

ORIGINAL RESEARCH ARTICLE

The effectiveness of an interactive digital-based educational program in improving breastfeeding knowledge, attitudes and self-efficacy among primiparous women in Egypt

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Abstract

Malnutrition is the main cause of two-thirds of deaths among Egyptian under five children, which could be due to reduced rates of breastfeeding, as it is one of the contributing factors. Breastfeeding is the optimal solution for health promotion to mothers and their infants. It has various benefits not only for the mother and infant but also for society. Breastfeeding educational programs are essential for the enhancement of knowledge and self-efficacy of new mothers, and to ensure a longer duration of breastfeeding. Therefore, this study aims to evaluate the effects of an interactive digital-based educational program about breastfeeding on the knowledge, attitudes, and self-efficacy of primiparous women in Egypt. A quasi-experimental study design was adopted. The study was held in Itay El-baroud maternal and child health center, whereby 120 pregnant women were purposively selected. Then, they were randomly assigned to either a study group (60) or control group (60). The derived data were statistically analysed using SPSS version 20, Pearson correlation coefficient, chi-square test and independent sample t test were utilized. Four tools were utilized for data collection. A statistically significant mean difference was found concerning total breastfeeding knowledge scores after one month and three months. The total attitude and self-efficacy scores showed highly statistically significant differences after one month and three months from the start of the program. Moreover, breastfeeding self-efficacy was found to be positively correlated with knowledge and attitude. In conclusion, the interactive digital-based educational program about breastfeeding was suggested to be effective in enhancing the knowledge, attitude and self-efficacy of the primiparous women, in combination with other health education activities. Therefore, it is recommended that web-based educational sites are created for first-time mothers. (*Afr J Reprod Health* 2022; 26[11]: 79-91).

Keywords: Breastfeeding, self-efficacy, digital-based, interactive, educational program, primiparous women

Résumé

La malnutrition est la principale cause des deux tiers des décès chez les enfants égyptiens de moins de cinq ans, ce qui pourrait être dû à la réduction des taux d'allaitement, car c'est l'un des facteurs contributifs. L'allaitement maternel est la solution optimale pour la promotion de la santé des mères et de leurs nourrissons. Il présente divers avantages non seulement pour la mère et l'enfant, mais aussi pour la société. Les programmes éducatifs sur l'allaitement maternel sont essentiels pour l'amélioration des connaissances et de l'auto-efficacité des nouvelles mères, et pour assurer une plus longue durée de l'allaitement. Par conséquent, cette étude vise à évaluer les effets d'un programme éducatif numérique interactif sur l'allaitement maternel sur les connaissances, les attitudes et l'auto-efficacité des femmes primipares en Égypte. Un plan d'étude quasi-expérimental a été adopté. L'étude s'est déroulée au centre de santé maternelle et infantile d'Itay El-baroud, au cours de laquelle 120 femmes enceintes ont été délibérément sélectionnées. Ensuite, ils ont été assignés au hasard à un groupe d'étude (60) ou à un groupe témoin (60). Les données dérivées ont été analysées statistiquement à l'aide de SPSS version 20, le coefficient de corrélation de Pearson, le test du chi carré et le test t d'échantillon indépendant ont été utilisés. Quatre outils ont été utilisés pour la collecte des données. Une différence moyenne statistiquement significative a été trouvée concernant les scores totaux de connaissance de l'allaitement maternel après un mois et trois mois. Les scores totaux d'attitude et d'auto-efficacité ont montré des différences statistiquement très significatives après un mois et trois mois après le début du programme. De plus, l'auto-efficacité de l'allaitement s'est avérée positivement corrélée avec les connaissances et l'attitude. En conclusion, le programme éducatif numérique interactif sur l'allaitement a été suggéré comme étant efficace pour améliorer les connaissances, l'attitude et l'auto-efficacité des femmes primipares, en combinaison avec d'autres activités d'éducation

Mots-clés: Allaitement, auto-efficacité, numérique, interactif, programme éducatif, femmes primipares

Introduction

Breastfeeding promotes health and well-being of not only mothers but also their children. Exclusive breastfed Infants are less prone to morbidity than those who are partially breastfed¹. However, supporting mothers to start and continue breastfeeding is a global challenge^{2,3}. Breastfeeding is regarded by The United Nations International Children's Emergency Fund (UNICEF) and the World Health Organization (WHO) as being essential for child growth and development. However, compared to the 2025 objectives of 50% ,only 38% of infants under six months are exclusively breastfed globally^{4,5}.

