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Maternal Knowledge of Fetal Movement Monitoring Before and After Mobile App-Based Education Among Third-Trimester Pregnant Women

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ABSTRACT
Introduction *Maternal lack of knowledge regarding fetal movement monitoring may contribute to delayed recognition of decreased fetal movement and delayed health-seeking behavior during pregnancy.*
Methods *This study aimed to analyze changes in maternal knowledge regarding fetal movement monitoring before and after receiving education through The Asian Parent mobile application among third-trimester pregnant women. This study used a pre-experimental one-group pretest-posttest design without a control group. The study involved 60 third-trimester pregnant women who were purposively selected at Pandanwangi Community Health Center, Malang City. Maternal knowledge was measured using a 20-item questionnaire on fetal movement monitoring. Data were analyzed using the Wilcoxon Signed-Rank Test because the knowledge scores were not normally distributed.*
Results *Before the intervention, 34 (56.7%) participants were classified as having good knowledge, 9 (15.0%) participants had fair knowledge, and 17 (28.3%) participants had poor knowledge, with a median knowledge score of 16 (IQR: 6). After receiving fetal movement monitoring education through The Asian Parent mobile application, 59 (98.3%) participants were classified as having good knowledge and 1 (1.7%) participant remained in the fair category, with a median knowledge score of 18 (IQR: 1). The Wilcoxon Signed-Rank Test showed a significant difference in maternal knowledge scores before and after the intervention ($Z = -6.746$, $p < 0.001$).*
Discussion and Conclusion *Education on fetal movement monitoring through The Asian Parent mobile application was associated with changes in maternal knowledge among third-trimester pregnant women.*

Keywords: *education, fetal movement,* knowledge, *the asian parent application, maternal knowledge*

INTRODUCTION

Maternal health is important to support fetal well-being during pregnancy. Adequate antenatal care with proper fetal monitoring is essential to detect early signs of fetal compromise and allow for timely management [1]. Fetal movement monitoring is a simple, non-invasive technique that allows pregnant women to detect changes in fetal activity, especially reduced fetal movement, which may indicate possible fetal compromise [2]. However, effective fetal movement monitoring depends on adequate maternal knowledge of proper monitoring procedures, interpretation of fetal movement changes and appropriate health-seeking behavior when decreased fetal movement is experienced [3]. Reduced fetal movement is an important clinical sign associated with impaired fetal well-being and should be recognized early and managed appropriately [4].

Perinatal mortality is the death of fetus and early neonatal death within seven days of life. Intrauterine fetal death (IUFD) or fetal death before delivery is still a major issue in maternal and fetal health. The World Health Organization (WHO) estimates that there are approximately 2 million stillbirths occurring annually in the world, most of which occur in low- and middle-income countries [1]. IUFD and stillbirth are closely related, though the definitions may vary by clinical and epidemiological reporting systems. In this study IUFD is defined as fetal death before delivery. The terminology of stillbirth is used as per the international reporting standards to present global epidemiological information.

Maternal and neonatal health problems are still a major issue in perinatal care, according to the Ministry of Health of the Republic of Indonesia (2024) [5]. Impaired fetal well-being, such as delayed recognition of decreased fetal movement, can contribute to adverse pregnancy outcomes. This problem also happens in East Java Province, like Malang City, where increasing maternal awareness and fetal monitoring practices are important in pregnancy care. The incidence of IUFD at the Pandanwangi Community Health Center was reported in 2025, with 2.68% cases among 218 recorded births [6]. The situation emphasizes the necessity of early detection strategies for the identification of possible fetal well-being impairment, including the involvement of the mother in fetal movement monitoring. Limited maternal knowledge of the danger signs of pregnancy, especially reduced fetal movement, may contribute to delayed recognition and delayed healthcare-seeking behavior.

Reduced fetal ovements may be an indication of fetal compromise and require appropriate awareness and response of the pregnant woman. Fetal movements are usually felt in the second trimester of pregnancy and multiparous women may feel fetal movement earlier than primiparous women [7]. Therefore, it is important to improve the maternal knowledge and

awareness of fetal movement monitoring to support the early identification of possible fetal problems. The progress of digital technology creates great opportunities to support maternal health education. Mobile health (mHealth) interventions may improve maternal knowledge through various mechanisms including greater access to health information, repeated exposure to educational content, interactive learning opportunities, and self-monitoring [8]. Smartphone-based applications allow pregnant women to have access to reliable information related to pregnancy at any time and place [9].

