Official study title: Empowering First-Time Mothers: The Effect of Digital Lactation Nursing Support on Breastfeeding Achievement and Maternal-Infant Outcomes.

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1. Introduction

Breastfeeding is a fundamental practice recommended by global health authorities for optimal infant and maternal health. Early initiation of breastfeeding, ideally within the first hour after birth, significantly reduces neonatal mortality and enhances infant immune protection (Darboe et al. 2023). However, despite strong recommendations, many mothers face barriers that delay initiation or lead to early cessation of breastfeeding. Factors such as lack of professional support, misinformation, cultural barriers, socio-environmental challenges, and maternal anxiety affect timely breastfeeding initiation worldwide. Therefore, effective digital lactation targeting early breastfeeding support is critical to improve health outcomes (O'Dea et al. 2023)

Nursing interventions are important for initiating and maintaining breastfeeding. Traditional face-to-face lactation consultations have been found to successfully manage breastfeeding difficulties and boost maternal confidence (Purkiewicz et al. 2025). However, geographical, sociodemographic, and pandemic-related barriers have limited access to in-person lactation support and have led to the emergence of digital lactation as a new solution (Howell et al. 2023). Digital lactation nursing support employs technologies like video conferencing, telephone calls, and mobile applications to deliver specialized breastfeeding guidance remotely, enhancing access for mothers irrespective of their geographical position or limitations in mobility (Iamchareon & Maneesriwongul, 2025).

The initiation of breastfeeding is influenced by maternal factors, such as knowledge, self-efficacy, emotional well-being, and physical readiness, as well as external factors, including healthcare support and cultural practices . Digital lactation nursing addresses these factors by providing timely, individualized counseling and troubleshooting, which helps mothers overcome early breastfeeding

challenges like latching difficulties, pain, and concerns about milk supply . Evidence indicates that mothers who receive digital lactation support report higher confidence levels and higher breastfeeding initiation rates compared to those who receive only standard postnatal care (Uscher-Pines et al. 2025).

Maternal outcomes related to breastfeeding are multifaceted, including immediate physical benefits such as reduced postpartum bleeding and faster uterine involution, as well as long-term health benefits, particularly a reduced risk of ovarian and breast cancers .Additionally, breastfeeding contributes to improved maternal mental health by lowering the incidence of postpartum depression and enhancing emotional bonding with the infant. Digital lactation nursing interventions positively influence these outcomes by supporting mothers in initiating and sustaining breastfeeding, thereby reducing early cessation, which can adversely affect maternal physical and psychological health (Lenells et al., 2025).

The COVID-19 pandemic accelerated the integration of telehealth services into maternal care, with digital lactation becoming an essential resource for breastfeeding support during periods of restricted in-person contact . Recent clinical studies have explored the potential of digital lactation support to improve breastfeeding outcomes compared with conventional care models. Telelactation services offer mothers timely access to professional breastfeeding guidance, particularly those living in rural and underserved areas who may face geographical and transportation barriers to accessing in-person support. These services represent a scalable and patient-centered approach to breastfeeding promotion, although further research is needed to establish their effectiveness in improving breastfeeding initiation and continuation rates (Miremberg et al., 2022).

Nursing professionals providing digital lactation support can reach a broader demographic, ensuring equitable access to expert lactation care and enhancing public health outcomes at the community level. This capacity to democratize breastfeeding support makes digital lactation a promising tool for health systems aiming to improve maternal-child health equity (Stoodley et al. 2023).

Significance of the Study

This study addresses the increasing need to utilize digital health technologies to support breastfeeding, especially in rural, underserved, and pandemic-affected populations where face-to-face consultations may be limited or unavailable (Uscher-Pines et al., 2020). By evaluating the effectiveness of digital lactation nursing support, the study aims to provide evidence-based insights into how remote lactation assistance can improve breastfeeding initiation rates and maternal-infant outcomes, including physical recovery and psychological well-being.

