SYSTEMATIC REVIEW

Identifying the Characteristics of Technology-Based Educational Interventions and Their Impact on Mothers' Breastfeeding Self-Efficacy

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ABSTRACT

This review aims to identify the features of technology-based educational interventions and their effects on breastfeeding self-efficacy among mothers. Peer-reviewed articles published in Persian and English between 2015 and 2024 were collected. Various types of studies, including clinical trials, descriptive studies, mixed-methods research, and quasi-experimental studies (with or without blinding), were included. Databases such as Google Scholar, ScienceDirect, PubMed, Scopus, and domestic (Iranian) databases were searched using keywords like "breastfeeding," "educational technology," and "nursing mother." Out of 2,233 initially retrieved articles, 20 met the inclusion criteria, involving a total of 2,719 participants. Key variables examined included the type of technology used, delivery methods, and measured outcomes. The primary outcome assessed was mothers' breastfeeding self-efficacy, with major variables being intervention duration and breastfeeding self-efficacy. The findings indicate that interventions combining education with ongoing maternal support are the most effective technology-based approaches. While such interventions were widely implemented through mobile applications, maternal support was more prominent in interventions delivered via social networks and telephone follow-ups.

Keywords: Breast Feeding, Mobile Applications, Telemedicine, mHealth, Self Efficacy

INTRODUCTION

Breastfeeding plays a vital role in the survival, growth, and health improvement of both mothers and infants, offering significant benefits to their overall well-being. In addition to its health advantages, breastfeeding is also a cost-effective practice (1). The United Nations Children's Fund (UNICEF) and the World Health Organization (WHO) recognize breastfeeding as the most influential factor in maternal and child health (2).

Infants who are not breastfed face a higher risk of infectious diseases (e.g., respiratory, urinary, and gastrointestinal infections), Sudden Infant Death Syndrome (SIDS), and necrotizing enterocolitis (NEC). They are also more susceptible to childhood obesity, diabetes, and leukemia (3). While multiple factors may contribute to early weaning, evidence suggests that for many mothers, weaning is often involuntary (3, 4).

One of the most well-established risk factors for involuntary weaning is low breastfeeding Self-Efficacy (BSE) in mothers (4). In 1999, the U.S. National Library of Medicine (NIH) classified self-efficacy as a subset of personal development and a secondary component of self-acceptance. Self-efficacy is also considered a prerequisite for effective self-care (5).

Bandura's Social Cognitive Theory posits that self-efficacy influences motivation and the ability to engage in self-care behaviors, making it a key psychosocial determinant of such behaviors (6). Self-efficacy, often regarded as a branch of self-confidence, originates from

four primary sources: Mastery experiences (personal accomplishments), Vicarious experiences (observational learning), Verbal persuasion (encouragement from others), and Physiological/emotional states (7).

Some theories also incorporate an individual's self-perception into these sources, suggesting that people unconsciously influence their own inclinations based on their behaviors and emotional states.

In the context of breastfeeding, self-efficacy refers to a mother's confidence in her ability to breastfeed successfully, shaped by her expectations, knowledge, and perceived competence (4). Given that initiating and sustaining exclusive breastfeeding is influenced by biological, environmental, socio-cultural, and psychosocial factors, self-efficacy—a modifiable psychosocial factor—can be improved through targeted interventions (7).

Studies indicate that higher maternal confidence in breastfeeding is associated with longer breastfeeding durations. Consequently, given the malleable nature of self-efficacy, healthcare professionals should prioritize interventions that enhance this trait in women during the prenatal and postpartum periods (8). Additionally, studies suggest that technology-driven health interventions can lead to long-term behavioral changes, including enhanced breastfeeding practices (9). The broad domain of health technology encompasses diverse tools, including computer-based systems, software solutions, and advanced platforms that leverage cloud computing, the Internet of Things (IoT), artificial intelligence (AI), blockchain, and big data analytics (10).