Breast feeding is regarded to be the gold standard of infant nutrition. Infants benefits from it in terms of survival, growth, and also it promote health and wellbeing of mothers⁶. It has been strongly encouraged for newborns due to its immunological properties, its role in gastrointestinal maturation and the establishment of the mother-child bond, and its contribution to better growth and development. Due to its facilitation of weight loss in mothers, reduction of uterine bleeding and decreased chance of breast cancer and osteoporosis, breastfeeding can also be advantageous to the mother⁷.

The risk of infectious diseases such as gastroenteritis, respiratory conditions, and middle ear infections is higher in infants who are not breastfed. They are also more likely to develop childhood diabetes, obesity, and dental conditions, which increase hospitalisation, morbidity, and mortality⁸. According to UNICEF research, 1,500,000 children die each year as a result of not being breastfed, and more than 3,000 children per day succumb to infectious infections brought on by bottle feeding⁸⁻¹¹.

At the individual, family, health system, and societal levels, a number of complicated factors can have an impact on whether or not a person decides to start and maintain breastfeeding. This covers factors such the mother's socioeconomic situation, age, education level,

health status, and access to resources for assistance, as well as ideas and attitudes towards breastfeeding and hospital practices like early discharge¹²⁻¹⁴. Breastfeeding difficulties can include lack of awareness about the health advantages of breastfeeding and lack of confidence in one's ability to breastfeed. Another crucial aspect is breastfeeding self-efficacy, which can be altered by using prenatal education and supporting measures¹⁵⁻¹⁷.

Breastfeeding self-efficacy which is defined as the mother's perceived ability to breastfeed her newborn, and it is a significant element in breastfeeding as it predicts if the mother will choose to breastfeed their children or not, the effort that she will spend in the process, how she will handle any self-defeating thoughts about it, and her response to the breastfeeding difficulties¹⁸. This means that if the mothers had a high level of self-efficacy, they are more likely to decide to breastfeed their babies and be able to handle any difficulties that they encountered. Literature has indicated that breastfeeding self-efficacy is positively correlated with breastfeeding success¹⁹⁻²². Therefore, investigating the breastfeeding self-efficacy of mothers is important. Nevertheless, there is limited research on it in Egypt.

Approaches for enhancing breast feeding initiation may target pregnant women, families, communities and society, or the health service^{8,23}. Educational programs to support and raise breastfeeding rates are significant and should be delivered before the first feed, for example, before or during pregnancy, or immediately after birth. The use of digital gadgets has become an important aspect of every daily life. Information and Communications Technology (ICT) is defined as 'digital technology utilized to capture, handle, store, and transmit information via electronic communication such as smart phones, WhatsApp, emails and Zoom applications. It may be suitable in changing conventional education and support into a service that is free and broadly available²⁴.

Community health nurses have a main role in improving the awareness of women about the

importance of breastfeeding, digital technology utilization could be a helpful tool for them in this direction^{25,26}. Conducting digital-based interactive educational programs to those mothers can be beneficial, which was supported by the literature²⁷⁻²⁹. For example, these can be undertaken in the community through home visits or in maternal and child health centers during pregnancy or early in the post-partum period. Increasing knowledge can improve women's attitudes and practices regarding breastfeeding. When women (especially primiparous women) know the benefits and importance of breastfeeding for them and their babies, they will start breastfeeding early after delivery and continue it for as long as possible¹⁷. Successful breastfeeding can be achieved by enhancing breastfeeding self-efficacy and intention. Educational interventions emphasizing breastfeeding can enhance the self-efficacy of the mothers to initiate and sustain breastfeeding practices^{8,22}. Research suggested that digital-based education or training has a positive impact on clients' self-efficacy, as it increases their knowledge and increases their self-confidence^{30,31}.

