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LITERATURE REVIEW
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The Effectiveness of Smartphone-Based Nutrition Education Intervention in Successful Practice of Exclusively Breastfeeding: A Meta-Analysis

Efektifitas Intervensi Edukasi Gizi Berbasis Smartphone *dalam Keberhasilan Praktik ASI Eksklusif: Meta Analisis*

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ABSTRACT

Background: Exclusive breastfeeding is the cornerstone of infant health and one of the 2030 Sustainable Development Goals (SDGs). The advancement of information technology can be used to promote health, and providing information through messages on smartphone applications can improve breastfeeding awareness and adherence.
Objectives: To determine which social media platforms effectively promote exclusive breastfeeding through nutrition education interventions.
Methods: This study employed a meta-analysis method. The terms "breastfeeding," "social media," and "smartphone" were used to search for articles in multiple electronic journals, such as Scopus, PubMed, ScienceDirect, and Google Scholar. Articles that provide an intervention using smartphone media for groups of expectant mothers who wish to breastfeed their babies and mothers who have ceased breastfeeding and want to resume were selected. Forest plot analysis was performed using the STATA 12.
Results: From 2018 to 2021, seven articles were obtained, with research conducted in the United States, India, Indonesia, Israel, and Brazil. The study's findings revealed that a nutritional education intervention using Smartphones led to an average success rate of exclusive breastfeeding between the intervention group and the control group of 1.23 (7 studies), 95% CI (1.08 - 1.39); P = 0.000; and I2 = 97.1%.
Conclusions: Intervention using smartphones by sending short messages daily and counselling by telephone every week can increase mothers' knowledge and ability to provide exclusive breastfeeding to their infants. An intervention using smartphones to transmit daily text messages and weekly telephone counselling could enhance mothers' knowledge and ability to breastfeed their children exclusively.

INTRODUCTION

Exclusive breastfeeding is the basis for a child's health, development, and continued existence. Exclusive breastfeeding protects infants from infections such as diarrhoea, pneumonia, and malnutrition, which are the leading causes of mortality in infants under five[1]. Exclusive breastfeeding can assist in attaining the 2030 Sustainable Development Goals (SDGs) for human health and prosperity[2]. According to the 2020 World Breastfeeding Week commemoration, breastfeeding is prudent for promoting global and societal health. The World Health Assembly (WHA) aims to attain at least 50% exclusive breastfeeding by 2025. UNICEF reports that only 38% of mothers exclusively breastfeed, and Indonesia has only reached 55% of its 80% goal. According to these statistics, infants in Indonesia are not exclusively breastfed. Decades of campaigns to advocate exclusive breastfeeding have yielded results below expectations. One of the most significant barriers to exclusive breastfeeding is the need for more excellent knowledge and assistance with breastfeeding management[3].

Breastfeeding is the most excellent option for infants up to six months after birth, as the mother's milk contains all essential nutrients. Suppose the mother receives family support, such as encouragement and assistance with domestic duties, breastfeeding will be more successful. Spending money on nutritious food for mothers is preferable to purchasing infant milk. Even malnourished mothers can typically breastfeed their offspring. Consequently, mothers should know they can produce high-quality breast milk for their infants[4,5].

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Due to an absence of social support, numerous breastfeeding mothers experience difficulty after giving birth, resulting in inconsistent breast milk supply for their infants[6]. Knowledge of mothers, motivation to breastfeed, lack of counselling services, absence of comprehensive breastfeeding campaigns, the role of medical personnel, working mothers, formula milk campaigns, mother attitudes, and family support all influence exclusive breastfeeding. According to one study, a low level of social support for breastfeeding mothers led to mothers not providing exclusive breastfeeding and discontinuing breastfeeding before the infant reached six months of age[7].

Information technology innovations are increasingly used as a medium for providing health services and promoting health, with mobile applications as one example. The effect of providing nutrition and food information through text messages is an increase in knowledge of diet and nutritional intake[8]. Android-based nutrition education media improve the comprehension, attitude, and practice of balanced nutrition among primary school children[910].

