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# The Use of Fetal Movement Cards and Happy Tummy Applications against Anxiety among Pregnant Mothers in Trimester III at the Cisoka Health Center, Tangerang, Indonesia

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## ABSTRACT

**Introduction:** Foetal well-being refers to the condition of the foetus being in a good and healthy state, as measured by heart rate and foetal movement. Regularly counting foetal movements, a subjective measure, can reduce anxiety among expectant mothers. The purpose of this study is to analyse the effectiveness of using the Foetal Movement Card (FMC) and the Happy Tummy Application (HTA) in reducing anxiety among mothers in their third trimester. **Methods:** This study uses a quasi-experimental design without a control group. The sample consisted of 60 respondents, divided into the FMC and HTA groups, using accidental sampling in July 2023 at the Cisoka Health Centre. Data collection tools included HAR's anxiety questionnaires, FMC, and the HTA. A paired t-test was used to measure anxiety levels before and after using the tools, and the Mann-Whitney Test was used to compare the two groups. **Results:** The study showed that 24 participants (80%) were adherent, while 6 participants (20%) did not comply with using the FMC. In the HTA group, 26 participants (86.7%) complied, while 4 participants (13.3%) did not. The mean anxiety level before using the FMC was 9.77, and after using it, the anxiety level decreased to 6.37. For the HTA, the mean anxiety level was 10.50 before use and 7.40 after use. The paired *t*-test results were 0.000 (<0.05), indicating a significant reduction in anxiety levels before and after using the FMC and HTA among third-trimester pregnant women at the Cisoka Health Centre. However, the Mann-Whitney test results showed an insignificant value of 0.492 (>0.05), suggesting no significant difference in compliance between the two groups. **Conclusion:** The use of the FMC and HTA effectively reduced anxiety in third-trimester pregnant women and can serve as an alternative method for monitoring foetal well-being. Consistency and attention in using these tools are essential, and the support of healthcare workers plays a crucial role in promoting health and preventing complications during pregnancy.

*Keywords: Anxiety; Happy Tummy Application; Foetal Movement Card; Foetal Well-Being*

## INTRODUCTION

Pregnancy is a momentous but stressful life transition, requiring effort from many stakeholders, including expectant parents, family members, and friends, to navigate. Antepartum foetal monitoring is a crucial component of positive postpartum outcomes, particularly for at-risk pregnancies (Oepkes & Sueters, 2017). The well-being of the foetus and mother is routinely monitored in health facilities with the aim of early detection of abnormalities in pregnancy (O'neill & Thorp, 2012). Monitoring and observation, carried out to assess foetal welfare, are essential tasks for every mother. The purpose of monitoring is to prevent foetal death. Pregnant women who do not undergo ANC (Antenatal Care) during pregnancy cannot assess the welfare of their foetus (Tunçalp, 2017). Pregnant women who come to health facilities in a deteriorating condition can experience foetal and maternal death.

One of the ANC examinations, namely 14T, is conducted following the ANC service standards set by the Midwifery Service Standards. 14T typically outlines 14 key tasks or components that must be performed during ANC visits to meet clinical and service quality standards (WHO, 2016). The Ministry of Health, Republic of Indonesia, has had a policy since 2016 that ANC examinations consist of weight and height measurement, blood pressure monitoring, uterine fundal height measurement, tetanus toxoid vaccination, iron (Fe) tablets, interviews, urine tests, anti-malarial therapy, nutritional status assessment, hemoglobin (HB) tests, VDRL tests, breast care, pregnancy exercise, and iodine capsule supplementation (Kemenkes, 2019). Counting fetal movements is not included in the 14T examination, so health workers should independently educate pregnant women on how to count foetal movements (Laddad *et al*., 2024). Monitoring and observation during pregnancy are documented in the MCH (Mother and Child Health) book, which every pregnant woman receives when she checks into a health facility. ANC examinations are conducted according to the standards set by the government: once in the first trimester, once in the second trimester, and twice in the third trimester. Another important factor in the first trimester or early pregnancy is the mother's body mass index (BMI), which can impact fetomaternal outcomes and interact dynamically with gestational weight gain (Patil *et al.*, 2024; Kumar *et al.*, 2024).

The nurse's role is to provide education to patients to increase maternal compliance with ANC examinations. High adherence of pregnant women to ANC can reduce complications during pregnancy (Yeoh, Hornetz & Dahlui, 2016). Monitoring and observing during pregnancy are a form of compliance for pregnant women, which can be assessed through visits to health facilities. One of the roles of nurses in reducing complications during pregnancy is to consider the mother's age range when planning pregnancy. Research by Laddad *et al.* (2024) mentions that maternal ages between 20 and 29 years, especially in the third trimester, contribute to the average kidney length. Mean kidney length is correlated with head circumference, femur length, biparietal diameter, gestational age by the last menstrual period, and abdominal circumference. Routine exams improve gestational age estimates, allowing for better prenatal care and intervention planning.