According to UNICEF, Egypt is one of a group of 36 countries that are responsible for 90% of global malnutrition. Malnutrition has been mentioned as the main reason of two-thirds of deaths among Egyptian under-five children, which could be due to reduced rates of breastfeeding, as it is one of the contributing factors. This was reflected in the high rates of iron deficiency anemia, wasting and stunting, among young children in the country. Breastfeeding is the optimal solution to promote the health and wellbeing of mothers and their infants. Health care provider should tailor training programs based on the knowledge and skills that primiparous pregnant women need to successfully breastfeed their children. According to WHO ICT increase access to information, which will improve healthcare services globally^{1,32,33}. Data indicate that in January (2022), 75.66 million, out of 105.2 million Egyptian population, were using the internet, which indicates that 71.9% of the population had access to the internet³⁴. In addition, the latest statistics from GSMA Intelligence highlighted that 93.4% of the total Egyptian population did have a mobile connection at the beginning of 2022³⁴. This suggests that providing health education through digital technology can be implemented in the

Egyptian context and that this type of intervention can have an impact on mothers that may be most in need of it.

Aim of the study

To evaluate the effect of an interactive digital-based educational program about breastfeeding on the knowledge, attitude and self-efficacy of primiparous women in Itay El-baroud, Egypt.

Research hypothesis

- Primipara women who receive a digital-based educational program will exhibit higher breastfeeding-related knowledge than those who are not.
- Primipara women who receive a digital-based educational program will exhibit higher breastfeeding self-efficacy than those who are not.
- Primipara women who receive a digital-based educational program will exhibit more positive attitudes toward breastfeeding than those who are not.

Methods

Design, setting and sample

A quasi-experimental design "pretest-posttest nonequivalent groups" was utilized to conduct the current study. The study was held in Itay El-baroud Maternal and Child Health (MCH) center due to it having the highest percentage of registered pregnant women in El-Beheira governorate. This MCH center was one of the main centers that provide antenatal care, postnatal care, and children care to the community. One hundred and twenty pregnant women were purposively selected from the center in a way that ensure maximum variation in the sample, with the following inclusion criteria: primiparous woman at 32 or more weeks of gestation, plan to breastfeed, had a smart phone and internet connection, willing to participate in the study, and did not previously attend any educational sessions about breastfeeding. After the initial selection, the pregnant women (120) was randomly assigned to either a study (60) or control group (60). The sample size for this study was computed using EPI info 7 software according to the average number of registered pregnant women

in Itay El-baroud maternal and child health center (300) (this represents the average number of pregnant women who visit the clinic every month), 50% expected frequency with an acceptable error of 5% and confidence limit of 95%. This resulted in a minimum requisite sample size of 105. The ultimate sample size was upgraded to 120 to compensate for the probable non-response.

In this study the educational program was developed by the researchers with the aim of improving the knowledge, self-efficacy and attitude of primiparous women toward breastfeeding. The content of the program was developed from recent literature and the latest WHO recommendations. The content of the program included: a definition of exclusive breastfeeding, the physiology of lactation, colostrum, advantageous of breastfeeding to the mother and the baby, breastfeeding techniques, the criteria of adequate breastfeeding, criteria of successful breastfeeding, different positions for breastfeeding, problems with breastfeeding (nipple problems, breast engorgement, scanty milk). Furthermore, various interactive digital methods were used, such as Zoom, WhatsApp, and email. After designation, the content was presented utilizing text, animated and fixed images, videos, and Power Point presentations. In order to facilitate daily communication with the experimental group and to deliver the Zoom meeting link on a day that worked for the entire group, the researchers also developed a WhatsApp group.