Multiple technologies are employed in healthcare delivery, including mobile health (mHealth) applications, web-based platforms, short message service (SMS), social media networks, and basic telephonic support (even at rudimentary levels) (10, 11). By 2022, an estimated 60% of the global population used the internet, while 73% of individuals aged 10 and above owned a smartphone (12). With advancements in information and communication technology (ICT), traditional SMS has become obsolete, replaced by multimedia formats (e.g., voice messages, video calls, images) shared via smartphone communication apps (12). The widespread adoption of smartphones has spurred research into their potential for delivering health services (12–14).

To improve exclusive breastfeeding (EBF) rates, technology-based interventions (e.g., e-learning, mHealth apps) are now prioritized over traditional breastfeeding education. Researchers suggest that internet-based tools and mHealth solutions represent a progressive step toward enhancing maternal breastfeeding awareness (15). Evidence confirms that electronic educational interventions (e.g., web platforms, mobile apps) positively impact breastfeeding behaviors and outcomes (15, 16).

Globally, only 38% of infants under 6 months are exclusively breastfed, falling short of the 2050 target of 50% (17). This gap underscores the urgent need for technology-aided strategies to address early weaning, maternal reluctance to breastfeed, and psychosocial barriers (e.g., low self-efficacy) (7).

Multiple technology-based interventions have been employed to improve maternal breastfeeding self-efficacy and exclusive breastfeeding (EBF) rates. These include online educational workshops, distribution of instructional materials through messaging applications, telephone consultations, and similar digital approaches. Among these, mobile health (mHealth) solutions utilizing smartphones have emerged as particularly prevalent and effective tools for promoting breastfeeding. Concurrently, web-based demonstrations

and video-assisted breastfeeding education programs are increasingly being adopted and are strongly recommended in clinical guidelines (18).

Comparative effectiveness studies indicate that technology-mediated interventions yield superior long-term outcomes compared to traditional in-person interventions conducted by specialists (19). These technological approaches demonstrate significant benefits across multiple dimensions: they enhance maternal knowledge and awareness of breastfeeding, improve initiation rates, and prolong breastfeeding duration.

This systematic review aimed to achieve three primary objectives first, to identify the characteristic features of various technology-based educational interventions; second, to evaluate their impact on maternal breastfeeding self-efficacy; and third, to synthesize existing evidence to determine the optimal technology-delivered education approach for improving breastfeeding self-efficacy. The ultimate goal is to establish evidence-based recommendations for implementing technological solutions that can effectively support and sustain breastfeeding practices among mothers.

METHODS

This systematic review examined both domestic and international databases, including Iranian sources (SID, MagIran, Irandoc, Civilica) and global databases (Google Scholar, ScienceDirect, PubMed, Scopus, Cochrane Database of Systematic Reviews). The search extended to specialized digital health journals (JMIR), IEEE/ACM technical publications, grey literature from WHO/UNICEF, and trial registries (WHO ICTRP, ClinicalTrials.gov).

The review incorporated various study designs (clinical trials, descriptive studies, mixed-methods, quasi-experimental studies) published in peer-reviewed English or Persian journals between 2015 and 2024. We included all technology-assisted educational interventions, regardless of delivery method, but excluded app-based studies without proper evaluation, parent-focused interventions, gamification approaches, studies targeting specific comorbidities where continuous care was the primary focus, and studies with dual parental involvement as key participants. The selection process intentionally excluded gaming elements and special population studies to maintain focus on direct maternal education interventions.

Studies were excluded if they evaluated app-based interventions without a proper app assessment, involved parents as primary participants in the intervention, utilized gamification approaches, focused on specific comorbid conditions where continuous care was the primary intervention, or had dual parental involvement as key study participants

The included studies featured pregnant women or postpartum mothers as participants, with no restrictions imposed regarding occupational status, ethnicity, nationality, age, parity, or socioeconomic status. All enrolled women had previously expressed an intention to breastfeed. Notably, studies involving both mothers and fathers (parents) as intervention participants were included, provided maternal outcomes were reported separately in the results (Figure 1).