The Asian Parent is an Indonesian app with features to teach and monitor related to pregnancy. We picked this app because it combines maternal education, pregnancy tracking and interactive monitoring into one digital tool. The software features include pregnancy information, pregnancy calendars, discussion forums and baby kick counter that allows pregnant women to record and monitor fetal movements regularly. By combining educational content and monitoring features into a single platform, pregnant women can repeatedly access pregnancy-related information and perform fetal movement monitoring activities as needed. These features support the appropriateness of The Asian Parent application as a vehicle for providing education on foetal movement monitoring in this study. The Asian Parent application provides opportunities for sustained exposure to educational materials during pregnancy, unlike traditional pregnancy education, which is offered on an intermittent basis in a classroom setting and has limited opportunities for sustained exposure [10].

Preliminary research at the Pandanwangi Community Health Center demonstrated that maternal understanding about fetal movement monitoring was still low. In 8 of 152 pregnant women (5.26%) participants claimed that they were unable to observe fetal movements independently. This result suggests that current educational approaches on fetal movement monitoring need to be further improved, as it may support early recognition of potential fetal well-being problems [7]. Previous studies have shown that mobile health (mHealth) apps my support maternal health knowledge and engagement. However, most of the existing programs have been limited to pregnancy information and general education. Recent research has demonstrated the potential of digital health interventions to promote maternal education and antenatal care by enhancing access to health information, enabling continued engagement, and providing flexible learning opportunities through mobile platforms [11]. However, there is limited evidence specifically examining mobile application-based education for foetal movement monitoring in third-trimester pregnant women. Therefore, this study contributes additional evidence by examining changes in maternal knowledge regarding foetal movement monitoring before and after education through The Asian Parent application. This educational

approach aims to facilitate maternal understanding and encourage pregnant women's active involvement in self-monitoring fetal movement. This study aims to analyse the changes in maternal knowledge regarding fetal movement monitoring before and after education through the application of The Asian Parent in third trimester pregnant women in Pandanwangi Community Health Center, Malang.

METHODS

Research Design

This study used a pre-experimental one-group pretest–posttest design. The objective of this study was to determine the difference in the knowledge of pregnant women about daily fetal movement monitoring before and after education through The Asian Parent application. In the same participants, maternal knowledge was evaluated before the educational intervention (pre-test) and after the intervention (post-test). Because the study did not have a control group, changes in knowledge cannot be attributed solely to the educational intervention and may have been due to testing effects, exposure to other sources of information, increased attention of the participants, or other events during the period of study.

Ethical Considerations

Ethical approval for this study was obtained from Poltekkes Kemenkes Malang's Health Research Ethics Committee (KEPK). Ethical approval was given with the number DP.04.03/F.XIII.31/0477/2026. All respondents were informed about the objectives, procedures, benefits, and potential risks of the research before participating in the study. The pregnant women who were willing to participate voluntarily provided written informed consent. Information of participants was kept confidential and anonymous during the study.

Research Location and Time

This research was carried out at Pandanwangi Public Health Center, Malang City. The total study period was from February to April 2026, consisting of preparation, implementation, data analysis, and report writing. Data collection was done for two weeks in February 2026, including participant recruitment, pre-test assessment, intervention by The Asian Parent application for 7 days, and post-test assessment.

Population and sample

The population in this study were 152 pregnant women in the third trimester who registered or came to the Pandanwangi Public Health Center from February to April 2026. The study had specific requirements for the participants. Therefore, purposive sampling was used to select 60 participants based on the eligibility criteria of the study. All 60 subjects completed

pre- and post-test assessments and were included in the paired analysis. Eligibility criteria were: pregnant women in the third trimester, willing to participate, had had, and could use a smartphone, and had not used The Asian Parent application before. Women who did not complete all phases of the study and women with pregnancy-related complications of gestational hypertension, anaemia in the third trimester and intrauterine foetal death were excluded.

Data Collection

The data were collected using a 20-item questionnaire on knowledge of fetal movement monitoring which was adapted from Samutri (2021). The data was collected by the researcher with the assistance of midwives in Pandanwangi Community Health Center. The researcher explained the research procedures, distributed the questionnaire before and after intervention and collected the completed questionnaires from the respondents.