Instrumentation

In this study four tools were utilized to collect the required data: Tool (I): women's knowledge about breastfeeding. This tool was developed by the researchers based on the related literature and consisted of two parts: Part 1: socio-demographic characteristics and antenatal history. This part included age, level of education, residence, occupation, income, marital status, onset of antenatal care visits, number of antenatal care visits. Part 2: women's knowledge about breastfeeding. This consisted of 50 items about the advantages of breastfeeding to the mother and the baby, colostrum, general knowledge about breastfeeding, problems with breastfeeding (nipple problems, breast engorgement, management of scanty milk), breastfeeding technique, criteria for

adequate breastfeeding, criteria for successful breastfeeding. The correct answers were scored as follows: (1) correct answer, (0) incorrect or unknown answers. The total knowledge score was calculated and ranged from 0 to 50, and then further categorized into three levels: Poor knowledge < 50%, Fair knowledge 50% < 75%, Good knowledge \geq 75%. An additional question (not included in the total score) was added, which asked about sources of information about breastfeeding.

Tool (II): women's attitude toward breastfeeding. This tool was adopted from Iowa Infant Feeding Attitude Scale (IIFAS). It was adopted to assess the attitude of women toward breastfeeding³⁵. It included 17 statements, of which the respondents were asked to indicate the extent to which they agreed on a five-point Likert scale ranging from 1 = "strongly disagree" to 5 = "strongly agree". The IIFAS total score ranged from 17 to 85, where 17 and less was considered a bad attitude, 18-34 considered a neutral attitude and 35-85 considered a good attitude, with a higher score indicating a more positive attitude toward breastfeeding.

Tool (III): women's breastfeeding self-efficacy. This tool was adopted from the breastfeeding self-efficacy scale short form to assess the women's self-efficacy³⁶. It included 14 items, and each item was scored on a five-point Likert scale with 1 indicating not confident at all and 5 indicating always confident. The range of breastfeeding self-efficacy scores included a minimum of 14 to a maximum of 70. Scores from 14-32 showed weak self-efficacy, 33-51 showed average self-efficacy and 52-70 showed good self-efficacy.

Tool (IV): satisfaction with the interactive digital-based educational intervention scale. The researchers developed this scale to measure the respondent's satisfaction with the educational program from various dimensions. It included 10 items, and each item was rated on a five-point Likert scale: strongly disagree (1), disagree (2), neutral (3), agree (4) to strongly agree (5). The total scale scores ranged from 1 to 50 and were categorized into three levels: \leq 50% (\leq 25) = Dissatisfied, 51% < 75% (25 < 37.5) = Neutral, \geq 75% (\geq 37.5) = Satisfied.

Validity of the study tools were checked by a jury of five experts in the field and suggested modifications were undertaken. Reliability was

examined using the Cronbach Alpha test. This found Tool II: $r=0.88$, Tool III: $r=0.78$, Tool IV: $r=0.89$, which indicated an acceptable reliability. Furthermore, a pilot study was implemented whereby twelve primiparous women (not included in the sample) were piloted to ensure the clarity, feasibility, and applicability of the study tools and to determine obstacles that might hinder the data collection process. The necessary modifications were made according to the response.

Data collection

Data collection process lasted six months (February 2022 to July 2022). It commenced with a pre-test for both the experimental group and the control group to assess their knowledge, attitude and self-efficacy using tools I, II, and III in June 2021. The program was conducted over a period of two months for the experimental group only- by the researcher. Finally, the post-test evaluation of the program was performed after one month and three months using the same tools (tool I part 2, II, III, IV).

Initially, the researcher visited the study setting and explained the aim and the tools of the study to both the study and control group. The researchers interviewed the participants for the pre-test. Each interview took about 10-15 minutes. Then, the researchers took the phone number and the email address of each woman in the experimental group to follow them during the study and to solve any problems that might occur during program implementation.

In the program implementation phase of this study, the researchers scheduled Zoom meetings with the experimental group of two sessions per week for seven consecutive weeks to explain the program content. Additionally, the content of the program was sent to the women through WhatsApp and emails. A daily short health message about breastfeeding was sent to the women via WhatsApp, and the researchers were available all day to answer the women's questions to ensure interactive learning. At the end, evaluations of the program were performed after one month and three months of the program completion using the same tools utilized in the pre-test, and the satisfaction of the experimental group with the program was measured at the end of the program using tool IV. In comparison, the control

group gets the usual care in the clinic, which means that they did not get regular health education sessions, only the nurses answer their questions about breastfeeding, if they have any.