The research question was systematically analyzed to identify core keywords. Through consultation with the MeSH (Medical Subject Headings) database on the National Library

of Medicine website, synonymous and related terms were extracted and selected to construct a comprehensive search strategy (Table 1).

This study received ethical approvals from the Ethics Research Committee of Ahvaz Jundishapur University of Medical Sciences with code IR.AJUMS.REC.1402.64.

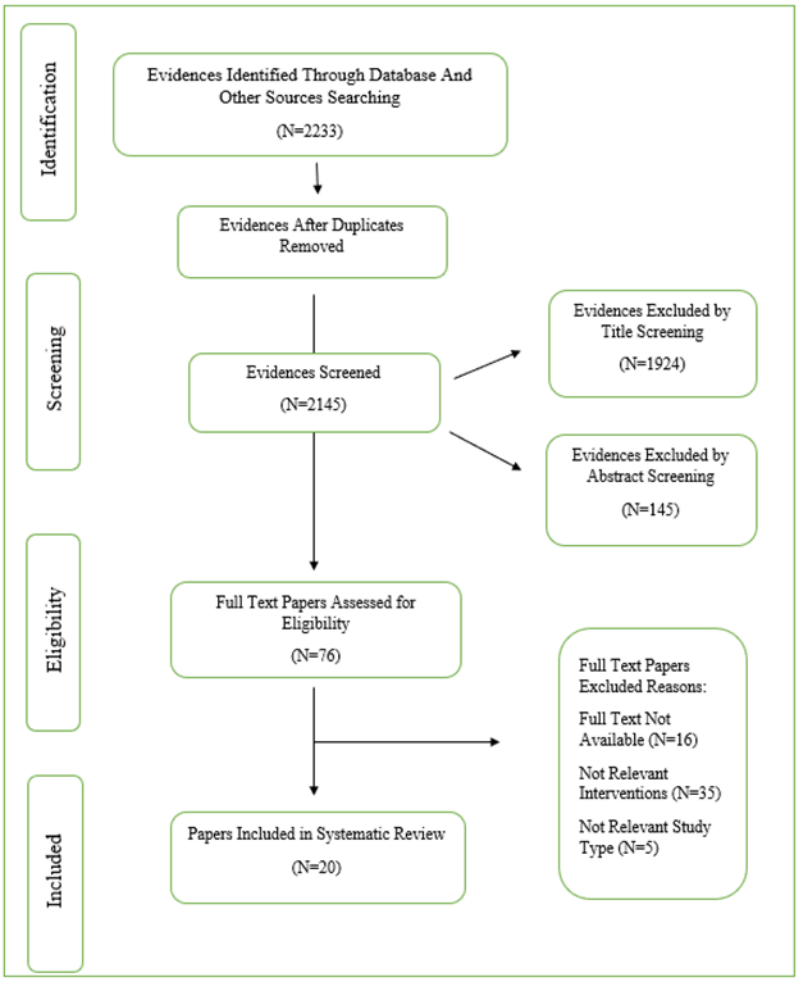

FIGURE I. FLOW DIAGRAM OF THE SYSTEMATIC REVIEW

TABLE II. SEARCH QUERY

#1	(Education OR curriculum OR teaching OR training OR Educational Technic* OR Educational Technique* OR Academic Training OR Training Activity* OR Training Technic* OR Training Technique* OR "Teaching Method*)
#2	(Technology*OR Educational Technology* OR Instructional Technology*)
#3	Intervention
#4	("Breast Fed" OR "Breastfeeding" OR "Breastfed" OR "Exclusive Breast Feeding" OR "nursing mother*" OR "Exclusive Breastfeeding" OR "Wet Nursing" OR "Milk Sharing "OR Breastfeeding promotion)
#5	Self-efficacy
#6	(HIV OR Smoke OR diabetes OR alcohol OR obesity OR premature OR vaccination OR weight loss OR physical activity OR Chemotherapy OR disease OR autism)

