

Effectiveness of Nursing Intervention Using Kick Counter Mobile Application on Improving Pregnancy Outcomes among Primigravida during COVID-19 Pandemic

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Abstract

Background: Counting of fetal movement during pregnancy is believed to be a method by which a woman estimates the fetal well-being. **Aim:** to assess the effectiveness of nursing intervention using kick counter mobile application on improving pregnancy outcomes among primigravida during COVID-19 pandemic. **Design:** A quasi-experimental research design was utilized in this study (study/control groups). **Settings:** the study was conducted at Maternal and Child Health Centers. **Sample:** A purposive sample of 120 pregnant women was involved in the study that was recruited from the previously selected settings. **Instruments:** Three instruments were used to collect the data of the study as a structured interviewing questionnaire, an observational checklist of pregnant women practice of fetal movement assessment using Kick counter mobile App, and pregnant women assessment regarding pregnancy outcomes. **Results:** The findings of this study showed statistically significant difference between the study and control groups regarding knowledge scores and also the practice of fetal movements' assessment using kick counter mobile application in the study group before and after the intervention. Also, the study findings revealed improvement the pregnancy outcomes in the study group compared to the control group. **Conclusion:** Nursing intervention using kick counter mobile application during COVID-19 pandemic has positive effect on enhancing the pregnant women' knowledge and practice in the study group regarding fetal assessment using kick counter mobile applications. It also has positive effect on improving the pregnancy outcomes among the pregnant women in the study group compared to the control group during COVID-19 pandemic. **Recommendations:** Encourage the pregnant women to be aware with the recognition of theirs' fetus normal pattern of fetal movements using kick counter mobile application and alarm them when this pattern change.

Keywords: Kick counter mobile application; pregnancy outcomes; primigravida during COVID-19 pandemic.

Introduction

Pregnancy applications, which become accessible on google play & apple, have indeed been installed hundreds of millions of instances and are a valuable source of information for several pregnant women (Daly, 2019). There are now over 100,000 health and medical apps available for use by lay people and healthcare workers, and apps directed at pregnancy constitute a major genre (Thomas & Lupton, 2016). These applications can include health information, motivational messages, monitoring, and behavior change tools, with content tailored by demographics such as maternal age, gestational age, health issues or other known risk factors, cultural affiliation, or language. Generally, mobile health techniques

have the potential to enhance pregnancy

outcomes through increasing access to medical information, altering demand for quality services, and allowing for the delivery of focused healthcare (Agarwal & Labrique, 2014). These interventions provide individual- level support to pregnant women due to their popularity, mobility, technological capabilities, and availability (Free et al., 2013).

Pregnancy applications interventions represent a transition in health promotion approaches toward a dynamic, interactive environment with linguistic, audio, and graphical communications especially during the Corona epidemic (Ledford et al., 2016). These interventions reduce attending the health-care facilities and consequent coronavirus disease 2019 and its adverse

effects which might also have affected the wellbeing of pregnant women and the newborns (World Bank, 2020; Robertson et al., 2020).

Fetal movement counting is a simple, inexpensive and easily accessible tool to support the mother in monitoring the fetus's well-being to identify alarming behavior in time to intervene (Levy et al., 2020; Bradford et al., 2019). Methods for assessing fetal movements (FMs) in pregnancy are varied and can broadly be categorized as either subjective (passive or unstructured) or objective (active or structured) (Akselsson et al., 2019). Subjective assessment relies on maternal perception and awareness of FMs rather than any formal or structured approach to monitoring FMs. Objective assessment, alternatively, uses a variety of tools for observing and/or recording FMs such as multisensor magnetocardiographic recordings, mobile applications and abdominal sensors (Avci et al., 2018; Daly et al., 2019; Altini et al., 2016). Maternal perception of a gradual diminishment of fetal activity is a significant marker of a vulnerable fetus and can indicate chronic fetal compromise (Bhatia et al., 2019), precede fetal growth restriction, stillbirth, preterm birth and emergency caesarean section (Das et al., 2020). The most important marker of decreased fetal activity is what women perceive as decreasing fetal movements (Kapaya et al., 2020).

Fetal movements felt by the pregnant women are a sign that the fetus is growing in size and strength. The pregnant woman is usually the first to feel these movements, which can later be perceived by others. The first fetal movements which are felt by the mother are called quickening. Quickening often occurs between the 16th to the 22nd weeks of pregnancy. A multiparous woman might feel movements as early as 16 weeks, whereas a primiparous woman may not feel anything until 20 to 22 weeks. At around 20 weeks of gestation, the trained healthcare provider can feel fetal movement externally through the abdomen. Reduced fetal movements can be worrisome for both the mother and the attending healthcare provider. Decreased fetal movement can be a warning sign of potential fetal impairment or risk, and therefore,

warrants further evaluation by the healthcare provider (Das et al., 2020; Kapaya et al., 2020).

Pregnancy outcomes remain significant public health issues globally. Pregnant women, who adopt, practice and maintain healthy behaviors can potentially improve the health of themselves and their newborns. Some maternal risk factors for adverse pregnancy outcomes, such as obesity, smoking, substance use, hypertension, diabetes, adequate nutrition and maternal perception of decreased fetal movement, may be modifiable through changes in maternal behavior. These risk factors also have an association with increased rates of stillbirth, pre-term birth, low birthweight and small for gestational age, and emergency caesarean section (Burki, 2020).