Moreover, the present study builds on existing digital lactation interventions by extending them beyond conventional approaches that primarily focus on standardized educational content. The intervention aims to enhance mothers' confidence and ability to initiate and continue breastfeeding through structured psychological and behavioral support. Group Zoom sessions offered evidence-based breastfeeding education, skill development, discussions on anticipated challenges, verbal encouragement, positive reinforcement, and problem-solving strategies. These sessions were supplemented by interactive communication via WhatsApp, which provided ongoing clarification and facilitated the sharing of experiences and evidence-based guidance from the researcher to address participants' breastfeeding challenges. (Islam et al., 2024)

Additionally, ongoing postnatal support was available through a WhatsApp-based breastfeeding support program for three months after delivery, allowing mothers to receive timely assistance whenever they faced breastfeeding difficulties or had questions. For mothers, particularly first-time or vulnerable populations, this study points out the potential for digital lactation support to increase breastfeeding self-efficacy, reduce complications, and promote sustained breastfeeding—factors that are crucial for both infant growth and maternal health.

Ultimately, the study contributes to global efforts aimed at increasing breastfeeding rates, reducing infant morbidity and mortality, and promoting equitable healthcare access through innovative nursing interventions. Furthermore, the findings will benefit nursing professionals and healthcare policymakers by identifying best practices and effective strategies for implementing digital lactation support programs. This can lead to enhanced training protocols, resource allocations, and healthcare policies that prioritize telehealth-based lactation support, thereby improving maternal-child healthcare services (Islam et al., 2024; Harger & Cartagena, 2025).

Aim of the Study

The present study aims to evaluate the impact of digital lactation nursing support on breastfeeding success and maternal-infant outcomes.

Research Hypotheses

H1: Primiparous mothers who receive digital lactation nursing support will show significantly greater breastfeeding knowledge and enhanced initiation and maintenance of exclusive breastfeeding compared to mothers in the control group at posttest.

H2: Primiparous mothers who receive digital lactation support will demonstrate significantly stronger bonding and attachment with their infants than mothers in the control group at posttest.

H3: Primiparous mothers who receive digital lactation support will report significantly higher satisfaction levels compared to mothers in the control group at posttest.

Methodology

Research Design

Quasi experimental design will use to examine the effectiveness of digital lactation nursing intervention on breastfeeding initiation and maternal outcomes.

Study Setting

This study was conducted in the antenatal and postnatal outpatient clinics of three major hospitals in Tanta University Hospital, General Hospital, and Menshawy Hospital.

Study Population

The target population will consist of primigravid women who met the study eligibility criteria was recruited from the selected settings. Purposive sampling was used to ensure the inclusion of participants, which is most appropriate for evaluating the effectiveness of the digital lactation intervention. Eligible participants were women in the third trimester of pregnancy who were literate, owned a smartphone capable of installing applications, and were carrying a single viable term fetus without congenital anomalies. Additional inclusion criteria included absence of medical or psychological disorders.

Sample Size and Sampling Technique

The required sample size will be determined using an appropriate statistical sample-size calculation based on the total number of eligible primigravid women in the previous setting.

Data Collection Instruments

Tools of data collection

Tool one: Demographic and Breastfeeding Structured Interview Questionnaire

A structured interview questionnaire will develop based on previous studies (Aldairy et al. 2025; Osman et al. 2023; Rashed et al. 2021). The questionnaire consisted of three parts.

Part1: Sociodemographic Characteristics

This section will collect data on participants' sociodemographic characteristics, including age, educational level, occupation, residence, age at

marriage, duration of the current marriage, family income, and sources of breastfeeding information.

Part 2: Breastfeeding Knowledge

This section will assess primigravida women's knowledge regarding breastfeeding. It included items related to the definition of breastfeeding; benefits for the mother and infant; types of breast milk; and the role of colostrum. It also covered the recommended time for breast feeding initiation, optimal deration of breastfeeding, appropriate breastfeeding techniques and positions, and indicators of adequate, insufficient, and excessive breastfeeding. In addition, the section addressed common breastfeeding-related problems, including breast engorgement, cracked nipples, and inverted nipples, with questions related to their definitions, risk factors, signs and symptoms, complications, effects on the infant, and maternal self- care measures. Each correct answer was assigned one point, and each incorrect answer was assigned zero. The total possible score ranged from 0 to 38. Knowledge levels were categorized as poor (<50%; <19 points), moderate (50% to <75%; 19–28 points), and good (≥75%; ≥29 points).