This study used a meta-analysis method to determine which social media platforms effectively promote complete breastfeeding success through nutrition education interventions. The objectives of this review were to determine which social media platforms are more effective in nutrition education interventions and to determine the effectiveness of the social media platform(s) to support and provide education about exclusive breastfeeding practices, thereby improving such practices.

METHODS

This meta-analysis utilised Scopus, PubMed, ScienceDirect, and Google Scholar databases. In September 2022, a literature search was conducted using text availability with free full text and the search terms “breastfeeding,” “social media,” and “smartphone.” The articles were selected based on PICO (Patient, Intervention, Comparison, and Outcome) eligibility criteria. This meta-analysis of expectant mothers who want to breastfeed, breastfeeding mothers, and mothers who have ceased breastfeeding and wish to restart included the research in the check for inclusion. The inclusion criteria include interventions that provide breastfeeding information and support to mothers through communication media or smartphones, such as the telephone, text message, social media, or other information technology media[11].

The research interventions were professional interventions about exclusive breastfeeding. This intervention directly contacted participants or breastfeeding mothers through the employed information systems. This article considers interventions such as providing breastfeeding mothers with support, information, and responses to their queries. In all interventions, interactions between the provider and the participant were required. Questions and conversation topics Breastfeeding issues, such as the signs an infant is feeding, how to position the nipple properly, and how to handle breast milk that does not come out, may be discussed. This educational intervention on exclusive breastfeeding satisfies the criteria for use in this article when administered to mothers with or without the participation of the father or other caregivers. The dependent variable was six months of exclusive breastfeeding. There were Indonesian and English study reports. Because it pertained to the potential use of information technology, research conducted before 2018 was precluded from this analysis. The selection of articles emphasises experimental and cluster-randomised studies. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart assisted with literature selection. STATA version 12 was used for data processing to calculate the effect magnitude and heterogeneity for the combined study and forest plot analysis. Figure 1 depicts the selection of articles for meta-analysis using the PRISMA diagram.

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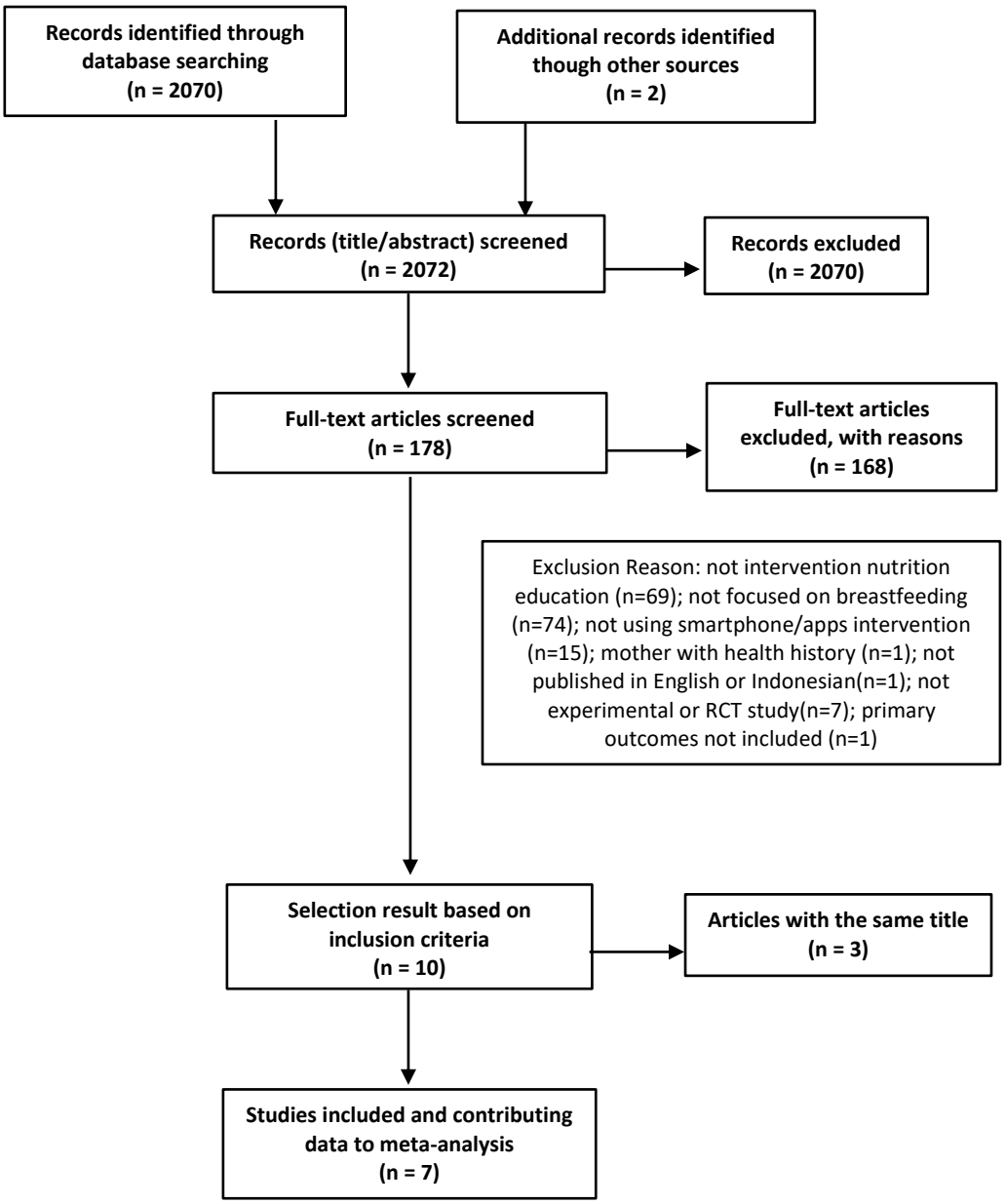