The importance of foetal movement (FM) patterns as a biomarker for foetal health is well-established (Salavati *et al*., 2019). One way to assess foetal well-being is foetal motion counting, which is a method by which a woman measures perceived movement to assess the condition of the baby. The purpose of counting foetal movements is to reduce perinatal mortality and allow for the early detection of complications in infants. Pregnant women feel foetal movement, which is assessed by increasing strength, frequency, and variety from 28 to 32 weeks of gestation (Smith *et al*., 2021). The pattern of foetal movement is usually consistent and increases daily, as does the interaction between mother and foetus during activity and rest. Maternal perception of decreased foetal movement should be trusted because it can be a significant predictor of pregnancies at risk, including stillbirth. Increasingly, pregnant women are using mobile applications ("apps") to access information during the antenatal period (Daly *et al*., 2019). When compared to standard foetal monitoring, remote foetal monitoring appears to lower the incidence of newborn asphyxia, particularly in high-risk pregnant populations such as those with diabetes, hypertension, and other conditions, while reducing healthcare expenses (Li *et al*., 2023).

Adequate perfusion and oxygen transport, facilitated by a healthy placenta, are the primary factors that determine a foetus's ability to maintain its health. Many physiological alterations, such as decreased foetal growth, occur when this equilibrium is disturbed in order to promote survival. Technologies to track these changes have been developed to decrease the risk of stillbirth while extending intrauterine maturity. Many of these strategies require complex interpretation, such as computerized analysis of foetal heart rate variations and Doppler ultrasonography for foetal blood flow (Lai *et al*., 2016). However, the inability of current FM monitoring methods, such as ultrasonography, to be used outside clinical environments has made it challenging to create tools for improving foetal health. Several efforts have been made to monitor FM using sensors and wearable devices to address this gap. FM was detected by 82% of mothers, with an overall accuracy of 90% in recognizing the presence of FM and non-FM. The strongest consistency of foetal movement occurs at 32 weeks of gestation and beyond, which is important for preventing stillbirth (Ghosh *et al*., 2024).

A study by Ghosh *et al.* (2024) that developed a wearable FM monitor for use by pregnant mothers at home mentions that a novel wearable FM monitor with an embedded heterogeneous sensor suite - combining

accelerometers, acoustic sensors, and piezoelectric diaphragms - was designed to capture a broad range of FM and interfering artifact signal features, enabling more efficient isolation of both. The results showed that the neural network performed best, with an overall accuracy of 0.90 and an F1 correlation ($R^2$ score of 0.79). The algorithm also showed a strong correlation (0.91) with maternal sensation detections during individual recording sessions. The tightness of the belt with the abdomen was found to be important for the optimal performance of the device.

FM can be calculated using a measuring device, such as a foetal movement card, or through a mobile phone application. The FM card is an instrument to help monitor or calculate foetal movement starting at 28 weeks of pregnancy, performed daily, with a minimum of 10 movements in 12 hours. The next measurement tool is the Happy Tummy App, which can be used on a mobile phone and allows participants to monitor movements at home. Results from 80% (35 mothers) who routinely monitored foetal movements for 5 days and 20% (9 mothers) who did not monitor routinely for 5 days (Novita, Acihayati & Pratiwi, 2023) show that the average time it takes a mother to feel 10 foetal movements varies greatly - two mothers felt 10 movements within 1 to 3 hours of monitoring, while six mothers felt movements within 4 to 6 hours.

To improve maternal and foetal health, monitoring foetal health in third-trimester pregnant women is essential during pregnancy. Foetal well-being indicators include maternal complaint analysis, daily foetal movement monitoring, uterine fundal height measurement, and foetal heart rate monitoring. Monitoring foetal well-being is important for pregnant women, and assistance during the Foetal Welfare Assessment for third-trimester pregnant women in Karang Bangkirai Village revealed that 87.5% of women did not comprehend the Foetal Welfare Assessment before receiving education. After education, the mother's level of knowledge increased to 100% (Novita, Acihayati & Pratiwi, 2023).