RESULTS

The systematic search initially identified 2,233 potentially relevant articles. Following duplicate removal, 2,145 records underwent rigorous title and abstract screening, from which 76 studies met preliminary eligibility criteria. During full-text review, 46 articles were subsequently excluded—6 due to unavailability of complete texts, 35 for non-alignment with intervention/outcome parameters, and 5 for incompatible study designs—resulting in 20 studies qualifying for final inclusion (Figure 1). Turning to study characteristics, these selected articles encompassed a total of 2,719 participants, with interventions administered variably during either the antenatal or postnatal periods. Of particular theoretical significance, only three studies explicitly grounded their methodology in established frameworks: Watson's Human Caring Theory (20), Pender's Health Promotion Model (21), and Community Empowerment Theory (22). However, when examining implementation details, these studies provided insufficient documentation regarding how these theories specifically informed intervention design or modulated breastfeeding self-efficacy outcomes—a critical limitation that will be further explored in the discussion of methodological gaps.

The studies were initially categorized according to country of origin, study setting, sample size, measured outcomes, intervention duration, and use of theoretical frameworks (Table 2). Subsequently, the interventions were classified into four main technological categories: electronic visits, web-based interventions (21, 23), social media platforms (20, 24-28), and mobile health applications (29-32).

Notably, interventions utilizing telephone calls (22, 33-35), SMS/text messaging (36), and video calls (37-39) were grouped under the category of electronic visits. Although SMS and telephone-based interventions represent more basic technologies, they were included in this review due to their widespread availability and ease of use, factors that contribute significantly to their practical implementation in clinical settings. This classification system enables a comprehensive comparison of intervention effectiveness

across varying levels of technological sophistication, while also considering accessibility factors.

TABLE II. CHARACTERISTICS OF TECHNOLOGY-ASSISTED INTERVENTIONS AND DELIVERY METHODS

Mode of technology delivery	*Study reference*	*Country*	*Study design*	*sample size*	*Outcome measure*	*Theoretical framework*	*Duration*
Social network	Fan, H. S. L., et al. (2022).[24]	China	RCT	33	IIFAS BFSE_SF	NR	*6 months Postpartum*
	Rafieyan-Kopaei, Z., et al. (2019). [27]	Iran	RCT	96	KAP BFSE_SF	NR	*4-6 months Postpartum*
	Martinez-Brockman, J. L., et al. (2018).[25]	Spain	RCT	130	EBF	NR	*2 weeks Postpartum*
	Uzunçakmak, T., et al. (2022). [28]	Turkey	RCT	68	BFSE_SF	NR	*6 months Postpartum*
	Sari Ozturk, C. and K. Demir (2023).[20]	Turkey	RCT	66	BFSE_SF	Watson's theory of human care	*32-37 gestational week till 2 months postpartum*
	Mohamad Pilus, F., et al. (2022). [26]	Malaysia	Cluster RCT	172	BFSE_SF KAP IIFAS	NR	*Pregnant till 8 weeks postpartum*
	Peiris, D. R., et al. (2023). [36]	Sri lanka	Before /after	720	KAP BFSE_SF	NR	*4 weeks postpartum*
Mobile health	Seddighi, A., et al. (2022). [31]	Iran	RCT	198	BFSE_SF	NR	*8 weeks postpartum*
	Karaçay Yıkar, S. and E. Nazik (2024). [30]	Turkey	RCT	75	BFSE_SF	NR	*7 weeks*
	Henshaw, E., et al. (2024).[29]	US	RCT	62	BFSE_SF	NR	*6 weeks till 6 months*
	Seyyedi, N., et al. (2021). [32]	Iran	RCT	40	KAP BFSE_SF	NR	*3 months*
Web-based	Abuidhail, J., et al. (2019).[23]	Jordan	RCT	112	IIFAS BFSE_SF	NR	*2 weeks (third trimester pregnancy)*
	Sari, C. and N. Altay (2020). [21]	Turkey	RCT	71	BFSE	Pender's health promote model	*32-37 gestational week till 3 months postpartum*
E-visit	Maslowsky, J., et al. (2016). [35]	Ecuador	Prospective evaluation	178	EBF	NR	*3months*