Figure 1. PRISMA Flowchart

RESULTS AND DISCUSSION

The results of the literature search were 2072 original records. Following the inspection of titles and abstracts, 178 articles satisfied the criteria for full-text review. This study discovered ten pieces that fulfilled the criteria and three with identical titles—reviewing papers that satisfied the requirements. This research determined that only seven studies fulfilled the inclusion criteria for the meta-analysis of the effect of nutrition education interventions to promote exclusive breastfeeding of infants for the first six months of life. From Table 1, seven characteristics of the articles selected for research in this study served as the data source for a meta-analysis to determine which social media platforms were effective in nutrition education interventions to promote exclusive breastfeeding success.

According to the forest plot analysis based on Figure 2, the average success rate of nutrition education interventions on the success of exclusive breastfeeding using a smartphone was 1.23 (7 studies), 95% CI (1.08 - 1.39), P = 0.000, and I2 = 97.1%. Thus, there is no correlation between smartphone-delivered nutritional education interventions and exclusive breastfeeding success. Archana Patel et al., 2018, with the platform used smartphone (weekly cell phone counselling and daily health promotional text message), found RR 3.49 (2.0-4.51)[12]. This study's findings were consistent with those of Alam., et al. (2017), who discovered a correlation between maternal and newborn care interventions delivered through text messages and handsets in Bangladesh[13]. Text message interventions could affect the healthcare practises of mothers and children. This was since sending text messages was a straightforward and inexpensive intervention that could reach all mobile

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phone owners. Even though the effect size was minor, the prospective health benefits were worthwhile[13].

Statistics from 2018 indicated that 49% of the population of Indonesia used social media, with 40% of the population being active WhatsApp users and 40% of WhatsApp users entering social media groups[14]. Smartphones are now extensively used for health interventions and by the general public. Smartphone interventions are more effective than traditional methods since they are less expensive and more feasible, and numerous smartphone users have the effect of reaching numerous people[15]. Smartphones are a promising method for addressing access, coverage, and equity issues in developing nations with limited resources[16]. Interventions employing text messages and phone calls are believed to promote behaviour and knowledge changes regarding pregnancy and health effectively[17]. Smartphone intervention is a promising solution for education and information dissemination, specifically for health-related topics that have the potential to significantly enhance individual and population health and well-being, such as maternal and reproductive health[18].