Most providers recommend that pregnant women should monitor fetal movements, especially by the third trimester. This can be accomplished by simply instructing the woman to have a general awareness of the fetus and determine if the fetus is moving less than normal on any given day or about the same as other days. Alternatively, healthcare providers might recommend a more formal fetal movement count (FMC), sometimes called a kick count. Clinicians often recommend starting this surveillance around 28 week's gestation and continuing throughout the remainder of the pregnancy. The "count to 10" method includes the instructions for the woman to count fetal movements at the same time each day. If the woman experiences less than one movement in a 2 to 3-hour period, she is instructed to contact the healthcare provider. One study noted that having women count fetal movements can improve maternal-child bonding during pregnancy as the mother starts to get to know the unborn newborn (Akselsson et al., 2019). Usually, the fetal movement count (FMC) is reassuring to pregnant women and prevents unnecessary visits. The care of pregnant patients is best undertaken with an interprofessional team approach. Healthcare providers of women during pregnancy have the responsibility to screen and monitor the fetus to identify potential problems. This allows the practitioner to provide patient-centered, targeted treatment, and follow-up. Patients should be educated about the importance of self-monitoring of fetal movements. When

decreased fetal movement is perceived, the team should work together to evaluate the fetus further. Maternal vigilance of fetal activity and timely reporting to healthcare providers when experiencing a decrease may prevent perinatal morbidity and mortality (Avci et al., 2018; Altini et al., 2016; Bellussi et al., 2029). However, there is only low level evidence on how to counsel women so they are empowered to timely identify and act on decreased fetal movements. Women are often taught by the health care provider to monitor or be aware of the movements of the fetus. This can be a general awareness of fetal movements, or the women can be taught to count the number of kicks they feel in a set amount of time (Norman et al., 2018).

Significance of the study

Fetal movement count monitoring is a low-cost and low-tech method that has the potential to prevent worsening problems with unborn newborns and merits the attention of providers and pregnant women. Fetal movements (FMs) in pregnancy have long been used as an indicator of fetal wellbeing. A reduction in or absence of FMs may indicate fetal compromise or death (Levy et al., 2020). The prevalence of women presenting with reduced FMs in pregnancy ranges from 4 to 23% across studies (Bhatia et al., 2019), with up to 55% of women experiencing a reduction in FMs in the days preceding an intrauterine death (Bradford et al., 2019). Raising awareness of the importance of FMs and advising women on the appropriate action to take if they experience reduced FMs is thus important for minimizing or avoiding adverse perinatal outcomes. The issues of concern would include perceived or actual decreased fetal movement. Historically, cases of a compromised fetus or infant have usually been preceded by decreased fetal movement. Therefore, the assumption is that if a woman notices a decrease in fetal movement and has it evaluated, then a possible adverse event with the fetus might be avoided by the use of interventions (Akselsson et al., 2020).

According to Egypt Demographic and Health Survey (EDHS, 2014) about 8, 90,000 perinatal deaths occurs annually in Egypt , 15 fetal deaths among 1000 live births in rural

areas and 18 deaths among 1000 births in urban areas are recorded. In Menoufia Governorate 4.48 fetal deaths among 1000 live births. Maternal assessment of fetal well-being during pregnancy and adequate prenatal care is very important to identify fetal well-being. It detects any abnormalities of the fetuses such as intrauterine injury and deaths. Therefore interventions and delivery at the expected date can prevent maternal and neonatal complications (Barker et al., 2013). Therefore, the present study aims to assess the effectiveness of nursing intervention using kick counter mobile application on improving pregnancy outcomes among primigravida during COVID-19 pandemic.

Aim of the work

This study aims to assess the effectiveness of nursing intervention using kick counter mobile application on improving pregnancy outcomes among primigravida during COVID-19 pandemic

Research Hypotheses

- Nursing intervention using kick counter mobile App during COVID-19 pandemic has positive effect on enhancing the pregnant women' knowledge regarding self-assessment of fetal well-being.
- Nursing intervention using kick counter mobile App during COVID-19 pandemic has positive effect on enhancing the pregnant women' practice regarding self-assessment of fetal well-being.
- Primigravida women will exhibit better pregnancy outcomes after receiving the nursing intervention using kick counter mobile App during COVID-19 pandemic than those who don't receive.

Definitions of the variables

Effectiveness: is the capability of producing a desired result or the ability to produce a desired output. When something is deemed effective, it means it has an intended or expected outcome, or produces a deep impression (Stanton and Mwanri, 2013). In this study, effectiveness refers to the changes in knowledge and practice score of primigravida mothers in study group on self- assessment of fetal well-being as determined by the

difference between the study and control groups and between pre and post- test scores in addition to improve the pregnancy outcomes.

Pregnancy outcomes: It refers to the final result of a fertilization event. Types of pregnancy outcomes include livebirth (full term or preterm birth), stillbirth, spontaneous abortion, and induced abortion (McHugh, 2019). In this study, pregnancy outcomes refer to the neonatal outcomes as delivery of normal fetus , low birth weight infant, neonatal intensive care unit (NICU) admission, small for gestational age, large for gestational age and neonatal death in addition to the maternal outcomes as normal labor delivery, emergency C.S and vaginal delivery using machine.

Primigravida women: It refers to the woman who is pregnant for the first time (Hackley et al., 2011). In this study, a primigravida woman refers to a woman who is pregnant for the first time and between the gestational weeks of 26 to 39 weeks.

Method

Research design: A quasi-experimental research design was utilized in this study (study/control groups).

Settings: The study was carried out at Maternal and Child Health Centers (Quibli and Bahari) at Shebin El-Kom in Menoufia Governorate for selecting all cases. These centers have high flow rate of mothers (222 pregnant women per year in MCH Quibli and 197 pregnant women per year in MCH Bahari) who come to these centers from the different surrounding cities and villages (IDSC, 2020). These centers also provide services to the community including maternal and child health services, antenatal, natal, postnatal, vaccinations during pregnancy and family planning services.

