarding Gestational Diabetes Mellitus following flipbook-based health education.

DISCUSSION

The findings demonstrate that flipbook-based health education significantly improves pregnant women's knowledge of Gestational Diabetes Mellitus. Prior to the intervention, the baseline knowledge level was primarily categorized as Fair (40.0%) and Poor (23.3%). Following the 20-minute digital flipbook intervention, the proportion of respondents achieving good knowledge increased substantially to 73.4%, accompanied by a drop in Poor knowledge to just 3.3%.

The Wilcoxon test confirmed a highly significant intervention effect (p = 0.001). This marked gain in knowledge occurred because participants actively engaged with the structured visual materials in the digital flipbook during the session. Interactive flipbooks facilitate active cognition by combining concise textual explanations with colorful illustrations and structured layouts.

Regarding knowledge levels before the educational intervention, 12 respondents (40.0%) had moderate knowledge, 11 respondents (36.7%) had good knowledge, and 7 respondents (23.3%) had poor knowledge. After the intervention, the proportion of respondents with good knowledge increased to 22 respondents (73.3%), while 7 respondents (23.3%) had moderate knowledge and only 1 respondent (3.3%) had poor knowledge.

Overall, the findings indicate an improvement in respondents' knowledge levels following the educational intervention, as reflected by the increased proportion of respondents in the good knowledge category from 36.7% in the pre-test to 73.3% in the post-test.

Table 2. Wilcoxon Signed-Rank Test Analysis of GDM Knowledge Before and After Intervention

Measurement Stage	Median Score	Z-Value	p-value (Asymp. Sig)
Pre-Test	11.00	-4.582	0.001
Post-Test	14.00		

These results strongly align with another findings who observed a significant boost in maternal health knowledge (p = 0.001) following flipbook health promotion (Jajuli et al., 2023). Furthermore, health education serves as an essential channel to raise maternal awareness of maternal-fetal risks. Educational media vary from traditional pamphlets to interactive visual modules and digital applications (Anggraini & Rahmawati, 2025). Effective health education media stimulate sensory perception, enhancing comprehension and memory retention (Notoatmodjo, 2010; Swarjana, 2023).

Edgar Dale's Cone of Experience underscores that integrating visual media with structured text substantially elevates knowledge retention compared to purely passive verbal lectures (Pagarra et al., 2022). Digital flipbooks emulate physical page-turning while enabling seamless navigation on mobile devices, making them ideal for modern maternal health counseling (Simarmata et al., 2026).

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Several socio-demographic factors also contributed to the observed knowledge gains. The majority of respondents were in their prime reproductive years (20-35 years, 76.7%), an age group with optimal cognitive readiness to receive and process health information. Furthermore, 56.7% of participants completed secondary education and 30% held higher education degrees, providing a solid foundation for health literacy. Additionally, 80.1% were housewives, providing dedicated time during antenatal visits to engage thoroughly with educational materials. Multigravida status (66.7%) also enriched their receptivity, as prior pregnancy experiences created context for absorbing GDM preventive concepts.

CONCLUSION

Providing health education using interactive digital flipbooks significantly increases pregnant women's knowledge of Gestational Diabetes Mellitus at Darul Imarah Health Center, Aceh Besar Regency ($p = 0.001 < 0.05$).

SUGGESTION

For Pregnant Women: Pregnant women are encouraged to actively expand their health knowledge on GDM and pregnancy complications through digital media, healthcare literature, and regular antenatal educational sessions conducted by health staff. For Healthcare Providers & Midwives: Midwives and health facility managers at primary healthcare centers (Puskesmas) should adopt digital flipbooks as an innovative, sustainable, and portable educational medium to complement conventional counseling, strengthening promotive and preventive maternal care.

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