After the pre-test questionnaire, respondents were immediately directed to foetal movement monitoring education through The Asian Parent application. The researcher gave instructions on how to access the application and outlined the activities that participants should complete during the 7-day intervention period. During the intervention period, the participants were asked to monitor fetal movements on a daily basis using the application The Asian Parent. The same instrument was used in the post-test questionnaire to measure the change in maternal knowledge after the intervention period of the study participants.

The questionnaire was composed of four domains: perception of fetal movement (items 1–9), methods of counting fetal movements (items 10–12), decreased fetal movement (items 13–15) and decision making when decreased fetal movement occurs (items 16–20). Each correct answer was scored as 1 and each wrong answer scored as 0. The total knowledge score was calculated by dividing the number of correct answers by the maximum score and multiplying by 100. The knowledge scores were categorized as good (≥76%; scores 16–20), fair (56%–75%; scores 11–15), and poor (≤55%; scores 0–10)[12]. In the previous validation study by Samutri (2021), the item validity was analyzed using the Pearson product-moment correlation, and all 20 items were stated to be valid [13]. The internal consistency was also checked in the previous study and the Cronbach's alpha value was 0.701. Based on the previous validity and reliability testing, the questionnaire was considered appropriate for use in the present study.

Processing and analysis of data

The collected data were edited, coded, entered and analysed using statistical software. Descriptive statistics were used to present characteristics of participants and knowledge scores

before and after the intervention. Normality of the knowledge scores was checked by using the Shapiro–Wilk test. The pre-test and post-test knowledge scores were not normally distributed (p<0.05); therefore, the Wilcoxon Signed-Rank Test was used for paired data analysis. Results are expressed as median and interquartile range (IQR). Statistical significance was assessed at $\alpha = 0.05$.

RESULT

Characteristics of the participants are presented in Table 1. Most participants were aged 20-35 years, had completed senior high school and were primiparous.

Table 1. Frequency Distribution of Respondents Based on General Characteristics at the Pandanwangi Community Health Center, Malang City, 2026

No.	Characteristic	Frequency(f)	Percentage(%)
1.	**Age**		
	<20 years	2,0	3,3
	20–35 years	46,0	76,7
	>35 years	12,0	20,0
	Total	**60,0**	**100,0**
2.	**Education**		
	SD	4,0	6,7
	SMP	15,0	25,0
	SMA	35,0	58,3
	Perguruan Tinggi	6,0	10,0
	Total	**60,0**	**100,0**
3.	**Occupation**		
	Housewife (unpaid domestic work)	12,0	20,0
	Employed outside home	16,0	26,7
	Not employed	32,0	53,3
	Total	**60,0**	**100,0**
4.	**Gestational age (Weeks)**		
	28–32 Weeks	38,0	63,3
	33–36 Weeks	15,0	25,0
	37–40 Weeks	7,0	11,7
	Total	**60,0**	**100,0**
5.	**Parity**		
	Primipara	33,0	55,0
	Multipara	27,0	45,0
	Total	**60,0**	**100,0**
6.	**Medical History**		
	History of illness	5,0	8,3
	No History of illnes	55,0	91,7
	Total	**60,0**	**100,0**

** Housewife refers to participants primarily engaged in unpaid domestic activities.*

Table 2. Comparison of Knowledge Levels Before and After Fetal Movement Monitoring Education Through The Asian Parent Application at Pandanwangi Community Health Center, Malang City, 2026

y	Knowledge Category	Pre-test n (%)	Post-test n (%)
1.	Good (≥76%)	34 (56,7)	59 (98,3)
2.	Fair (56%-75%)	9 (15,0)	1 (1,7)
3.	Poor (≤ 55%)	17 (28,3%)	0 (0,0)
	Total	**60,0**	**100,0**

Before education through The Asian Parent application, 34 participants (56.7%) had good knowledge, 9 participants (15.0%) had fair knowledge, and 17 participants (28.3%) had poor knowledge regarding foetal movement monitoring. Following the educational intervention, 59 (98.3%) participants were found to be in the good level of knowledge category. One participant (1.7%) was still in the fair category and none of the participants were classified as poor knowledge.