Sampling:

A purposive sample of 120 pregnant women (70 pregnant women from MCH in Quibli and 50 pregnant women from MCH in Bahari) who met the inclusion criteria were selected, including pregnant women who educated, had smartphones, primigravida with gestational age 20-40 week, free from any medical and psychiatric conditions.. The cases were then randomly assigned into two groups (study and control group).This took place

through asking each one of the 120 women to pick a piece of paper containing a number. Those who selected number 1 were assigned to the study group and those who selected number 2 were assigned to the control group. This technique helped in avoiding sample contamination and bias.

Exclusion criteria included women who had learning problems, refused to participate in the study & hadn't or can't use smartphone.

Sample size:

Reviewing the previous studies (Daly, (2019) who examined the same outcomes and found significant differences in women's scores of knowledge and practice, the average sample size was 60 women per group. The sample size per group was calculated based on a power analysis of 0.95 ($\beta=1-0.95=0.5$) at alpha .05 (one-sided) with large effect size (0.5) was used as significant. So, a purposive sample of 120 pregnant women was recruited in the study. The pregnant women were assigned randomly into the study and control group.

Data Collection Instruments: Three instruments were used to collect the data of the study as the following:

Instrument I: A structured interviewing questionnaire: it was developed by the researchers based on reviewing the relevant literature (Ben-Ari, et al., 2020) and consisted of three parts as follows.

Part (1): It included demographic data of the pregnant women such as age in years, educational level, job status, nature of work, quality of the wage and number of years of work.

Part (2): It included the pregnancy data of the women during Covid 19 pandemic; it contained questions about current pregnancy weeks, and regularity of follow up during pregnancy and place of follow up during pregnancy.

Part (3): Pregnant women's knowledge regarding the nursing intervention using kick count mobile apps during Covid 19 pandemic: It was designed by the researchers to identify the level of pregnant women's knowledge regarding the nursing intervention using kick count mobile apps, it contained questions as what is the definition of fetal

movements, when does the mother begin to feel the normal movements of the fetus, when does the fetal movements increase, how to monitor the movements of the fetus, what are the benefits of monitoring the movements of the fetus, when should a doctor be consulted about fetal movements and what are the causes of delayed or stopped fetal movements. Each question was answered by the pregnant women either true or wrong. The scoring system was (0) if the answer is wrong and (1) if the answer is true with a total grade of 7. The level of knowledge was determined as good ($\geq 70\%$), average (51- 69%), and poor level ($\leq 50\%$).

Instrument II: An observational checklist of pregnant women' practice of fetal movement assessment using Kick counter mobile App: It is a powerful, stress-relieving instrument that collects accurate kicks session counts and archives information to create an on-going timeline. It was adopted from Saastad et al., (2020) and included observation of women' practice of fetal movement assessment using Kick counter mobile App. It included seven items. The items observed to be adequately done were scored "1", the items not adequately done or not done were scored "0" with a total score of 7. For each area, the scores of the items were summed-up and the number of the items, giving a mean score for each part, divided the total. These scores were converted into a percent score. The practice was considered adequate if the percentage score was 60% or more and inadequate if less than 60%.

Instrument III: Pregnant women assessment regarding pregnancy outcomes: It was developed by the researchers based on reviewing the relevant literature (Berndl et al., 2013) and included assessment of the neonatal outcomes as delivery of normal fetus, low birth weight infant, neonatal intensive care unit (NICU) admission, and small for gestational age, large for gestational age and neonatal death in addition to the maternal outcomes as normal labor delivery,

emergency C.S and vaginal delivery using machine.

Validity and reliability:

The content validity of the instruments was reviewed by five experts in the Maternal and Newborn Health Nursing department for testing clarity, comprehensiveness, and appropriateness of the instruments and testing the content validity before using the instruments in the study. Modifications were done according to the panel's judgment on the clarity of sentences and content appropriateness as "rephrasing and canceling". The Cronbach's α test was used to assess the reliability of the questions relating to knowledge was 0.79.

Administrative and Ethical considerations:

Administrative permission was obtained through an issued letter from the Dean of Faculty of Nursing, Menoufia University to the directors of the MCH centers to conduct this study. The aim of the study was explained and the expected outcomes from the implementation of the study were included in this letter to obtain permission to collect the study data. The purpose of the study was explained to the pregnant women. The researchers informed the participants that, the study was voluntary; they were allowed to refuse to participate in the study. Pregnant women had the right to withdraw from the study at any time, without giving any reason. Pregnant women were assured that their information would be confidential and used for research purposes only.

Pilot study:

A pilot study was conducted on 10% of the study pregnant women (12). The clarity and testing of the feasibility of the research process needed for modifications were carried out based on the results of the pilot study to develop the final form of the instruments. Pregnant women involved in the pilot study were excluded from the study.

Study Procedure:

The procedure of this study consisted of three phases titled; preparatory, implementation, and evaluation phase.

A- Preparatory phase: It was based on the assessment data obtained through the interviewing questionnaire, literature review, knowledge and practice regarding fetal movements monitoring. The researchers prepared an educational

material (a booklet) after reviewing related literature regarding all elements of fetal assessment using fetal movements and gave it to all study participants women. The booklet includes items as definition, importance, when and how to monitor fetal movements in the Arabic language. Also, the researchers prepared mobile massages after reviewing an evidenced-based research and a comprehensive literature about fetal movements monitoring.

B- Implementation phase: Before starting the study, administrative permission was obtained from the directors of the selected settings. All pregnant women who met the inclusion criteria during the time of data collection were included in the study. The researchers introduced themselves to the pregnant women. Clear and simple explanations about the aim and nature of the study were discussed by the researchers to the pregnant women. An informed consent was obtained from the pregnant women to get their acceptance as well as to gain their cooperation. The researchers attended the antenatal outpatient clinics two days per week starting from 9.00 A.m. until 12:00 P.m. The data were collected through a period of eight months from the beginning of December 2020 until the end of June 2021. The interview took

approximately 20 minutes for each woman to answer and fill the questionnaire to assess the knowledge of pregnant women regarding fetal movements (instrument 1). Also, the practice of pregnant women monitoring of fetal movements using Kick counter application was assessed (instrument II).