Data analysis

The collected data were coded, organized, tabulated and statistically analyzed using (Statistical Package for Social Studies) SPSS version 20. The level of significance selected for this study was adopted at $P \leq 0.05$. The following statistical measures were used:

- Descriptive: number, percentage, mean, and standard deviation.
- Inferential: Pearson correlation coefficient was utilized to appraise the correlation between two proportions, chi-square test was used to compare between the two groups and independent sample t-test was utilized to show the mean change's significance before and after the program.

Results

The distribution of the studied sample according to their socio-demographic characteristics and antenatal history are highlighted in Table 1. This reveals an absence of statistically significant differences between the study and the control group concerning their socio-demographic characteristics and antenatal history. The mean age among the experimental group was (23.89 ± 1.5) and the control group was (24.79 ± 1.48) . More than half (60%, 68.3%) of the study and control groups were highly educated. Additionally, both groups did not have enough income. Moreover, more than three quarters of the experimental group and more than half of the control group respectively (78.3%, 58.3%) were urban residents. Furthermore, the majority of the experimental group (91.7%) and the control group (85%) were working. It is evident from the table that more than three quarters of both groups (86.7%, 81.7%) were married. Concerning antenatal care visits, the table revealed that slightly more than three quarters (76.7%) of the experimental group and slightly less than two thirds (65%) of the control group started antenatal care visits in the first trimester. Meanwhile, more than three quarters (85%) of the experimental group and slightly less than three quarters (73.3%)

Table 1: The participants' socio-demographic characteristics and antenatal history

Categories	Experimental group (n =60)		Control group (n =60)		Test of Significance
	No.	%	No.	%	
Age in years					
Mean ± SD	23.89±1.5		24.79 ±1.48		t=0.508 P=0.612
Level of education					
Secondary education	24	40	19	31.7	X ² =0.608
University education	36	60	41	68.3	P=0.417
Family income					
Enough	0	0.0	0	0.0	X ² =0.000
Not enough	60	100	60	100	P=1.000
Place of residence					
Rural	13	21.7	25	41.7	X ² =0.877
Urban	47	78.3	35	58.3	P=0.831
Occupation					
Working	55	91.7	51	85	X ² =0.523
Non-working	5	8.3	9	15	P=0.770
Marital status					
Married	52	86.7	49	81.7	X ² =0.255
Widow	1	1.7	2	3.3	P=0.606
Divorced	7	11.6	9	15	
Onset of antenatal care visits					
1st trimester	46	76.7	39	65	X ² =0.523
2nd trimester	5	8.3	5	8.3	P=0.778
3rd trimester	9	15	16	26.7	
Number of antenatal care visits					
< 4 times	9	15	16	26.7	X ² =0.554
≥ 4 times	51	85	44	73.3	P=0.841

*: Statistical significant at $p \leq 0.05$ X² Chi square test

of the control group had more than four antenatal visits. Regarding the distribution of the studied sample according to sources of their information about breastfeeding, the study data shows that YouTube was the main source of information about breastfeeding for both groups, with no statistically significant difference between them.

The distribution of the experimental group according to their total knowledge, attitude and self-efficacy scores is illustrated in Table 2. It shows that most of the experimental group (95%) initially had a poor level of total breastfeeding knowledge. In comparison, most of them after one month (83.3%) and three months (85%) of the program moved to a good level. Additionally, more than half of the experimental group (56.7%) had a bad attitude toward breastfeeding initially, while after the educational program at one month and three months, more than three quarters of them had a good attitude (83.3%, 86.7% respectively). With respect to breastfeeding self-efficacy, the table demonstrates that most of the experimental

group (88.3%) initially had weak self-efficacy, while a good level was reached among most of them after one month (86.7%) and three months (85%).

The distribution of the control group according to their total knowledge, attitude and self-efficacy scores is illustrated in Table 3. It shows that most of the control group remained at a poor level of total breastfeeding knowledge initially (91.7%), after one month (90%), and three months (93.3%) of the program. Additionally, half of the control group had a bad attitude toward breastfeeding initially, after one month, and after three months of the educational program (48.3%, 50%, 50%). With respect to breastfeeding self-efficacy, the table demonstrates that the control group showed weak self-efficacy scores initially, and after one month, and three months (95%, 91.7%, and 93.3% respectively). Table 4 shows the mean differences between the study and control groups according to their total knowledge, attitude and self-efficacy scores.