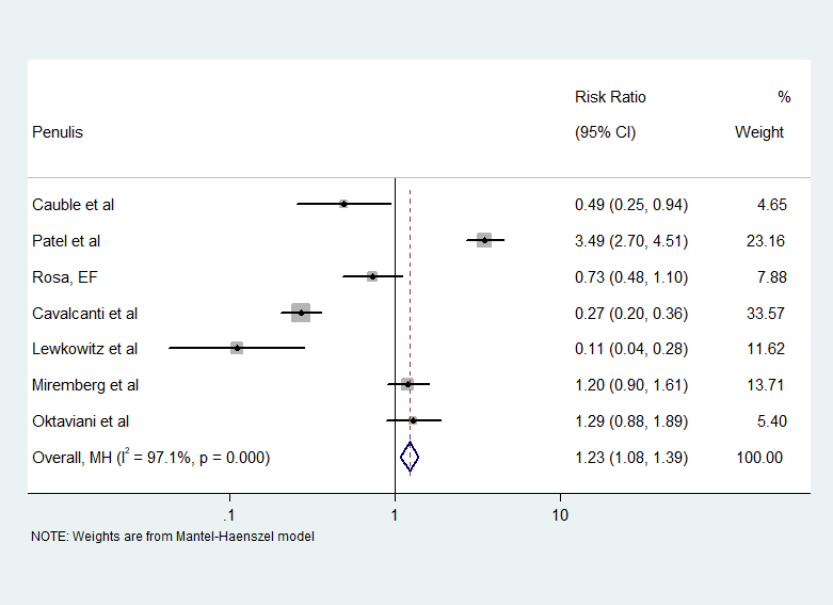

Figure 2. Forest Plot

Nutrition Education is the foundation for understanding and action in achieving optimal nutrition. It refers to planned and facilitated learning experiences in dietary practises and nutrition-related behaviours to promote health and well-being. This approach is centred on lifestyle and increases motivation to meet nutrition requirements—action-based methodology in nutrition education: social marketing, communication for behavioural change, community nutrition, and health promotion[19]. A mother is primarily responsible for parenting and providing for her child. Consequently, mothers must be knowledgeable about child health and nutrition, including breastfeeding, feeding infants and children, and the nutritional status of children. Therefore, a mother's knowledge of health and nutrition is crucial for the health and growth of her child[20].

Pregnant women who routinely receive prenatal care and breastfeeding counselling can better provide their infants with breast milk and complementary foods[21]. Using a cell phone or smartphone for counselling is more effective than residential visits or visits to a health center[22]. The increasing prevalence of devices and cell phones today makes it possible to promote health and alter the behaviour of mothers and their children[23]. Counselling can be provided through brief messages containing reminders and health promotion messages. Smartphone counselling can also assist in enhancing breastfeeding practices[12]. Mothers feel assisted and appreciate the nutrition education interventions conducted using this information technology; this is also related to how assistants provide information, the availability of professional staff who are always available to answer questions, and the availability of other breastfeeding-related information they require[24]. Information technology in the twenty-first century is an innovative, simple, and readily accessible method for nearly everyone. In this review, technological advances that facilitate information acquisition and encourage exclusive breastfeeding for infants up to six months greatly assist breastfeeding mothers[24].