Currently, technology is advancing, making it easier for healthcare professionals to distribute public service announcements through pamphlets, audiovisuals, posters, calendars, and tote bags. Pregnant women who can use media easily and can understand the impact of not attending ANC visits is able to use modern technology (Ghimire *et al*., 2023). Monitoring and observing foetal movements during pregnancy can reduce maternal anxiety. Anxiety during pregnancy is an emotional reaction experienced by pregnant women due to concerns about their well-being and that of their foetus during pregnancy, labor, postpartum, and motherhood.

Therefore, this research was conducted to study the use of foetal movement cards and happy tummy applications against anxiety among pregnant mothers in Trimester III.

**METHODOLOGY**

This research follows a quantitative quasi-experimental design with a one-group, post-treatment-only measurement approach (non-equivalent without group control), meaning observations were made after treatment without a control group and without pre-treatment data (Polit & Beck, 2010). The Foetal Movement Card (FMC) (X1) and the Happy Tummy Application (HTA) (X2) were used to evaluate foetal movement monitoring compliance, knowledge levels, and anxiety levels (Y). Statistical analysis was performed using a paired t-test and the Mann-Whitney test.

The sampling technique used in this study was accidental sampling. The sample size was calculated using the Slovin formula, resulting in 60 respondents. These were divided into two intervention groups: 30 respondents used the FMC, and 30 respondents used the HTA. Inclusion criteria were third-trimester pregnant women who did not have health problems such as preeclampsia or heart conditions, could read and write, and owned a cellphone to download the Happy Tummy app. The research was conducted from September 2022 to March 2023 at the Cisoka Community Health Center, Tangerang Regency.

**Ethical Consideration**

The ethical approval for this study was obtained from the Ethics Committee of Komisi Etik Penelitian Dan Pengembangan Kesehatan, Sekolah Tinggi Ilmu Kesehatan, Sint Carolus, Indonesia with reference number 017/KEPPKSTIKSC/II/2023, on 20th February, 2023.
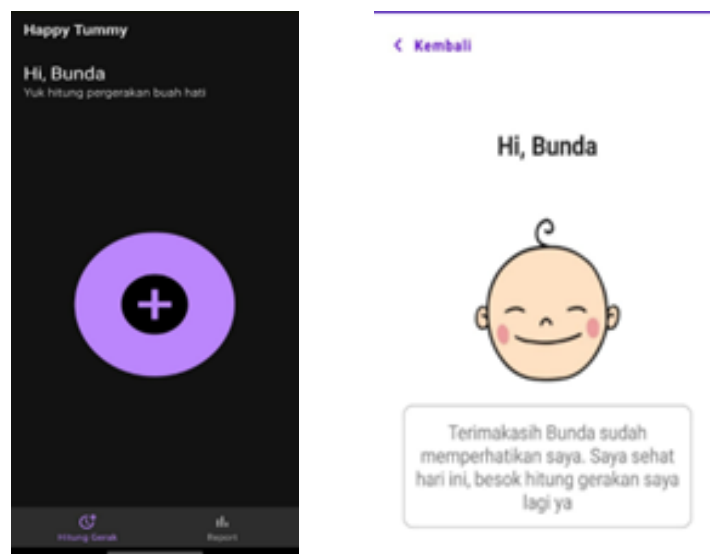
*Figure 1: Application Happy Tummy*

## RESULTS

*Table 1: Data on Respondent Characteristics at the Cisoka Health Center in 2023*

| Variable | Fetal Movement Card | | Application Happy Tammy | |
|---|---|---|---|---|
| | *n* | *f* | *n* | *F* |
| **Age** | | | | |
| • ≤25 years | 16 | 26.7 | 22 | 36.3 |
| • 25-35 years | 14 | 23.3 | 8 | 13.3 |
| **Parietas** | | | | |
| • Primipara | 16 | 26.7 | 23 | 28.3 |
| • Multivara | 10 | 23.4 | 7 | 12.6 |
| **Last Educations** | | | | |
| • Junior High School | 4 | 6.7 | 1 | 1.7 |
| • Senior High School | 18 | 30.0 | 20 | 33.3 |
| • University | 8 | 13.3 | 9 | 15.0 |
| **Work** | | | | |
| • Work | 15 | 25.0 | 13 | 21.7 |
| • Not Work | 15 | 25.0 | 17 | 28.3 |

The characteristics of respondents at the Cisoka Health Centre show that the majority preferred using the Happy Tummy Application (HTA) over the foetal movement card. The demographic breakdown indicates that 36.3% of the mothers were under 25 years old, 28.3% were primiparas (first-time mothers), 33.3% had a senior high school education, and 28.3% were unemployed. The HTA is designed for accessibility, being low-cost, easy to download from the App Store, and user-friendly, making it particularly appealing to young mothers.