Table 2: Distribution of the experimental group according to their total score of knowledge, attitude and self-efficacy

Items	Before the program	the educational program	One month after the educational program	Three months after the educational program
Total breastfeeding knowledge score	NO	%	No	%
Poor	57	95	0	0
Fair	3	5	10	16.7
Good	0	0	50	83.3
Total Attitude score				
Bad	34	56.7	0	0
Neutral	26	43.3	10	16.7
Good	0	0	50	83.3
Total self-efficacy score				
Weak	53	88.3	0	0
Average	7	11.7	8	13.3
Good	0	0	52	86.7

Table 3: Distribution of the control group according to their total knowledge, attitude and self-efficacy scores (n=60)

Items	Before the program	the educational program	One month after the educational program	Three months after the educational program
Total breastfeeding knowledge score	No	%	No	%
Poor	55	91.7	54	90
Fair	5	8.3	6	10
Good	0	0	0	0
Total Attitude score				
Bad	29	48.3	30	50
Neutral	31	51.7	30	50
Good	0	0	0	0
Total self-efficacy score				
Weak	57	95	55	91.7
Average	3	5	5	8.3
Good	0	0	0	0

It shows that the mean score of the total breastfeeding knowledge before the educational program had no statistically significant difference between the study and control group ($P=0.666$).

However, a statistically significant mean difference was seen after one month ($P=0.000$) and three months ($P=0.000$) of the educational program. The mean score of the attitude toward breastfeeding before the educational program showed no statistically significant difference between the study and the control group ($p=0.806$). Otherwise, a highly statistically significant mean difference appeared after one month ($P=0.000$) and three months ($P=0.000$) of the educational program. Finally, the mean score of total breastfeeding self-efficacy before the educational program revealed no statistically significant

difference between the study and the control groups ($P=0.896$). Meanwhile, a statistically significant mean difference was observed after one month ($p=0.000$) and three months ($p=0.000$) of the educational program.

The distribution of the experimental group according to their satisfaction with the program was highlighted in Table 5. It illustrates that the highest percentage of the experimental group strongly agreed with the knowledge presentation methods (78.3%), program content (63.3%), usefulness of the program (63.3%), clarity of the objectives (61.7%) and educational media used (53.3%). Furthermore, the results revealed that most of the experimental group participants were highly satisfied with the program. Finally, Table 6 shows the correlation between the experimental

Table 4: Mean difference between the experimental group and control group according to their total knowledge, attitude and self-efficacy scores

Items	Before the educational program		Test of significance	One month after the educational program		Test of significance	Three months after the educational program		Test of significance
	Experimental group n=60 mean± SD	Control group n=60 mean± SD		Experimental group n=60 mean± SD	Control group n=60 mean± SD		Experimental group n=60 mean± SD	Control group n=60 mean± SD	
Total breast feeding knowledge score	6.351 ±1.275	5.231 ±1.856	0.078 0.666	10.213 ±2.134	5.231 ±1.856	44.341 0.000*	11.471 ±1.521	4.914 ±2.518	27.876 0.000*
Total Attitude score	13.781 ±3.123	12.564 ±2.123	0.0889 0.806	16.431 ±2.368	10.571 ±1.236	38.678 0.000*	16.521 ±1.931	11.941 ±2.162	44.786 0.000*
Total self-efficacy score	11.281 ±2.124	10.231 ±1.785	1.265 0.896	14.834 ±2.689	9.724 ±1.236	28.803 0.000*	14.892 ±2.312	10.931 ±1.932	42.876 0.000*

Table 5: The distribution of the experimental group according to their satisfaction with the interactive digital based educational program