Part 3: Breastfeeding Practices

This section will assess the time of breastfeeding initiation following the current delivery and the duration of exclusive breastfeeding.

Tool two: The postpartum Bonding Questionnaire (PBQ)

It will adapted from the versions validated by Busonera et al. (2017) and Garcia-Esteve et al. (2016) to the mother's immediate emotional and affective feelings toward her newborn. The questionnaire consists of 25 items that evaluate maternal attitudes and feelings toward the infant. Each item is rated on a six-point Likert scale ranging from always to never. For positively worded items, responses are scored from 0 (always) to 5 (never). Negatively worded items are reverse scored from 5 (always) to 0 (never). The total score ranges from 0 to 125, with higher scores indicating poorer mother- infant bonding. The PBQ comprises four

subscales: impaired bonding (12 items), rejection and pathological anger (7 items). Infant-focused anxiety) 4 items), and incipient abuse (2 items). The impaired bonding subscale assesses difficulties in establishing an emotional connection with the infant. The rejection and pathological anger subscale evaluate maternal feelings of rejection and anger toward the infant. The infant- focused anxiety subscale measures anxiety specifically related to the infant's well-being and care. The incipient abuse subscale identifies early indicators of potentially harmful thoughts or behaviors toward the infant.

Psychometric properties of the Postpartum Bonding Questionnaire (PBQ). PBQ has good psychometric properties. Garcia-Esteve et al. (2016) have provided evidence of its validity and reliability for the evaluation of disturbances in mother bonding during the postpartum period. El Hadathy et al. (2024) confirmed the validity of maternal-infant bonding measures among Arabic communities, which supports the cross-cultural use of bonding evaluation tools. The PBQ revealed very good internal consistency (Cronbach's alpha = 0.88) in the present study. Five specialists in Maternal and Neonatal Nursing assessed the relevance, comprehensibility and clarity of the items, proposing minor language modifications, to establish content validity.

Tool three: Mother-Infant Attachment Scale (MIAS)

The Mother-Infant Attachment Scale was adapted from Bhakoo et al. (1994) measured maternal attitudes and relational engagement associated to attachment, including emotional closeness, positive emotions, enjoyment of interaction, interest in the infant's behavior and response, and perceptions of the developing mother–infant attachment. The scale consists of 15 items that evaluate maternal attitudes and perceptions, toward the infant, including feelings of love, pride, concern, anger, annoyance, expectations, and perceptions of the infant's temperature and behavior. Responses are rated on a five- point Likert scale ranging from strongly agree to strongly disagree. Each item is scored from 1 to 5, with scoring arranged in this study so that higher scores reflect less favorable attachment The total score ranges

from 15 to 75. Higher total scores indicate poorer mother-infant attachment, whereas lower scores reflect stronger attachment.

The MIAS was first developed and psychometrically evaluated by Bhakoo et al. (1994). The original validation study reported a split-half reliability coefficient of 0.83 for the 15-item scale and gave evidence for face and construct validity, supporting its use as a measure of mother–infant attachment. Wittkowski et al. (2020) subsequently examined the psychometric properties and clinical utility of parent-report measures of the parent–infant relationship (including the MIAS) and summarized the psychometric evidence available for the scale. Internal consistency was assessed with Cronbach's alpha, and the MIAS showed excellent internal consistency in the present study (Cronbach's $\alpha = 0.74$). The present study findings support the MIAS reliability and content validity in the present study population.