Chaves, A. F. L., et al. (2019).[33]	Brazil	RCT	132	BFSE_SF duration EBF	NR	*4 months*
Dodou, H. D., et al. (2021).[34]	Brazil	RCT	240	BFSE_SF	NR	*150days postpartum*
Harris-Luna, M. L. and L. K. Badr (2018).[22]	Portland	RCT	61	EBF BFSE_SF	Community empowerment	*12 weeks*
Wong, M. S. and W. T. Chien (2023).[39]	China	RCT	40	BFSE Depression	NR	*2 months*
Akyıldız, D. and B. Bay (2023).[37]	Turkey	RCT	72	BFSE	NR	*1 month*
Metin, A. and N. Baltacı (2024).	Turkey	RCT	80	BFSE_SF Depression	NR	*3 weeks (pregnant woman)*
Peiris, D. R., et al. (2023). [36]	Sri lanka	Before /after	720	KAP BFSE_SF	NR	*4 weeks postpartum*

The primary outcome assessed across the studies was maternal breastfeeding self-efficacy, aligning with the core objective of this review (Figure 2). In addition, several secondary outcomes were examined in select studies, including knowledge, Attitude, and Practice (KAP) scores, exclusive breastfeeding (EBF) rates, duration of breastfeeding, Edinburgh Postnatal Depression Scale (EPDS) scores, and Iowa Infant Feeding Attitude Scale (IIFAS) scores.

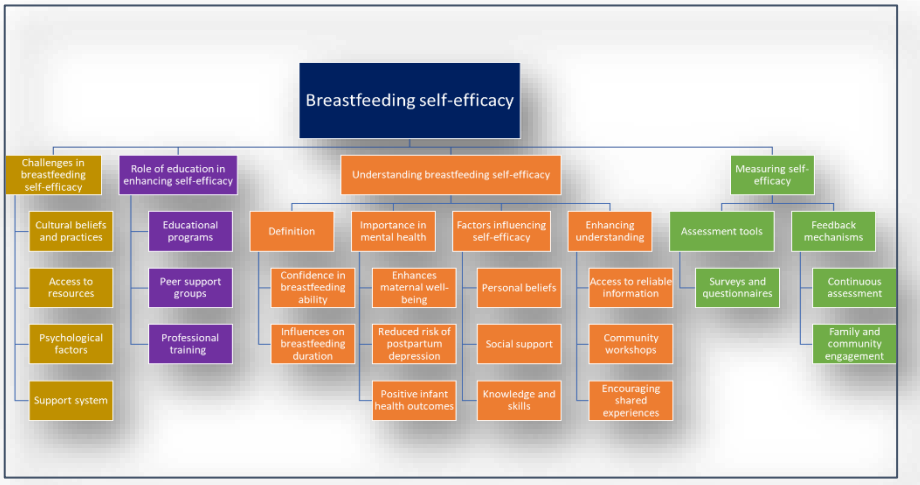

FIGURE IIII. BREASTFEEDING AND SELF-EFFICACY MIND MAP

These secondary measures were systematically documented and analyzed (Table 3), ensuring a comprehensive evaluation of intervention effects beyond self-efficacy alone.

TABLE III. NUMBER OF STUDIES BASED ON TECHNOLOGY

Outcome Measure	Total (N=20)	Any Platform (WhatsApp)	Text Message	Mobile Application	Web-Based	Telephone	Video Call
Breastfeeding Self-Efficacy	18	5	1	4	2	3	3
Exclusive Breastfeeding	4	1	NR	NR	NR	3	NR
Breastfeeding Duration	1	NR	NR	1	NR	NR	NR
KAP	4	2	1	1	NR	NR	NR
IIFAS	3	2	NR	NR	1	NR	NR
EPDS	2	NR	NR	NR	NR	NR	2