In a study conducted by Patel et al. (2018), Cell Phones for Breastfeeding Counselling - A First Trial in India, it was determined that in the intervention group, the rate of exclusive breastfeeding reached 95%; on the other hand, in the control group, only 48.5% of infants received exclusive breastfeeding[12]. According to research conducted by Rosa (2022), providing breastfeeding counselling through Android during the COVID-19 pandemic resulted in a change in the exclusive breastfeeding practises of mothers[25]. Android-based breastfeeding counselling could increase breastfeeding knowledge and mothers confidence that breastfeeding was safe during the COVID-19 pandemic and dispel myths regarding breastfeeding practices. The developed

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electronic resource provided breastfeeding mothers with access to breastfeeding-related information. They provided information in a format other than text messages to address the queries and concerns of mothers regarding the increase and maintenance of adequate breast milk. The Indonesian nutrition directorate prioritises breastfeeding guidance during a pandemic by providing breastfeeding advice. During the COVID-19 pandemic, mothers were also advised to continue breastfeeding their infants; however, they were required to adhere to certain health protocols, such as donning masks, washing hands with soap and water, using hand sanitizer, and routinely sterilising breastfeeding equipment. Counselling was also provided through brief videos on breast care, breastfeeding, expressing and storing breast milk. According to one study, the intervention group received 3,3 times more exclusive breastfeeding than the control group. Therefore, utilising Android to provide breastfeeding education interventions was the correct course of action[25,26].

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Table 1. Characteristics of Included Studies

No	Author	Location	Study Design	Year	Study Characteristic
1.	Jennifer S. Cauble, et al[5]	Kansas City, USA	Randomized Controlled Trial	2021	• 41 samples (intervention group = 21 females; control group = 19 females) were analysed. • Inclusion Criteria: Pregnant women aged 18 to 35 were 9 to 30 weeks along in their pregnancies. • Education is provided once per week for six weeks as part of the intervention. The Acano Audio Conferencing System is utilised for education. A registered dietitian and an International Board Certified Breastfeeding Consultant teach each 60-minute course. Among the materials distributed to respondents were Basics of Breastfeeding, Pumping 101, Back to Work, Introduction to Complementary Foods, and Nutrition and Physical Activity for Breastfeeding. The control group received routine pregnancy and paediatric education from their healthcare provider, and no additional breastfeeding or nutrition education was provided.
2.	Archana Patel, et al[12]	Nagpur, India	Randomized Controlled Trial	2018	• 1036 pregnant women (intervention group = 518 women; control group = 518 women) • Inclusion Women with low socioeconomic status who were in their third trimester of pregnancy registered with the birthing clinic where they intend to give birth. They were willing to receive additional treatment until their infant was six months old. • Telephone consultations with a certified breastfeeding counsellor once weekly from the third trimester of pregnancy until the infant was six months old. The counsellor facilitated their care when the mother or infant was hospitalised due to illness. In addition to phone consultations, mothers received daily health and breastfeeding-related text messages.
3.	Eni Folendra Rosa[25]	Palembang, Indonesia	Randomized Controlled Trial	2022	• Sample: 100 Respondents (50 in the intervention and 50 in the control groups). The intervention group consisted of breastfeeding mothers from Public Health Centre of Sukaraya who could use smartphones and join the WhatsApp group during the study. In contrast, the control group consisted of breastfeeding mothers from Public Health Centre of Kemalaraja. • Inclusion criteria: mothers of 3- to 4-month-old infants who were not administered additional food. • The intervention provides breastfeeding counselling through an Android-specific WhatsApp Group. In the control group, breastfeeding information was only offered through pamphlets and no electronic follow-up counselling.
4.	Débora Silva Cavalcanti, et, al[24]	João Pessoa-PB Brazil	Single-Blind Randomized Clinical Trial	2018	• Each respondent received assistance from the perinatal period until the infant was six months old. The intervention group joined the Facebook group for Projecto Amamenta Mamae. The group's interventions were designed with infant education science in mind. Consequently, mothers would participate actively and critically in social media for up to 24 weeks.