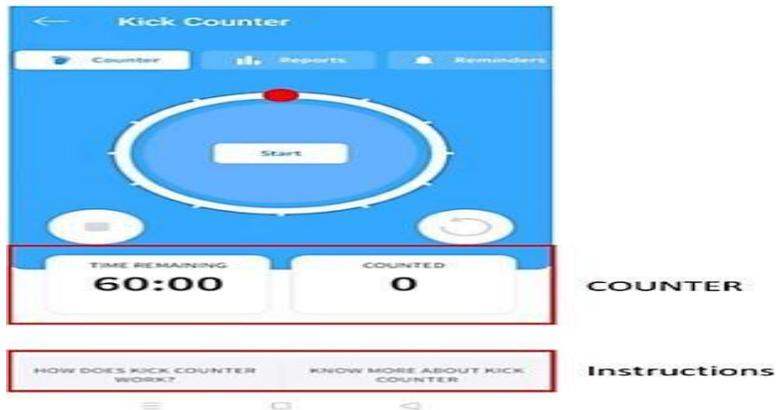
For the study group, all telephone numbers of participated pregnant women were collected and participated in what's up group on mobile for all pregnant women. Three online sessions and appropriate health- education mobile messages were given to **the study group**. Each session lasted 20-30 minutes. **The first and second sessions** included definition of fetal movements, when does the mother begin to feel the normal movements of the fetus? When does the fetal movement increase? What are the benefits of monitoring the movements of the fetus? When should a doctor be consulted about the fetal movements? What are the causes of delayed or stopped fetal movements?

The third session included the benefits of fetal kick counter and how fetal kick counter work: The researchers provided health education to the pregnant women about the importance of fetal kick count apps, in addition to the instructions about how to use kick counter apps which include the followings:

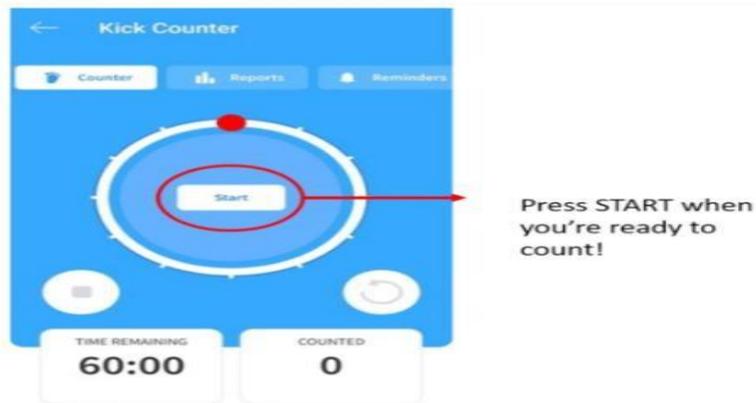
1-Explore the App



2- Once you click the tool, you will be brought to the kick counter itself

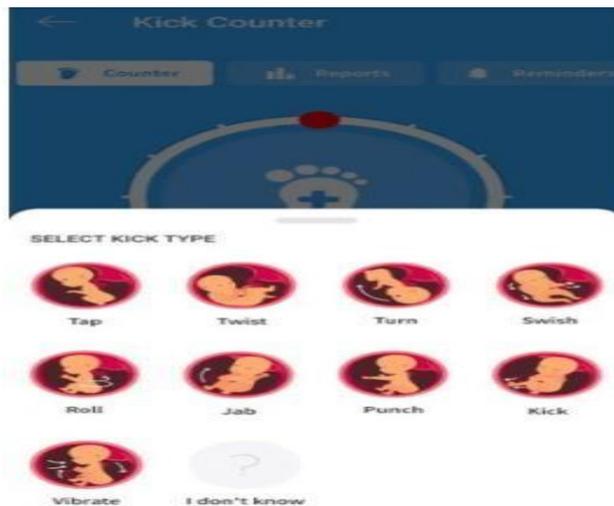


3-Once you have read the instructions; press the start button to start count kicks.

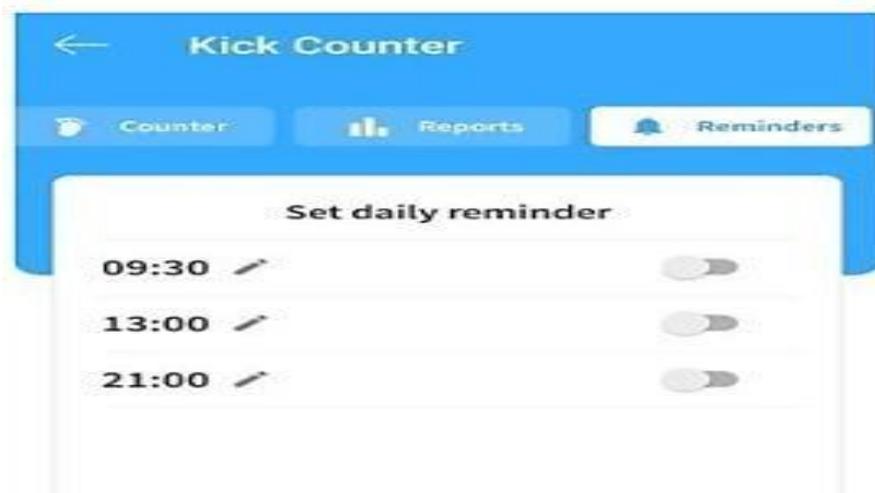


4- Continue recording the kicks over one hour. The best time to do this after eating as this is usually when fetuses are most active