Items	Neutral		Agree		Strongly agree	
	No.	%	No.	%	No.	%
Objective's clarity	5	8.3	18	30	37	61.7
Content of the program	9	15	13	21.7	38	63.3
Knowledge presentation methods	5	8.3	8	13.3	47	78.3
Educational media used	12	20	16	26.7	32	53.3
The program usefulness	7	11.7	15	25	38	63.3
Total satisfaction score	Dissatisfied		Moderately satisfied		Highly satisfied	
	No	%	No	%	No	%
	0	0.0	7	12	53	88

Table 6: Correlation between the experimental group total scores of breastfeeding knowledge, attitude and self-efficacy

Items	Total Self-efficacy score (pre-program)	
	r	P
Total breast-feeding knowledge score	0.588	0.000*
Total breastfeeding attitude score	0.761	0.000*

r: Pearson correlation coefficient test * Statistically significant at ≤ 0.05

group total scores of breastfeeding knowledge, attitude, and self-efficacy. It reveals that before the program implementation, the total self-efficacy score of the experimental group had a statistically significant positive correlation with the total breastfeeding knowledge ($r=0.588$, $p=0.000$) and total breastfeeding attitude ($r=0.761$, $p=0.000$).

Discussion

Breastfeeding is vital for promoting health for both mothers and their infants. Various supportive and educational approaches have therefore been prompted. These programs targeted women during pregnancy, post-partum or both periods to promote and enhance exclusive breastfeeding. Pregnant women, their partners, and families have the chance to learn about the advantages of early breastfeeding and how to continue it for themselves and their unborn children during the antenatal period. This can be accomplished through the enhancement of women's breastfeeding self-efficacy³⁷⁻³⁹.

According to the current study, YouTube was the main source of information about breastfeeding for both groups, with no statistically significant difference between them. This contradicts the study by Jagadale, Salunkhe⁴⁰, which found that TV/Radio was the main source of health information. This may be due to the difference in the historical period in which the studies were conducted as the present study was conducted in 2020-21, when smart phones had become more readily available and using the internet had become easier. This result is also not consistent with the study by³² in Ben-seuif, which illustrated that the sources of information for women were family (40%), followed by mass media (25%), then friends (20%), and lastly the medical team (15%).

The knowledge deficit regarding breastfeeding should be taken into consideration as an important issue affecting women's attitude and practices⁴¹. In this context, the present study revealed that the vast majority of the study and control groups initially had a poor level of total breastfeeding knowledge. Also, nearly half of both groups had bad attitudes toward breastfeeding. Most of both groups had weak self-efficacy prior to program implementation. This is comparable with⁴⁰, who found that most of the studied women

had average knowledge, and more than half of them had average attitudes regarding breastfeeding. This may be due to differences in areas of residence, as most women in the current study were from urban areas, while most women (62.8%) in the other study were from rural areas, where culture and beliefs may promote breastfeeding more.

The current study revealed a statistically significant mean difference in the total breastfeeding knowledge and attitude scores after one month and three months of the implementation of the educational program. This is in line with results from the study done by Seyyedi, Rahmatnezhad¹⁶ and found that after three months, the mothers' knowledge, attitude, and practice scores had significant differences in the intervention group compared to the control group. Also, Hernández Pérez, Díaz-Gómez⁴² found that there were no significant differences between the two groups regarding knowledge or attitudes towards breastfeeding, before the intervention. Meanwhile, a significant increase in the level of knowledge of students as well as a higher percentage of positive attitudes towards breastfeeding was found post-intervention.

Moreover, Ahmed, Abd Al-Moniem⁴³ stated that there was a highly statistically significant difference between post and pre-educational program results concerning mothers' knowledge about the period of exclusive breastfeeding. Furthermore, Huang, Kuo⁴⁴ found that no significant differences could be found between the two groups in the pretest. However, there were significant differences in breastfeeding knowledge and attitude between the two groups in the post-test. Moreover, Ahmed, Roumani⁴⁵ showed that a significant difference was found in breastfeeding outcomes between both groups at one, two and three months after the intervention.

Successful breastfeeding requires enhancing breastfeeding self-efficacy and intention. Mothers with low breastfeeding self-efficacy stop breastfeeding early than the recommended time, but mothers with high breastfeeding self-efficacy have fewer troubles with breastfeeding continuation¹⁷. Regarding the mean score of total breastfeeding self-efficacy, the present study revealed no statistically significant difference between both the experimental and control groups before the educational program.