The review identified four studies utilizing telephone-based electronic visits (22,33-35), with three examining maternal breastfeeding self-efficacy (22,33,34) and three assessing exclusive breastfeeding (EBF) rates (22,34,35). A clinical trial with 61 participants (22) demonstrated significant improvements in both outcomes after 12 weeks, with maternal self-efficacy increasing by 3.24 points (95% CI [1.05, 3.24], $p<0.04$) and EBF rates showing an odds ratio of 11.46 (95% CI [1.01, 11.46], $p<0.04$). Contrasting results emerged regarding EBF sustainability: while Maslowsky et al.'s 178-participant trial (35) reported that 86.7% (65/75) maintained EBF at 3 months, another study (33) found no significant EBF differences at 2-month ($p = 0.983$) or 4-month ($p = 0.573$) follow-ups, despite improvements in self-efficacy.

The largest study by Doudou et al. (34) ($N = 240$) confirmed the robust benefits of self-efficacy, with the intervention group achieving significantly higher median scores than the control group after 6 months ($p < 0.001$). These findings suggest that telephone interventions consistently enhance self-efficacy, while EBF outcomes appear more variable, depending on the study design and follow-up duration. The observed effect size correlation with sample magnitude (strongest in studies with $n \geq 178$) (34,35) warrants consideration when interpreting the clinical utility of these technologies.

Four studies evaluated video-based support, with three demonstrating significant benefits. Akyıldız and Bay's RCT ($N=72$) (37) provided individual Zoom sessions for 2 weeks postpartum, yielding reduced maternal anxiety ($MD=47.72$, $p < 0.001$) and improved self-efficacy ($MD=10.1$, $p < 0.001$) at the 1-month follow-up. Metin and Baltacı (38) replicated these findings using group-based Google Meet/WhatsApp sessions (weekly for 3 weeks, $N = 80$), showing superior self-efficacy in the intervention group ($p < 0.000$). Conversely, Wong and Chien's underpowered trial (final $N = 30$) (39) reported non-significant outcomes after 2 months, potentially due to high attrition (from 40 to 30 participants).

A quasi-experimental study (36) delivered 19 educational text messages over 4 weeks to pregnant and breastfeeding women, demonstrating significant post-intervention improvements in both KAP scores (Knowledge, Attitude, Practice) and breastfeeding self-efficacy. The study reported 84% breastfeeding retention pre-intervention and 78% post-intervention retention.

Divergent outcomes emerged across two trials. Sari and Altay (21) implemented a Pender's Health Promotion Model-based website ($N = 71$) with four educational modules and telephone follow-ups, reporting significantly higher 3-month self-efficacy compared to controls ($p < 0.05$). In contrast, Abuidhail et al.'s 2-week trial ($N=112$) (23) found non-significant improvements in self-efficacy and no differences in IIFAS scores ($F(1,109)=0.243$, $p=0.62$, $\eta^2=0.002$), suggesting that intervention duration may moderate effectiveness.

Six studies (20,24-28) utilized popular platforms (WhatsApp, Telegram, Zoom) for breastfeeding education. While Martinez-Brockman et al. (25) reported hypothesized positive effects on exclusive breastfeeding (EBF) in their 2-week intervention, these results lacked statistical significance ($p = 0.50$), with similar non-significant findings at the 3-month follow-up. Contrastingly, Mohamad Pilus et al. and Sari Ozturk et al. (20,26) demonstrated significant self-efficacy improvements ($F(1,601)=111.73$, $p<0.001$; $p<0.05$ respectively) through 2-month WhatsApp/SMS educational programs, along with enhanced maternal knowledge ($F(21,601)=8.33$, $p<0.001$), though without significant behavioral changes ($F(21,602)=5.50$, $p=0.47$). Longer interventions (6-8 months) by Rafieyan-Kopaei et al. and Uzunçakmak et al. (27, 28) using WhatsApp, Telegram, and Soroush showed superior gains in self-efficacy. In contrast, Fan et al.'s (24) 6-month study found no significant differences in EBF, self-efficacy, or feeding behaviors.