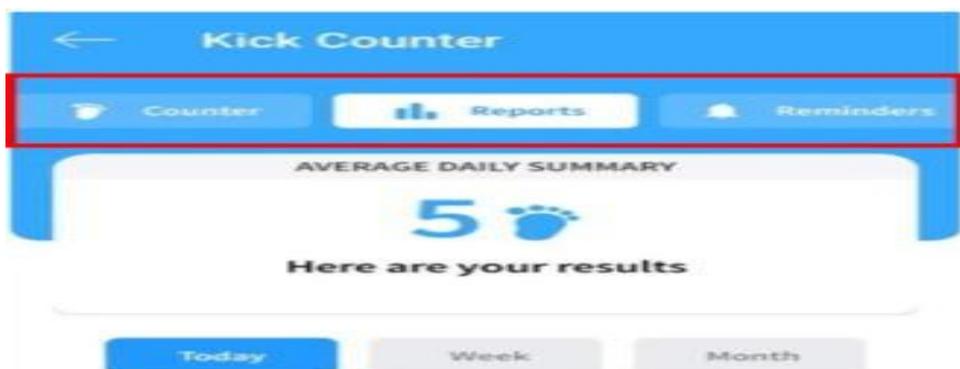
5- You can pick what kind of kick it is?



6- Set daily reminder of fetal kick counter: to make sure that you count your kicks every day



7- Get average daily summary (Report): there are daily, weekly and monthly reports of fetal movements.



The intended learning outcomes of the teaching sessions were:

Knowledge

- Define the fetal movements monitoring.
- Identify the time of feeling the fetal movements.
- Recognize the causes of increasing fetal movements.
- Explain the benefits of monitoring the movements of the fetus.
- Identify when a doctor should be consulted about fetal movements.

- Discuss the causes of delayed or stopped fetal movements.

Skills

- Demonstrate monitoring of fetal movements using kick count mobile apps.

Competence

- Value the importance of fetal movements monitoring.
- Appropriate health-education mobile messages were given to the **study group** and categorized under **seven** major sub-items: definition of fetal movements monitoring, when does the mother begin to feel the normal movements of the fetus? What are the

benefits of monitoring the movements of the fetus? When should a doctor be consulted about fetal movements? How to monitor the movements of the fetus using fetal kicks count mobile Apps? When does fetal movement increase? What are the causes of delayed or stopped fetal movement? All the health messages were also translated and available in Arabic language and delivered in women's preferred time of the day. During mobile massages, the researchers asked the pregnant women if they had adapted the nursing interventions given previously and included giving information related to the fetal movements monitoring. The researchers allowed the pregnant women to ask any questions they want.

The control group

The women who were assigned to the control group were also interviewed, assessed for their knowledge regarding the nursing intervention using kick count mobile apps and for the pregnancy outcomes after childbirth. They received routine antenatal care.

C-Evaluation phase

After the end of the intervention, the pregnant women' knowledge, study group's practice and pregnancy outcomes were assessed using instrument I, II and III.

Statistical Analysis

Data was collected, tabulated, statistically analyzed using an IBM personal computer with Statistical Package of Social Science (SPSS) version 22 where the following statistics were applied: Descriptive statistics: in which qualitative data were presented in the form of numbers and percentages. Analytical statistics: used to find out the possible association between the studied factors and the targeted variables. Wilcoxon test and χ^2 test were used to assess the significance of the difference between two correlated proportions. P value of > 0.05 was considered statistically non-significant. P value of < 0.05 was considered statistically significant. P value of < 0.001 was considered statistically highly significant.

Results

Table 1: showed the pregnant women' demographic characteristics. According to age, the mean age of the study group was 28.34 ± 8.12 years old while the mean age of control group was 29.93 ± 9.89 years old. In addition, about half of the study group (48.3%) had secondary education compared to (41.7%) in the control group. It also revealed that more than half of the study group (70%) had not worked compared to 36.7% in the control group. Meanwhile, more than half of the pregnant women in both the study and control groups reported insufficient family income (73.3% & 63.3% respectively).

Table 2: showed the pregnancy data of the pregnant women during COVID-19 pandemic. Regarding the current pregnancy weeks, it was reported that 43.3% of the study group had more than 32 weeks of gestation compared to 18.3 % in the control group. Also, there was statically significant difference between both groups related to regularity of pregnancy follow up p (0.004*). Also more than half of the study group (55%) followed up at a private clinic compared to 56.7% followed up at maternity hospital.

Table (3): Showed the pregnant women's knowledge regarding the nursing intervention using kick count mobile Apps between the study and control groups during Covid 19 pandemic pre & post intervention. It showed that there was no statistically significant difference between the study and control groups in terms of all items regarding the nursing intervention using kick count mobile Apps ($p > 0.05$) except when does fetal movement increase ($p < 0.05$) before the intervention. Meanwhile, there was highly statistically significant difference between the study and control groups in terms of all items regarding the nursing intervention using kick count mobile Apps ($p < 0.000$) after the intervention.

Figure 1 showed that 89% of the study group had good knowledge after the intervention compared to 30% of them before the intervention during Covid 19 pandemic. Meanwhile, 3% of the study group had poor knowledge after the intervention compared to

55% of them before the intervention during Covid 19 pandemic.

Figure 2 showed that 98% of the study group had adequate practice regarding fetal movements monitoring using kick count mobile apps after the intervention compared to 7% of them before the intervention during Covid 19 pandemic. Meanwhile, 2% of the study group had inadequate practice after the intervention compared to 93% of them before intervention during Covid 19 pandemic.

Table 6: reflected the pregnancy outcomes after childbirth among the study and control group during COVID-19 pandemic. Related to the neonatal outcomes, it shows that the study group had fewer complications than the control group in terms of NICU admission (1.7%) in the study group compared to 5% in the control group. Regarding the maternal outcomes, 91.7% of the pregnant women in the study group delivered normally compared to 48.3% in the control group.