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No	Author	Location	Study Design	Year	Study Characteristic
5.	Adam K. Lewkowitz, et al[26]	USA	Randomized Controlled Trial	2021	• Example: 87 first-time mothers (intervention group: 41 women, control group: 46 women). • Criteria for inclusion: First-time mothers • The intervention was administered through the BFF smartphone application. This application provided mothers with education to expand their knowledge. The app discussed and facilitated interactive discussions regarding the difficulties of breastfeeding, the benefits of breastfeeding, the physiology of mothers after childbirth, optimising breastfeeding for working mothers, and how to correctly breastfeed.
6.	Hadas Miremberg, et al[27]	Israel	Randomized Controlled Trial	2021	• The sample consisted of 197 individuals (intervention group = 93; control group = 100). • Respondents must be between 18 -45, possess a smartphone, and exclusively breastfeed new mothers. • A postpartum nurse accompanied respondents to obtain breastfeeding instructions and a brief course on infant care. The control group only received standard treatment, and the intervention group received the usual care and a web application installed on their devices. The intervention group accessed to the application for six months and could utilise it for communication. In addition, there was information about breastfeeding and prospective difficulties that may arise after childbirth.
7.	Oktaviani, et al.[28]	Palangkaraya, Indonesia	Quasi-Experimental	2021	• 60 pregnant women (30 in the ASI-Mobile app group and 30 in the control group). • Inclusion criterian: pregnant women in Jekan Raya during their third trimester • The intervention group received the ASI-Mobile application; on the other hand, the control group received traditional breastfeeding counselling.

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Table 2. Summary of the Included Studies

No	Author	Platform	Primary Outcome(s)	Secondary Outcome(s)
1.	Jennifer S. Cauble, et al[5]	Smartphone	In the intervention group, only 31.6% of infants were exclusively breastfed until six months, compared to 31.8% in the control group (p = 0.97).	94.7 % of women in the control group and 73.7 % in the intervention group received breastfeeding care and support from the hospital during the postpartum period. Breastfeeding experts provided breastfeeding support, with 36.8% receiving standard care and 63.2% receiving intervention. 5.3% of women in the control and intervention groups had a postpartum gynaecological examination. In the intervention group, 10.5% of mothers, infants, and their children received WIC health exams; on the other hand, none did in the control group.
2.	Archana Patel, et al[12]	Smartphone	48.5% of infants in the control group were exclusively breastfed, compared to 97.3% in the intervention group. The odds ratio for the intervention group is 6.30 (95% CI: 4.93 to 8.03).	Due to the following factors, mothers did not breastfeed their infants: the availability of alternatives to breast milk (p<0.001), mothers' perceptions of the quantity of milk they secreted (p<0.001), and doctors recommendations to give formula milk (p<0.001). As a result of being healthier, infants in the intervention group were less likely to be hospitalised (p<0.01), and their weight gain was more significant in the intervention group than in the control group (p = 0.87).
3.	Eni Folendra Rosa[25]	Social media (Whatsapp)	The intervention group exclusively breastfed 2.06 times more infants than the control group (p = 0.00).	The group that received exclusive breastfeeding acquired more excellent knowledge (24.25) than those that did not (15.25). Consequently, a relationship existed between the mother's knowledge and complete breastfeeding (p = 0.00). Women from higher-income families were 1.94 times more likely to breastfeed exclusively than women from lower-income families (p = 0.001).
4.	Débora Silva Cavalcanti, et, al[24]	Social media (Facebook)	After six months, 33.3% of the intervention group and 8.2% of the control group were exclusively breastfeedings (P<0.001).	Until the age of six months, infants in the control group were more frequently ill than those in the intervention group (P<0.0001). Exclusive breastfeeding for the first six months of a child's life had an infant protection factor of 65 %.
5.	Adam K. Lewkowitz, et al[26]	Social media (Novel Smartphone Application-BFF)	The intervention group received exclusive breastfeeding for up to six months after delivery at a rate of 13.8%; on the other hand, the control group received exclusive breastfeeding at 17.8% (p = 0.06, RR = 0.77).	This study also examined early breastfeeding initiation, formula feeding, breastfeeding up to six months of age, breastfeeding challenges, and the function and support of breastfeeding at home and in the hospital, and breastfeeding challenges.
6.	Hadas Miremberg, et al.[27]	Smartphone	The intervention group (59.8%) and the control group (49%) did not differ significantly. (p value 0.775).	In the first two weeks after delivery, there was no difference between the two groups regarding exclusive breastfeeding. By the sixth week, the intervention group breastfed significantly more infants than the control group (96.9% versus 82.0%; P<0.001). In the first three months following delivery, the intervention group breastfed their infants more exclusively than the control group (81.4% vs