Tool four: Maternal Satisfaction of Tele-lactation:

The maternal satisfaction with digital lactation questionnaire will develop by researchers based on an extensive review of the relevant literature including studies by DeYoreo et al. (2025); Uscher-Pines et al. (2025), and Chua et al. (2023). The instrument was designed to assess mothers' satisfaction with digital lactation services. The questionnaire consisted of 11 items covering several dimensions of satisfaction, including clarity and comprehensiveness of the nursing information provided, appropriateness of the language used, convenience and time-saving aspects of the services, and its effectiveness in improving breastfeeding knowledge and practices. Additional items assessed the extent to which digital lactation helped resolve breastfeeding problems, supported continuation of breastfeeding, and participants' willingness to recommend the service to relatives and friends or to incorporate it into routine hospital care. Responses were rated on a three-point Likert scale: 3 = satisfied, 2 = partially satisfied, and 1 = not satisfied. Total scores ranged from 11 to 33 and were categorized as not satisfied (<18), partially satisfied (18 to <25), and satisfied (≥25).

Validity and Reliability of the Instruments; The study tools will be tested for face and content validity by a jury of five professors' expertise in the field of community health nursing before conducting the study. The study tools will be tested for their reliability by using suitable statistical tests.

Pilot study;

It will be carried out by the researcher on 10% of the participants for testing the tool for its clarity, applicability and to identify obstacles that may be encountered with the researcher during data collection. Accordingly, the necessary modifications will be made. This sample will be excluded from the study if any modification is made. The study will initiate following approval from Faculty of Nursing, Tanta University All participants provided written informed consent after being fully informed about the study's purpose, objectives, potential risks, and benefits. They were assured that their data would remain confidential, the digital lactation was safe, and they could withdraw from the study at any point without any consequences.

Data Collection Procedure

Data will collect from January to September 2025 in the previously described study settings. Recruitment and data collection were conducted on Saturdays, Sundays, Mondays, and Wednesdays from 09:00 to 12:00 until the required sample size will achieve. The study will implemented in four phases: preparation, baseline assessment, intervention delivery, and outcome evaluation. During the preparation phase, antenatal clinic records were screened to identify eligible primigravida pregnant women. Eligible women received a detailed explanation of the study procedures, and written informed consent ll obtained prior to enrollment. At baseline, participants in both groups completed tool 1 to assess sociodemographic characteristics, breastfeeding knowledge, sources of breastfeeding information, and intended breastfeeding initiation practices.

Outcome evaluation will conduct immediately after childbirth and again at three months postpartum. Breastfeeding knowledge, breastfeeding initiation, and exclusive breastfeeding were assessed at the specified follow-up points. Maternal

emotional bonding with the infant and mother–infant attachment will assess using the Postpartum Bonding Questionnaire and the Mother–Infant Attachment Scale, respectively. Both instruments were administered immediately after childbirth and again at three months postpartum. Maternal satisfaction with the digital lactation intervention will assess only among participants in the digital lactation.

The four sessions focused on: (1) the benefits of breastfeeding for mothers and infants, as well as the importance of initiating breastfeeding; (2) breast milk composition and breastfeeding techniques; (3) determinants of breastfeeding success, anticipated challenges, and coping strategies for common difficulties; and (4) recognizing and managing common breastfeeding problems alongside practical approaches to facilitate successful breastfeeding. The WhatsApp groups were designed to be interactive, rather than merely a one-way dissemination of instructional content. Participants were encouraged to ask questions, engage in discussions about breastfeeding with the researchers, and share their experiences and concerns with one another.

Group conversations were monitored by the researchers, who provided evidence-based clarification and guidance. Participants expressing specific worries or challenges regarding breastfeeding received tailored assistance and problem-solving support according to their needs. After delivery, individual breastfeeding support was offered via WhatsApp for three months postpartum. Participants could contact the researchers when they faced issues with breastfeeding or required clarification or assistance, with tailored, evidence-based help.

Data Analysis

Data will be analyzed using an appropriate statistical software package. Descriptive statistics will be used to summarize participant characteristics and the levels of mental

health literacy, psychological well-being, resilience, coping, and perceived social support. Depending on the distribution and measurement properties of the variables, Pearson's correlation or an appropriate non-parametric alternative will be used to examine bivariate relationships. Multiple linear regression will then be performed to determine whether mental health literacy, resilience, coping, and social support significantly predict psychological well-being. Assumptions of regression, including linearity, independence, normality of residuals, homoscedasticity, and multicollinearity, will be assessed before interpreting the regression model. Statistical significance will be set at $p < .05$.

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