Table (1): Demographic Characteristics of the Pregnant Women (N=120).

Items	Study group (N=60)		Control group (N=60)		χ^2 or t /(p) value
	No.	%	No.	%	
Age in years:					
- 20 : > 30	39	65.0	49	81.7	4.261 (0.062)
- 30 : 40	21	35.0	11	18.3	
Mean \pm SD	28.34 \pm 8.12		29.93 \pm 9.89		(t) (0.229)
Educational level:					
Basic education	8	13.4	15	25.0	3.702 (0.267)
Secondary education	27	45.0	25	41.7	
High education	25	58.5	20	33.3	
Job status:					
Worked	18	30.0	38	63.3	12.087 (0.001**)
Not-work	42	70.0	22	36.7	
Nature of work:					
Needs physical effort	3	5.0	8	13.3	4.673 (0.059)
Needs mental & muscular effort	12	20.0	21	35.0	
Needs mental effort only	3	5.0	3	5.0	
Quality of the wage:					
100% full wage	12	20.0	25	41.7	3.672 (0.067)
75% wage	4	6.6	12	20.0	
50% wage	2	3.3	1	1.7	
Number of years of work:					
Less than 10 years	8	13.3	20	33.3	8.726 (0.03*)
From 10 to 15 years	7	11.7	11	18.3	
More than 15 years	3	5.0	7	11.7	
Monthly income of the family:					
Sufficient	16	26.7	22	36.7	1.386 (0.326)
Insufficient	44	73.3	38	63.3	

χ^2 value of chi-square test

* Statistically significant (p <0.05)

** high Statistically significant (p <0.01)

Table (2): Pregnancy data of the Women during COVID-19 Pandemic (N=120).

Items	Study (N=60)		Control (N=60)		Z / (p) value
	No.	%	No.	%	
Current pregnancy weeks:					
20-29 week	12	20.0	27	45.0	11.749 (0.003*)
30-32 week	22	36.7	22	36.7	
More than 32 week	26	43.3	11	18.3	
Regularity of pregnancy follow up:					
Yes	20	33.3	6	10.0	9.624 (0.004*)
No	40	66.7	54	90.0	
Where do you follow up the pregnancy:					
At the maternal and child health center	8	13.3	21	35.0	30.704 (0.000**)
At a private clinic	33	55.0	3	5.0	
At maternity hospital	19	31.7	34	56.7	
When did you follow up the pregnancy for the first time:					
As soon as I knew about the pregnancy	38	63.3	23	38.3	7.502 (0.006*)
In the third month	22	36.7	37	61.7	

Z value of Wilcoxon W test * statistically significant ($p < 0.05$) ** high statistically significant ($p < 0.01$)

Table (3): Pregnant Women's Knowledge regarding the Nursing Intervention Using Kick Count Mobile Apps between the Study and Control Groups during Covid 19 Pandemic (Pre & Post intervention)

Items	Study (N=60)				Control (N=60)				z / (p) value
	rre		rost		rre		rost		
	No.	%	No.	%	No.	%	No.	%	
What are the movements of the fetus?									
Correct answer	15	25	55	91.7	13	21.7	14	23.3	29.263/ (0.000**)
Incorrect answer	7	11.7	3	5.0	8	13.3	7	11.7	
I don't know	36	60	2	3.3	39	65	39	65.0	
When does the mother begin to feel the normal movement of the fetus?									
Correct answer	10	16.7	46	76.7	14	23.3	12	20.0	22.909/ (0.000**)
Incorrect answer	14	23.3	6	10.0	19	31.7	21	35.0	
I don't know	36	60	8	13.3	27	45	27	45.0	
When does fetal movement increase?									
Correct answer	9	15.0	43	71.7	8	13.3	8	13.3	23.920/ (0.000**)
Incorrect answer	6	10.0	10	16.6	14	23.3	14	23.3	
I don't know	45	75.0	7	11.7	38	63.4	38	63.4	
What are the benefits of monitoring the movement of the fetus?									
Correct answer	5	8.3	53	88.3	6	10.0	6	10.0	22.516/ (0.000**)
Incorrect answer	16	26.7	5	8.3	10	16.7	10	16.7	
I don't know	39	65.0	2	3.4	44	73.3	44	73.3	
How to monitor the movement of the fetus?									
Correct answer	2	3.3	58	96.7	3	5.0	3	5.0	17.602/ (0.000**)
Incorrect answer	19	31.7	2	3.3	11	18.3	11	18.3	
I don't know	39	65.0	0	0.0	46	76.7	46	76.7	
When should a doctor be consulted about fetal movement?									
Correct answer	4	6.7	47	66.6	3	5.0	3	5.0	19.470/ (0.002*)
Incorrect answer	15	25.0	11	26.7	7	11.7	7	11.7	
I don't know	41	68.3	2	6.7	50	83.3	50	83.3	
What are the causes of delayed or stopped fetal movement?									
Correct answer	7	11.7	48	56.6	8	13.4	7	11.7	15.322/ (0.026*)
Incorrect answer	7	11.7	7	21.7	15	25.0	10	20.0	
I don't know	44	73.3	3	21.7	37	61.6	37	61.6	

Z value of Wilcoxon W test * statistically significant ($p < 0.05$) ** high statistically significant ($p < 0.01$)