*Table 2: The Compliance Using Fetal Movement Cards and Happy Tummy Apps*

| Variable Obedience | Fetal Movement Card | | Application Happy Tammy | |
|---|---|---|---|---|
| | *n* | *F* | *N* | *f* |
| Obedience | 24 | 80.0 | 24 | 80.0 |
| Not Obedience | 6 | 20.0 | 6 | 20.0 |

Table 2 shows that 80% of the mothers demonstrated compliance with using both the Foetal Movement Card (FMC) and the Happy Tummy Application (HTA). The devices were user-friendly, contributing to the mothers' ability to sustain their compliance with both tools. This indicates that both the FMC and HTA are effective in encouraging adherence among users.

*Table 3: Anxiety in Respondents Using Foetal Movement Cards and Happy Tummy Apps*

| Anxiety | Card | | | HTA |
|---|---|---|---|---|
| | Pre | Post | Pre | Post |
| Normally | 23 | 30 | 21 | 30 |
| Light | 4 | 0 | 3 | 0 |
| Currently | 3 | 0 | 6 | 0 |
| Heavy | 0 | 0 | 0 | 0 |
| Very Heavy | 0 | 0 | 0 | 0 |

Table 3 shows that the majority of mothers using both the Foetal Movement Card (FMC) and the Happy Tummy Application (HTA) had normal anxiety levels. The use of these tools allows mothers to directly monitor information about their foetus's well-being, which helps to reduce their anxiety. The ability to track foetal movements effectively through FMC and HTA appears to provide reassurance and emotional support to pregnant mothers.

*Table 4: Analysis of Difference Tests of Anxiety Levels Before and Sfter Using Foetal Movement Cards and Happy Tummy Apps*

| Group | N | Mean | Std. Deviation | P Value |
|---|---|---|---|---|
| **FMC** | | | | |
| Pre | 30 | 9.77 | 3.549 | 0.000 |
| Post | 30 | 6.37 | 1.903 | |
| **HTA** | | | | |
| Pre | 10.5 | 30 | 2.316 | 0.000 |
| Post | 7.40 | 30 | 1.850 | |

The difference in anxiety levels before and after using the Foetal Movement Card (FMC) and the Happy Tummy Application (HTA) showed statistically significant results ($p = 0.000$) for both groups, indicating a significant reduction in anxiety after using these tools. The ability to detect decreased foetal movement early allows mothers to monitor the foetus's condition promptly. Both devices provide fast and accessible information about foetal well-being. According to Lai *et al*. (2016), a decrease in foetal movement may indicate an acute hypoxic event, while an increase in movement could signal either the end of the hypoxia or the onset of a stable, chronic hypoxia.

*Table 5: Difference Levels of Anxiety between Foetal Movement Cards and Happy Tummy Apps*

| Group | | N | Mean | Std. Deviation | P Value |
|---|---|---|---|---|---|
| **Pre** | FMC | 30 | 9.77 | 3.549 | 0.348 |
| | HTA | 30 | 10.50 | 2.316 | |
| **Post** | FMC | 30 | 6.37 | 1.903 | 0.000 |
| | HTA | 30 | 7.40 | 1.850 | |

Table 5 shows that both the FMC and HTA groups had significant results after the intervention (*p*-value = 0.000) but not before (*p*-value = 0.348). These findings align with Lu *et al*. (2024), who highlighted the growing use of self-tracking gadgets and apps in daily life to reduce anxiety, improve relationships during pregnancy, and aid the transition to motherhood. Pregnant women are increasingly aware of and supportive of these tools. By using the FMC and HTA, mothers experience less anxiety, knowing their baby is in a healthy state and that they can seek medical help if needed. Self-tracking of the foetus using these tools also helps strengthen the bond between the mother and the foetus.

*Table 6: Difference Test Analysis Compliance Level Between Foetal Movement Card and Happy Tummy Apps*

| Variable | Groups | | | | | | P value |
|---|---|---|---|---|---|---|---|
| | Fetal Movement Card | | Applications Happy Tammy | | Total | | |
| | n | f | N | f | n | f | |
| Not Obedience | 6 | 20.0 | 4 | 13.3 | 10 | 16.7 | 0.492 |
| Obedience | 24 | 80.0 | 26 | 86.7 | 50 | 83.3 | |

Table 6 shows that the difference in compliance levels between using the Foetal Movement Card (FMC) and the Happy Tummy Application (HTA) for evaluating foetal movement is not statistically significant ($p$-value = 0.492). However, compliance remains high, with 80% of mothers in the FMC group and 86.7% in the HTA group adhering to the evaluation of foetal movement over seven days. This indicates that both tools are effective in encouraging mothers to monitor foetal movement consistently.