All four app-based studies (29-32) yielded positive outcomes. Seddighi et al. (31) (8-week intervention) and Karaçay Yıkar et al. (30) (7-week intervention) reported substantial self-efficacy improvements ($r=-0.446$, $p=0.025$; 53.78 ± 12.61, $p<0.001$), respectively, though the latter found in-home care superior to app-based training ($p<0.05$) across three groups (control n=25, app n=25, home-care n=25). Longer interventions (3-6 months) by Henshaw et al. (29) and another study (32) showed delayed but significant self-efficacy gains (6-month: $M=3.69$, $SE=0.15$, 95%CI=3.39-3.99), with no early effects at 6 weeks ($F(1,61)=1.80$, $p=0.19$, $\eta p^2=0.03$) nor impact on maternal depression ($F(1,57)=0.00$, $p=0.99$).

The 20 included studies exhibited substantial variation in intervention duration, with effectiveness closely tied to the length of implementation. Short-term interventions (≤8 weeks), primarily app-based, have shown limited efficacy, often requiring extended follow-up to demonstrate significant effects. This is exemplified by one study, where outcomes only became apparent at 6 months, despite an 8-week program. Medium-length interventions (2-3 months), commonly used in social media-based studies, yielded mixed results, improving knowledge and self-efficacy but often failing to translate into behavioral changes in breastfeeding practices.

The most consistent benefits were observed in longer interventions (≥6 months), particularly those utilizing web-based platforms or sustained social media engagement. These programs produced stronger effect sizes, more durable exclusive breastfeeding (EBF) outcomes, and greater improvements in self-efficacy. A clear dose-response relationship was evident, with extended interventions correlating to better results. However, implementation quality (e.g., daily messaging vs. weekly sessions) also played a key role, independent of duration alone.

These findings suggest that while medium-length interventions may be sufficient for improving maternal knowledge and confidence, longer-term technological support appears necessary to achieve meaningful and lasting changes in breastfeeding behavior (Table 4 and Figure 3).

TABLE IV. DESCRIPTION OF STUDIES BASED ON INTERVENTION DURATION

Type of intervention	*Average of intervention duration*	*Number of studies included*	*Studies with significantly high results*
e-visit	10.3 weeks	8	75% (n=6)
Web-based	19 weeks	2	50%(n=2)
Social network	17 weeks	6	67%(n=4)
Mobile health	12.7 weeks	4	100%(n=4)

FIGURE IVII. INFOGRAPHIC OF BF AND BSF IMPROVEMENT INTERVENTIONS

DISCUSSION

This systematic review comprehensively evaluates the growing body of research on technology-assisted breastfeeding interventions, with particular focus on their efficacy in improving maternal breastfeeding self-efficacy (BSE) and promoting exclusive breastfeeding (EBF) practices. Our analysis of 20 selected studies reveals several critical insights about the current state of technological interventions in breastfeeding education and support.

The reviewed studies were systematically classified into four primary technological categories based on their delivery methods:

Electronic Visits (e-visits): This category encompassed telephone consultations (22, 33-35), SMS/text messaging (36), and video conferencing (37-39). Telephone-based interventions demonstrated particularly strong outcomes, likely due to their persistent follow-up protocols where healthcare consultants would repeatedly attempt contact until reaching participants (22,33-35). This persistence, combined with 24/7 availability for clinical referrals, resulted in significant improvements in both BSE and EBF rates.

Web-Based Platforms (21,23): These interventions showed excellent long-term retention of breastfeeding knowledge and practices. Their success can be attributed to several factors, including cross-device compatibility (accessible via computers, tablets, and smartphones), 24/7 availability, and the perceived credibility of official health websites. However, researchers consistently emphasize the need for rigorous content oversight to ensure the quality of information (42, 43).

Social Network Interventions (20,24-28): While these platforms showed promise due to their ubiquity and ease of use, their effectiveness was limited by several practical constraints. Internet accessibility issues, variable costs of data plans, and technological literacy barriers created significant disparities in access across different socioeconomic groups (24,28). Interestingly, one six-month social media intervention (24) failed to show significant improvements, suggesting that duration alone cannot compensate for implementation challenges.