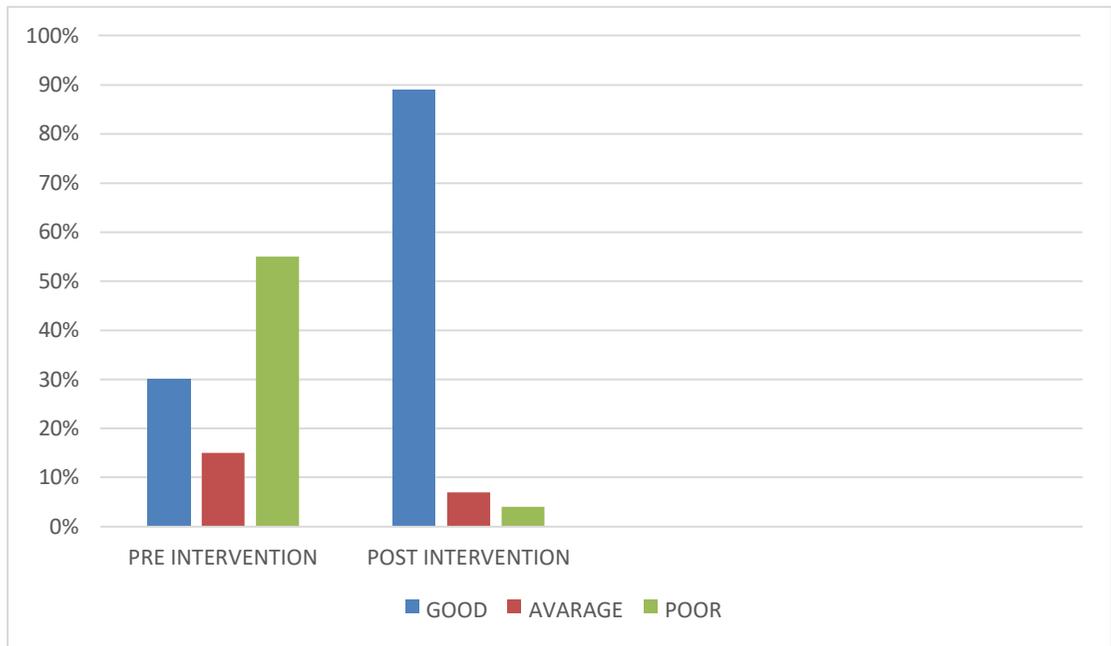


Figure 1: Knowledge Scores of the pregnant women of the Study group regarding the Nursing Intervention Using Kick Count Mobile Apps before and after the intervention during Covid 19 Pandemic (N=60)

Women practice of fetal movement monitoring using kick counter application

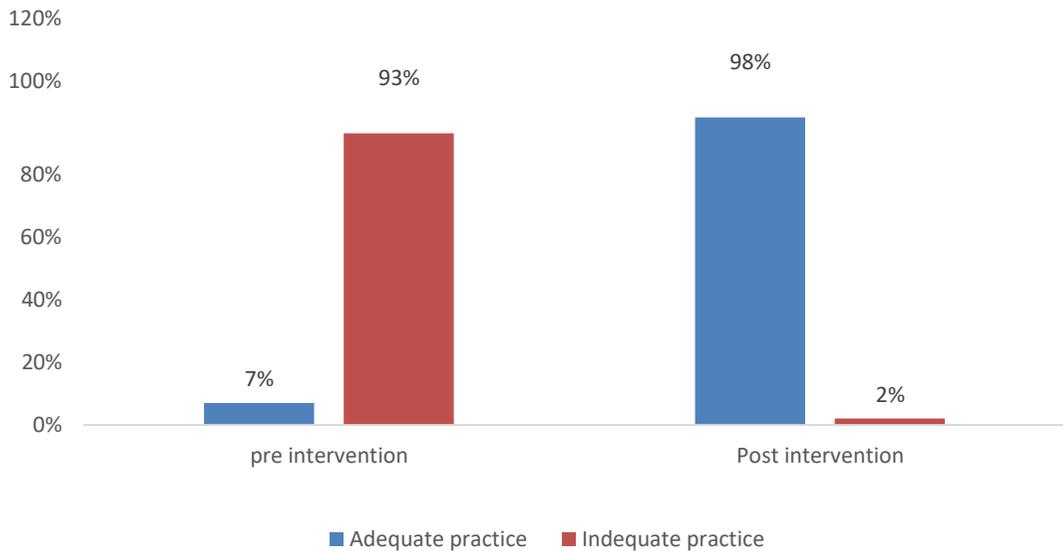


Figure 2: Practice Scores of the Pregnant Women of the Study group of Fetal Movements Monitoring Using Kick Count Mobile Apps before and after the intervention during Covid 19 Pandemic (N=60)

Table (5): Pregnancy Outcomes after childbirth among the study and control groups during COVID-19 pandemic (N=120).

Items	Pregnant Women				(p) value / χ^2
	Study (N=60)		Control (N=60)		
	No.	%	No.	%	
Neonatal outcomes					
• Normal fetus	46	76.7	29	48.3	14.291/ (0.000**)
• Low birth weight	0	10.0	8	13.3	
• NICU admission	1	1.7	3	5.0	
• Small for gestational age	4	6.7	9	15.0	
• Large for gestational age	2	3.3	7	11.7	
• Neonatal death	1	1.6	4	6.7	
Maternal outcomes					
• Normal labor	55	91.7	29	48.3	
• Emergency cesarean section	5	8.3	30	50.0	
• Vaginal delivery using machine (forceps or ventose)	0	0.0	1	1.7	

Z value of Wilcoxon W test * statistically significant ($p < 0.05$) ** high statistically significant ($p < 0.01$)

Discussion

Maternal perception of fetal movement has become recognized as a valuable tool for early detection of fetal compromise. Fetal movement is a reliable sign of fetal well-being (Stacey et al., 2011).

Regarding the demographic characteristics, the current study findings indicated that the majority of the pregnant women aged less than 40 years old and all of them were educated. As mobile applications are mostly used by young and young adults who use mobile phones actively. On the other hand, since the educational level is a factor affecting the health literacy and use of technological devices, education level has also been a factor determining the use of mobile applications related to health. On the same line, Daly et al., (2019) reported that most of Australians aged 18-34 years old downloaded an app on a mobile phone in 2014, and adults aged 18-34 years old used mobile phones to go online more than any other device (laptop, desktop or tablet).