## DISCUSSION

The results indicate a significant effect ($p$-value = 0.000) on anxiety levels before and after using the Foetal Movement Card (FMC) and the Happy Tummy Application (HTA). This finding aligns with the research by Lu et al. (2024), which shows that pregnant women increasingly understand and support the use of technology, including self-tracking devices and applications, to reduce anxiety and foster relationships during pregnancy and the transition to parenthood. Additionally, technologies such as Foetal MRI can enhance the bonding between parents and the foetus (Latif, 2018; Skelton *et al.*, 2024).

Monitoring foetal well-being by counting foetal movements (FM) independently can positively impact mothers, as tools like FMC and HTA reduce anxiety by providing reassurance about the foetus's well-being. This understanding enables parents, especially mothers, to connect with their babies through quality interactions with healthcare professionals. Positive feedback from these tools can help mothers feel excited about becoming parents.

In addition to the FMC and HTA, foetal movement can also be assessed through various methods, including maternal perception, palpation, auscultation, ultrasound, Doppler, Foetal MRI, and cardiotocography (CTG). The perception of FM may vary depending on the mother's activity level; for example, foetal movements are more easily felt when the mother is lying down and at rest. Bonding scores significantly increased after imaging for both mothers and fathers ($p < 0.05$). Parents who underwent Foetal MRI reported significantly higher bonding levels than those who used ultrasound ($p = 0.02$). The first regression model indicated that employment status ($\beta = -0.38$, $p < 0.05$) was a significant predictor for bonding post-imaging. The second model revealed that imaging modality ($\beta = -0.53$), imaging experience ($\beta = 0.42$), and parental excitement after the scan ($\beta = 0.29$) were significantly associated with increased bonding ($p < 0.05$). Qualitative results highlighted that Foetal MRI fosters a confident expectation of foetal development, supporting connection and parental excitement (Skelton *et al.*, 2024).

Mothers under 25 years of age with their first experiencing pregnancies (primiparas) are more likely to seek health services, often due to their lack of previous experience. This study found that primiparous mothers aged below 25 years predominantly used the HTA. This age group, being part of the millennial generation, tends to be tech-savvy and adaptable, which aids their understanding of how to use tools or technology for calculating foetal movement, ultimately helping to decrease their anxiety. Millennial mothers often rely on mobile apps for health information, trusting these resources for accuracy and usefulness. Healthcare providers play a crucial role in educating mothers on how to count foetal movements, whether through self-assessment or other means. Self-assessment, in this context, allows mothers to monitor foetal well-being and detect potential dangers early (Pouriayevali *et al.*, 2023).

The findings of this study suggest that there is no significant relationship between mothers' compliance levels in filling out the FMC and using the HTA. This may be attributed to the productive age of mothers, making it easier to educate and engage with these tools. Mothers with a high school education level and who are primiparous may be more receptive to learning about the importance of counting foetal movements independently, recognizing its benefits for monitoring their foetus's well-being. Counting FM independently can enhance the bond between mother and foetus, as sensitivity and awareness of foetal movements are essential to avoid potential complications during pregnancy. Ensuring the welfare of the foetus through FM monitoring promotes consistent observation as the foetus grows (Ghosh *et al.*, 2024).

## Limitations

Many mothers aged over 30 years were not willing to participate as respondents because using the Foetal Movement Card (FMC) and the Happy Tummy Application (HTA) requires a commitment of 7 days. Additionally, the HTA is not yet available on the Play Store; therefore, the application had to be sent via WhatsApp and shared among potential users.

## CONCLUSION

Foetal Movement Cards (FMC) and Happy Tummy Apps (HTA) can serve as effective alternatives for monitoring foetal well-being, especially for pregnant women who often worry about their baby's condition before delivery. Pregnant women who receive information about foetal movement from nurses demonstrate an improved ability to describe healthy foetal movement patterns, reduced time from maternal perception of decreased foetal movement to presenting at the hospital, and lower stillbirth rates. This improvement is supported by levels of knowledge and education. Both FMC and HTA are not difficult to use; they simply require attention and consistency. Millennial mothers find the HTA particularly easy to use due to its accessibility on cell phones, which they use daily.

## Recommendation

It is evident that healthy foetal movements correlate with the physiological state of the foetus. The clinical utility of monitoring foetal movements is supported by its association with both reassuring and pathological aspects of current monitoring systems. However, this utility relies on the development of an objective and accurate assessment tool or device that mothers can use independently.

## Conflict of Interest

The authors declare that they have no competing interests.

## ACKNOWLEDGEMENT

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