Table 3. Domain-Specific Knowledge Scores Before and After Fetal Movement Monitoring Education Through The Asian Parent Application at Pandanwangi Community Health Center, Malang City, 2026

No.	Knowledge Domain	Pre-test mean (%)	Post-test mean (%)
1.	Perception of fetal movement (P1–P9)	71.30	92,59
2.	Methods of counting fetal movements (P10–P12)	75,00	94,44
3.	Decreased fetal movement (P13–P15)	68,33	90,00
4.	Decision making when decreased fetal movement occurs (P16–P20)	74,00	90,67

The domain-specific analysis indicated an increase in maternal knowledge in all domains after the fetal movement monitoring education used The Asian Parent application. The highest post-test score was for methods of counting fetal movements (94.4%) followed by perception of fetal movement (92.6%), decision making when decreased fetal movement occurs (90.7%) and decreased fetal movement recognition (90.0%).

Table 4. Statistical Test Results of Differences in Knowledge Scores Before and After Fetal Movement Monitoring Education Through The Asian Parent Application at Pandanwangi Community Health Center, Malang city, 2026

Variable	Negative Ranks (n)	Positive Ranks (n)	Ties (n)	Z-Value	*p*-Value
Pre-Test Knowledge – Post-Test Knowledge	0	60	0	-6.746	$p < 0.001$

**Wilcoxon signed-rank test. Positive ranks indicate that post-test knowledge scores were higher than pre-test knowledge scores.*

The median knowledge score increased from 16 (IQR: 6) before the intervention to 18 (IQR: 1) after the intervention. All 60 participants showed an increase in knowledge scores after receiving education through The Asian Parent application. No negative ranks or ties were identified. The Wilcoxon signed-rank test demonstrated a statistically significant difference between pre-test and post-test knowledge scores (Z = -6.746, $p < 0.001$). The findings indicated an increase in maternal knowledge scores following fetal movement monitoring education through The Asian Parent application among pregnant women at Pandanwangi Community Health Center.

DISCUSSION

Knowledge Level of Pregnant Women on Daily Foetal Movement Monitoring Before Education Through The Asian Parent Application (Pre-Test)

Before receiving education through The Asian Parent app, most pregnant women had limited knowledge regarding fetal movement monitoring. Results indicated that many participants struggled with understanding the importance of monitoring fetal movements, how to properly monitor fetal movements and what to do when fetal movements decrease. Adequate maternal knowledge is an important aspect in supporting maternal awareness of fetal movement monitoring during pregnancy [14].

The baseline characteristics showed that most of the respondents had senior high school education. The educational characteristics were included in this study only to describe the background of the pregnant women who participated in the study. Further exploration of differences in knowledge based on educational level or other respondent characteristics was not conducted as the main purpose of this study was to assess changes in maternal knowledge pre and post education through The Asian Parent application.

The low level of knowledge before the intervention may reflect limited exposure to information regarding fetal movement monitoring among participants [15]. While prenatal care offers opportunities for maternal education, pregnant women may receive different information based on the educational approach and resources available. By enabling pregnant women to access pregnancy-related information via mobile platforms, digital health interventions, such as mobile health applications, have the potential to offer accessible and frequent educational exposure. Therefore, by offering information that can be accessed during the intervention period, the use of The Asian Parent application in this study represents an approach to support maternal education on foetal movement monitoring [16].

Furthermore, these findings are consistent with Samutri (2021) who also found that

most pregnant women had inadequate baseline knowledge on foetal movement tracking prior to educational intervention [17]. The study explained that many expectant mothers did not know the correct hours to count kicks, what is normal foetal movement, and what emergency steps to take if foetal movement slows.

The observed improvement in maternal knowledge after the intervention may be associated with several characteristics of digital-based education through The Asian Parent application. The application may provide repeated exposure to fetal movement monitoring information and allow pregnant women to access and review educational materials according to their needs [18]. Digital media may facilitate learning by providing accessible and structured information, which can support better understanding and retention of knowledge regarding fetal movement monitoring[9]. Therefore, digital-based education through The Asian Parent application may serve as an accessible approach to support maternal knowledge development.

Knowledge Levels Of Pregnant Women About Daily Foetal Movement Monitoring After Education Through The Asian Parent Application (Post Test)

Pregnant women had better knowledge on fetal movement monitoring after the intervention. The increase in knowledge scores after the intervention indicates that maternal knowledge regarding fetal movement monitoring was higher after receiving education through The Asian Parent application. The high difference in knowledge score between pre-test and post-test shows an increase in maternal knowledge after the educational intervention.