Regarding regularity of pregnancy follow up, more than two thirds of the pregnant women stated that they did not have regular follow up. The study's findings are similar to those of Hall et al., (2020) and Riley et al., (2020) that stated that access to reproductive health and antenatal healthcare services decreased, and many undesirable complications emerged due to the situation. Also, this finding

was similar to a study conducted in Turkey during the COVID-19 pandemic, about one fourth of the pregnant women were reported to ignore their regular prenatal follow-ups (Kahyaoglu Süt & Küçükkaya, 2020). It may be explained that pregnant women might be anxious about receiving face-to-face prenatal care and unwilling to go to health institutions during the COVID-19 pandemic for fear that they might get infected.

Regarding the knowledge about fetal movements monitoring before the intervention, the minority of the women in the current study knew the meaning of fetal movements, when does the mother begins to feel fetal movement, what are the benefits of monitoring the fetal movements, how to monitor the fetal movements, when should a doctor be consulted about the fetal movements and the causes of delayed the fetal movements. This result was matching with OLESEN & SVARE (2004) who found a significant number of mothers more than half had no clear understanding of how to monitor the fetal movements.

Regarding the knowledge about fetal movements monitoring after the intervention, the majority of the women in the study group knew the meaning of fetal movements, when does the mother begins to feel the fetal movements, what are the benefits of monitoring the fetal movements, how to monitor the fetal movements, when should a doctor be consulted about the fetal movements

and the causes of delayed the fetal movements. This could be due to the nursing intervention that was effective in enhancing the pregnant women's knowledge level in the study group regarding the fetal movements monitoring. The current study findings were matching with a study conducted by ACOG, (2020) and found that forty- seven percent of the women demonstrated good knowledge of fetal movements monitoring. The current study findings are also similar to Liu et al., (2020) who reported that almost all pregnant women in their study stated that using mobile applications in this process was beneficial. About three-fourths of the pregnant women expressed that they wanted to receive services through mobile applications during the pandemic process. This may be attributable to the mobile applications that are an increasingly popular mode of accessing, storing and sharing health information among the pregnant women (Zhu, et al., 2019).

Regarding the study group practice of fetal movements monitoring using kick counter mobile Apps after the intervention. The current study findings showed that nearly all pregnant women in the study group performed adequate practice after the intervention compared to two percent before the intervention. This could be due to the nursing intervention that were effective in raising the pregnant women performance level in the study group regarding the fetal movement monitoring using kick counter application. This finding was matching with O'Higgins et al., (2014) who studied the use of digital media by women using the maternity services in a developed country and stated that recent studies have found that the pregnant women are seeking mobile apps to monitor the fetal development and to provide reassurance. Meanwhile Donner et al., (2013) reported that since mobile health is in its early stage of adoption, it lacks sufficient evidence that can prove that it is the most convenient health practice and added that lack of infrastructure; widespread network coverage

and availability of mobile devices are other obstacles that halt the development of mobile health

Regarding the pregnancy outcomes after childbirth, the study findings found that less than one-fourth of the study pregnant women

versus to more than half of the control pregnant women had maternal and neonatal complications. These findings are in accordance with the study findings conducted by Alotaibi, et al., (2018) who studied a smart mobile pregnancy management and awareness system for Saudi Arabia and found that mobile health has increased the percentage of safe childbirth and reduced the ratio of maternal and neonatal complications as mobile health has empowered specialists to measure the compliance of medics to standards of the treatment when treating patients. On the same line, Bradford et al., (2019) stated that the fetal movement changes throughout pregnancy can indicate normal or abnormal development. Also, Riley et al., (2020) determined that a decrease in receiving prenatal and neonatal care services would lead to an increase of women with major obstetrical complications and newborns with major complications, thereby resulting in the death of women and newborns. Therefore, it is important to provide prenatal care and counseling through telehealth tools, including mobile health applications, to reduce the negative effects of the COVID-19 pandemic on the healthcare services before, during, and after delivery is thought. It may be explained due to the irregularity of pregnancy follow up. In contradiction with the current study findings, Bush, et al., (2017) who studied the impact of a mobile health application on user engagement and pregnancy outcomes among Wyoming Medicaid members and found that supportive pregnancy apps are an emerging field, and little information is available on their effectiveness in attracting users and impacting birth outcomes.

So, COVID-19 has prompted new temporary telehealth flexibilities, expanding access to care through virtual means. These new flexibilities provide an opportunity to expand access to pregnancy and childbirth services and may help to mitigate adverse health outcomes for the pregnant women.

Conclusion:

This study showed that the pregnant women had good knowledge scores about self-assessment of fetal movement after receiving the nursing intervention using kick counter mobile application during COVID-19

pandemic than those who didn't receive it. This supports the first research hypothesis. Meanwhile, there was an improvement in the pregnant women practice level regarding self-assessment of fetal movement using kick counter mobile application during COVID-19 pandemic after the intervention than before the intervention (study group). This supports the second research hypothesis. Also, there were improvements in the pregnancy outcomes of the pregnant women receiving the nursing intervention using kick counter mobile application during COVID-19 pandemic than those who don't receive it. This supports the third research hypothesis. Thus, all research hypotheses are accepted.

Recommendations:

Mobile application-assisted nursing intervention should be used in various maternity health care settings. Health providers should be aware of this technology and familiarize themselves with the various features of each app because this method will enable them to instruct women pregnant remotely. Health educational programs should be provided for the pregnant women about fetal self-assessment using kick counter mobile application. Further research should be done about effect of using new technology among pregnant women on improving nursing care during pregnancy.

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