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No	Author	Platform	Primary Outcome(s)	Secondary Outcome(s)
				69.0%; P=0.049).
7.	Oktaviani, et al[28]	ASI-Mobile Android-Based App	Thirteen of thirty (21.7%) mothers in the control group exclusively breastfed their infants. In the intervention group, 36.7% (22 of 30) of mothers exclusively breastfed their infants (P = 0.018).	The average score before and after counselling did not differ significantly, and the mother's attitude could be significantly improved by counselling. The mother's attitude differed significantly before and after the intervention with the ASI-Mobile application. The intervention group had a higher average attitude score than the control group when using the ASI-Mobile application.

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Education on breastfeeding before or after delivery can increase exclusive breastfeeding by six times compared to mothers who did not receive education[29]. The increased rate of exclusive breastfeeding was correlated with the frequency with which lactating mothers were supported by daily text messages and weekly counselling from counsellors. Support from breastfeeding counsellors improved breastfeeding to acquire accurate medical information; breastfeeding counsellors also offered advice to mothers who experienced pain. Active participation in breastfeeding support groups could increase self-confidence and provide emotional support by inviting breastfeeding mothers to access online support groups for breastfeeding information. Therefore, breastfeeding mothers should join online support communities in the pandemic era. There were advantages and disadvantages to mother's education on giving and knowledge of exclusive breastfeeding. In addition, research indicated that the higher a mother's education level, the better she understands exclusive breastfeeding. According to other researchers, a mother's education positively affected complete breastfeeding, with mothers with higher levels of education more likely to breastfeed exclusively[30,31]. Another study found that mothers with a high level of education were 5,2 times more likely to breastfeed their infants exclusively than mothers with a low education[32].

A separate study conducted by Miremberg., et al (2022) determined that nutrition education interventions related to breastfeeding success in postpartum care using smartphone-based information technology media increased at 6 weeks and 3 months postpartum[27]. This application for smartphones was stated to have satisfied and aided 97 patients who participated in this study. Instructions on nutrition Breastfeeding enables women to recover and become healthier rapidly after childbirth, and it may assist women in regaining their weight before pregnancy. In postpartum women, it also reduces the risk of post-natal depression, type-2 diabetes, metabolic disease, breast cancer, and ovarian cancer. According to numerous studies, breastfeeding exclusively for the first six months after birth has multiple health benefits for both the mother and the infant. Unfortunately, worldwide breastfeeding rates, particularly exclusive breastfeeding, remained relatively low and suboptimal[33]. The family, particularly the father, was essential to the success of complete breastfeeding. The study's findings demonstrated that breastfeeding information was not only intended for the mother, the father or spouse also played a crucial role in providing exclusive breastfeeding to infants up to six months of age[34]. According to the findings of a study on the part of fathers in the success of exclusive breastfeeding, a father required immediate and easy access to information and access to health professionals for consultations, which could be obtained through a smartphone. In addition, as the head of the household, the father was accountable for his child's nutrition and health; thus, he must aid remind his wife about exclusive breastfeeding and matter else related[27].

CONCLUSIONS

The studies included in the present review indicated that smartphone-based nutrition education interventions could enhance breastfeeding exclusively among mothers by providing online counselling, including the delivery of reminders and health promotion through text messages. These also allowed mothers to interact with others who practise breastfeeding exclusively, enabling them to develop support networks and promote breastfeeding to a larger community. This review also indicated that nutrition intervention using a smartphone is the most effective strategy to encourage mothers to breastfeed exclusively, as it could enhance breastfeeding practises through counselling using smartphones, allowing for earlier detection of breastfeeding-related issues. In addition, this review suggests that promoting breastfeeding exclusively among pregnant women can be accomplished through smartphones, particularly during large-scale restriction periods or when the mother must be at home. Additionally, mothers have flexible access to information and assistance regarding exclusive breastfeeding.

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