Mobile Health Applications (29-32): These interventions stood out for their interactive features, including built-in video consultation capabilities, peer support forums, and personalized content delivery. However, their impact on postpartum depression was negligible (29), likely because their content focused primarily on breastfeeding education rather than comprehensive mental health support.

Our analysis identified three key factors that consistently predicted intervention success:

Duration and Persistence: Brief interventions (<1 month) uniformly failed to produce meaningful outcomes. Effective programs typically require 2-3 months of sustained engagement, with the most successful ones incorporating periodic booster sessions or ongoing support.

Personalization and Adaptability: Interventions that tailored content to individual needs and progress showed superior outcomes compared to standardized programs. This was particularly evident in mobile apps that allowed users to select relevant content and track personal progress (29-32).

Multimodal Delivery: The most effective programs combined multiple delivery methods (e.g., combining app-based education with periodic telephone follow-ups), creating multiple touchpoints for participant engagement.

Our analysis revealed several key limitations and gaps in the current research. First, while most interventions prioritized technological feasibility, only three studies explicitly grounded their approaches in established behavioral theories (e.g., Pender's Health Promotion Model), raising concerns about their potential to drive sustained behavioral change. Second, the reviewed studies predominantly originated from high-income countries with homogeneous populations, overlooking critical cultural adaptations despite evidence that cultural context significantly shapes breastfeeding practices. Third, sample characteristics were often narrow, with a focus on first-time mothers and small sample sizes (typically fewer than 100 participants), which limited insights into how parity influences feeding decisions and reduced generalizability. Finally, inconsistent outcome measures and assessment timelines hindered cross-study comparisons, which were further compounded by the infrequent use of standardized, validated tools for evaluating critical outcomes, such as breastfeeding self-efficacy. These gaps highlight the need for more theoretically rigorous, culturally inclusive, and methodologically consistent research in this field.

We outline key priorities for advancing research and intervention development in breastfeeding. First, future interventions should incorporate established behavioral theories, like Social Cognitive Theory or the Health Belief Model, to enhance impact. Second, cultural adaptation is crucial, especially in low- and middle-income countries, where breastfeeding challenges differ. Third, researchers should use standardized measures for breastfeeding outcomes and psychosocial factors at consistent time points for robust comparisons. Hybrid models that blend digital tools with personalized support should be further explored. Finally, extending follow-up periods beyond six months postpartum is essential to assess long-term effectiveness. Addressing these priorities will improve the applicability of future interventions.

CONCLUSION

This systematic review demonstrated that technology-assisted breastfeeding interventions have significant potential to improve maternal self-efficacy and breastfeeding outcomes, particularly when they incorporate personalized content, persistent support, and multimodal delivery. However, realizing this potential fully will require greater attention to theoretical foundations, cultural relevance, and rigorous outcome measurement. The most promising path forward appears to be hybrid models that combine the scalability of digital platforms with the personalization of human support, all grounded in established behavioral theories and adapted to local cultural contexts. As technology continues to evolve, so too must our approaches to designing and evaluating these interventions, always keeping sight of the ultimate goal: supporting mothers in providing optimal nutrition for their infants.

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Declaration of the Use of Artificial Intelligence Tools

The authors stated that they did not use any artificial intelligence tools in conducting this study and preparing this article. However, the following artificial intelligences have been used for paraphrasing and grammar checking: Deepseek, Grammarly, and Ahrefs AI.

Contributorship Statement

Author 1-2: Conceptualized the study, designed the methodology, supervised data collection, and critically revised the manuscript. Author 1: Performed formal analysis, curated data, visualized results, and wrote the original draft. Author 3: Contributed to investigation (e.g., recruitment, experiments), validated findings, and reviewed/edited the manuscript. Author 4: Provided resources, assisted in project administration, and approved the final version. All authors read and approved the submitted manuscript and agree to be accountable for all aspects of the work.

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The authors declared there are no conflicts of interest regarding the research, authorship, and publication of this article.

Data Availability Statements

The data will be made available by the corresponding author upon reasonable request.

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