This significant progress is in line with the theory of Notoatmodjo (2018) which states that a person's knowledge will increase after receiving accurate information through a structured learning process [19]. The increase in knowledge observed in this study may be related to the structured educational information provided through The Asian Parent application. The application offers structured and easily accessible information related to fetal movement monitoring including the importance of fetal movement monitoring, the right monitoring methods and what actions should be taken in case of fetal movement change [20]. The use of digital educational media can facilitate pregnant women's access to and understanding of health information regarding daily fetal movement monitoring [21]. Moreover, previous studies have shown that educational interventions through health information media can improve pregnant women's knowledge by providing structured and accessible pregnancy-related information [8].

The results of this study are supported by Farhati et al. (2018), who stated that mobile health applications can improve pregnant women's knowledge by providing accessible and repeated health information[22]. Previous studies also reported that structured health education

interventions can increase maternal knowledge regarding pregnancy care [23]. The accessibility of digital media allows pregnant women to obtain and review health information more easily, which may support knowledge retention. The Asian Parent app can be used as a supportive educational media for maternal education on fetal movement monitoring during pregnancy.

Improvement of Pregnant Women's Knowledge Following Education Through The Asian Parent Application

The findings of this study suggest that the knowledge of pregnant women on fetal movement monitoring increased after the educational intervention through The Asian Parent application. This improvement was seen in the significant difference between pretest and posttest knowledge scores. The median knowledge score increased from 16 (IQR : 6) before the intervention to 18 (IQR : 1) after 7 days of education. In addition, nearly all the respondents (98.3%) fell into the good knowledge category after the intervention. The findings suggest that the educational intervention may have contributed to increased maternal knowledge regarding fetal movement monitoring. However, due to the one group pretest-posttest design, the findings should be interpreted as an increase in knowledge following the intervention, rather than as conclusive evidence of causality.

The use of The Asian Parent application as a medium of education is a tool to provide information on fetal movement monitoring in this study. The systematic presentation of educational materials may facilitate the learning process by providing pregnant women with access to and understanding of information on fetal movement monitoring[24]. This finding is in line with the theory of Notoatmodjo (2018) that knowledge can be improved after getting enough health information through an organized learning process [17].

The results of this study are supported by Farhati et al. (2018), who stated that the use of mobile health applications can increase pregnant women's knowledge by providing accessible and continuous health information[22]. The result is also in line with the research of Nurdianti et al. (2021) that health education is effective to increase knowledge of pregnant women [11]. The findings indicate that The Asian Parent application may serve as a supportive educational medium for maternal education regarding fetal movement monitoring. The availability of digital educational materials may help pregnant women access and comprehend information about fetal movement monitoring during pregnancy[25].

There are some limitations to this study. First, the one-group pretest-posttest design does not have a control group, which restricts the ability to attribute the observed improvement in knowledge solely to the educational intervention. Second, the use of purposive sampling and

the inclusion of participants from only one community health center may limit the generalizability of the findings to other populations and settings. Third, the follow-up period was relatively short, which may not reflect the long-term retention of knowledge after the intervention. Fourth, testing effects cannot be ruled out, as the same questionnaire was used pre- and post-intervention. Therefore, some improvement in the post-test scores may have been related to exposure to the items of the questionnaire. Finally, this study measured changes in maternal knowledge concerning fetal movement monitoring, but not actual monitoring behavior or fetal outcomes.

CONCLUSIONS

The results of this study showed that maternal knowledge about daily monitoring of fetal movements increased after given education through The Asian Parent application in Pandanwangi Health Center. Before the intervention, most of the respondents had less knowledge about fetal movement monitoring, but after 7 days of education, most of the respondents obtained a good knowledge category. Wilcoxon Signed-Rank Test showed a significant difference between pre-test and post-test knowledge scores that indicates an increase in maternal knowledge after educational intervention. The Asian Parent application can be a medium of supportive education to provide information related to fetal movement monitoring and increase maternal knowledge. However, the study used one-group pretest-posttest design without control group, thus these results should be taken with caution. Further studies with controlled designs and longer follow-up periods are needed to confirm these findings and to evaluate the retention of improvement in maternal knowledge.

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