However, a statistically significant mean difference was observed after one month and three months of the educational program.

This is similar to Hatamleh⁴⁶ study, which showed that women who received the program had higher breastfeeding self-efficacy at two and six weeks postpartum than those who did not receive the program; women who attended the program also increased their self-efficacy scores over time. The mean duration of breastfeeding between the two groups was also statistically significant. In addition, the results of the study conducted by Mizrak, Ozerdogan¹⁷ showed that there were no significant differences between the two groups in the mean antenatal breastfeeding self-efficacy score. However, there was a significant difference between the groups in the mean self-efficacy scores at one, four and eight weeks postpartum.

An interactive, computer-based, bilingual breastfeeding education program's effects on knowledge, self-efficacy, and intent to breastfeed among rural Hispanic women residing in Scottsbluff, Nebraska, were assessed by Joshi, Amadi⁴⁷. Over the course of the study's six months, they discovered significant gains in each participant's intent to breastfeed and breastfeeding knowledge ratings ($p < 0.05$). Up until week six, there was a progressive rise in the nursing self-efficacy scores.

According to the current study's findings, the majority of experimental group participants were highly satisfied with the web-based instructional program. This is in line with the findings of Thomson, Crossland⁴⁸, who examined a telephone-based breastfeeding support program that was already in place in the UK. According to the study's findings, 94.4% of the participants were satisfied or extremely satisfied with the assistance and support they had gotten.

In the current study, the total self-efficacy score of the experimental group had a statistically significant positive correlation with the total breastfeeding knowledge and total breastfeeding attitude before the program implementation. This agrees with Boor⁴⁹ who found positive associations between knowledge scores and attitude scores. According to the overall results of this study, it can be suggested that implementing an interactive digital-based educational program about breastfeeding is expected to be an effective intervention. In Egypt in general as we stated

earlier 71.9% of the population had access to the internet and 93.4% of them has access to a mobile connection³⁴. This indicates that this intervention could be feasible to be implemented in this context. Nevertheless, further information about the access to mobile and the internet in El-Beheira governorate specifically is needed.

Limitations

This study was conducted in one facility, which is one of the limitations of this study. Therefore, we recommend conducting other studies in other settings. Additionally, the study sample was limited to pregnant women who intend to breastfeed and have a smartphone and internet connection. There is also a potential for bias as the same researchers who developed and implemented the intervention, collected the data from the same participants to whom they delivered the intervention.

Recommendations

According to the study's findings, the following suggestions are made: (1) Creating web-based educational sites for first-time mothers to enhance their knowledge and skills regarding breastfeeding. (2) Raising public awareness concerning breastfeeding advantageous for both mother and the baby through mass media and community mobilization campaigns. (3) Integrating breastfeeding educational sessions into antenatal care to enhance women's knowledge, practice, and self-efficacy. Future research is required to determine the perceived barriers of lactating mothers toward breastfeeding. We would also recommend conducting more qualitative and mixed methods research on the women's experience with using an interactive digital-based educational program around breastfeeding in Egypt.

Ethical considerations

Approval was obtained from the ethical committee in the faculty of nursing at Damanhour University. An official letter from the faculty of nursing was directed to the responsible authority of Italy El-baroud maternal and child health center to take their approval to conduct the study after explaining the aim of the study. After outlining the study's

objectives, all respondents gave their informed consent. The respondents were also made aware that they might leave the study at any point without incurring any fees. Privacy and confidentiality were taken into account at all stages of the research. For instance, the researchers asked members in the WhatsApp group to send any personal inquiries to the researcher's private page or via email to protect their privacy during discussion, and the data was de-identified/anonymized before analysis.

Conclusion

On the basis of the present study findings, it can be concluded that the interactive digital-based educational program about breastfeeding can be effective and improved the primipara women's knowledge, attitude, and self-efficacy. In addition, breastfeeding self-efficacy was found to be positively correlated with knowledge and attitude. It is also worth mentioning that most of the intervention group was highly satisfied with the educational program.

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