

Improving Nutritional and Cultural Awareness of Mothers towards Their Infants Using Mobile Applications

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Improving Nutritional and Cultural Awareness of Mothers towards Their Infants Using Mobile Applications

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Abstract

Mothers' knowledge of child nutrition plays a vital. Mothers, especially new, suffer from a lack of nutritional and cultural information, especially about basic daily information related to infant care. The first years of a child's life are the basis for building healthy eating habits throughout a lifetime and avoiding the consequences of food diseases. Parents have the main role at this age. Considering the current ubiquitous technology, the present study aimed to improve mothers' nutritional and cultural awareness using a mobile phone application. 147 mothers from Assiut City participated, aged 20-40 years, with infants aged 0-24 months. Mothers were tested before and after using the app for three months. The results showed a significant improvement in mothers' awareness and practices regarding infant care, as the study revealed highly significant differences between mothers' awareness regarding breastfeeding, artificial breastfeeding and weaning (0.79 ± 8.93 and 1.36 ± 21.93), regarding complementary feeding (1.02 ± 6.13 and 0.78 ± 17.9), while infant sleep and physical and skill development were recorded (1.01 ± 3.85 and 0.50 ± 11.51) respectively, pre- and post-using the app. The total results of mothers' practices of breastfeeding, weaning, infant feeding, infant sleep, and physical and skills development were (3.63 ± 4.41 and 2.49 ± 27.67) respectively, pre- and post-using the app. The study recommends conducting intensive awareness programs for mothers during pregnancy.

Keywords: Saghiri application - Nutrition Awareness - Breastfeeding - Complementary feeding.

Introduction

Mothers, especially new mothers, face a significant informational deficit, especially regarding basic, daily infant care information and health literacy challenges (*Lee, 2018*). Many mothers and recent became mothers lack the knowledge, assets, abilities, or confidence in their skills to take good care of their babies or themselves. This incomplete understanding may raise the risk for several detrimental health consequences, such as early breastfeeding cessation, postpartum depression, and sudden infant death syndrome (SIDS) (*Sætheret al., 2023*). Socioeconomic factors, such as low income, inadequate medical access, and low educational attainment, may further exacerbate the problem (*Prasetyo et al., 2023*).

In developing nations, malnutrition in childhood is a serious public health concern. The high death rate among children in these countries is a result of it, even with the numerous advocacy efforts of organizations like the FAO, WHO, and many others. Further research is necessary to support the attainment of the Sustainable Development Goals (*Hojati et al., 2023*). The nourishment of newborns during their first 1000 days of life, from conception to two years of age, has an impact on their health in the short and long term. Most of the world's disease burden, the rise in chronic non-communicable diseases, and the expenses that go along with them for individuals, communities, and society are linked to inadequate nutrition, which is made worse by the coexistence of under- and over-nutrition (*Saavedra and Dattilo 2022*). In addition, poor nutrition during the first 1000 days of a child's life can cause stunted growth irreversible cognitive impairment as well as decreased performance at school and work. (*WHO/UNICEF, 2014*).

One of the most major impact "critical periods" in human life is complementary feeding; according to Barker's theory, the introduction of solid foods to an infant during this critical window can affect the individual's future life by acting as a trigger for either a positive or negative epigenetic insult. The first 1000 days of a child's life are the most important for meeting their nutritional needs, during this time, the child has increased nutritional needs so it is imperative to make sure that every mother and child has access to the best nutrition possible (*UNICEF, 2019*), and the mother plays

a crucial role at this time. Thus, the development of a child and a mother's education are highly associated (*Shrestha, 2020*). The biggest opportunity for progress in society lies in prioritizing investments in bettering diets and lifestyles during the first thousand days of life (*Saavedra and Dattilo 2022*).

Regardless of family income, mothers' nutritional knowledge has a significant impact on children's nutritional status (*Hojati et al.,2023*). The mothers who have low health literacy are unable to provide for their children's nutritional needs because they do not have a clear understanding of their children's nutrition and malnutrition status, which makes it difficult for them to do so (*Debela et al., 2017*). Maternal knowledge and children's nutritional status are positively impacted by nutrition education. Guidebooks, pamphlets, booklets, and online technology applications are examples of media and methods for nutritional health education (*Prasety, et al.,2023*). It has been demonstrated that maternal education about infant care, especially for first-time mothers, can reduce and even improve infant health outcomes in places where access to healthcare is uneven (*Hannan, 2013*). Research indicates that new mothers generally believe they don't know enough about taking care of their babies daily. Furthermore, research indicates that mothers frequently lack or have inaccurate information about the development of their infants and the sleep safety (*Shrestha, 2020*).

The era of technology that is growing very rapidly is marked by the existence of smartphones supporting the development of knowledge transfer. Unquestionably, two of the most important aspects of life are nutrition and health. Therefore, technological innovations to help enhance and even promote health awareness are essential. With the advent of mobile computing, it is much easier to be aware of health information because of its mobility and availability (*Ocayet al.,2017*). Hence, smartphones could be used to enhance nutritional knowledge (*DiFilippo et al.,2015*). Smartphone-based technologies have the potential to improve outcomes and drastically cut costs (*Steinhubl et al., 2013*). Apps related to nutrition and healthy living could offer a useful means of educating the public about diet and nutrition. Additionally, these apps assist in providing specific groups with information that is relevant to them (e.g. overweight

people, cancer survivors, heart disease risk groups) (*Okumus et al., 2018*). Online technologies have gained increasing popularity in women's preference as a source of guidance and support (*Skelton et al., 2018*). For that, this study aimed to enhance the nutritional and cultural awareness of mothers, particularly first-time mothers, through the use of mobile applications.

SUBJECTS AND METHODS

SUBJECTS

- **Sample research:** The study included 147 mothers aged 20 to 40 years, from Assiut City; they have infants ranging in age from one day to 24 months. Mothers with infants who are unhealthy or exhibit congenital diseases or disorders were excluded.
- **Two electronic forms (pre and post):** Mothers' knowledge and practices forms. It was prepared in Arabic and sent to the mothers via their e-mails.
- **Mobile application:** A mobile phone application that has been prepared by specialists and sent to mothers. It is available on the Google Store and is called (*Saghiri*).
- **Ethical aspects:** Written approval was obtained from each subject before being involved in this study, and the protocol of this study was approved by the ethics committee of the Faculty of Specific Education, Assiut University.

METHODS

1- Mothers' knowledge form (pre and post-test)

It was an electronic form prepared in Arabic, it was judged by specialists in nutrition and food sciences. Sent to mothers via email, after 3 months of using the *Saghiri* application, the mothers were asked to answer the test again (post-test). This form included some information about mothers, such as the mother's age, educational qualification, job, family income level, and the child's age. The mothers' data were confidential and protected. The test consisted of 57 multiple-choice questions, divided into three axes: the first axis related to breastfeeding, artificial breastfeeding, and weaning (25 questions), the second axis related to complementary feeding (20 questions), and the third axis related to infant sleep

and physical and motor development (12 questions). Participants were asked to choose the most appropriate answer.

2- Mothers' practices form (pre and post)

This form included some practices of mothers regarding their infants. The questionnaire consisted of 50 questions, divided into 4 items: the first item: breastfeeding (10 questions), the second item: infant nutrition (10 questions), the third item: weaning (5 questions), and the fourth item about infant sleep and physical and motor development (5 questions). It was sent to mothers via email and were asked to choose the most appropriate answer. After 3 months of using the Saghiri application, the mothers were asked to answer the questionnaire again (post-test).

3- Description of mobile application (*Saghiri*)

The Saghiri app consists of dozens of screens with texts, photos, and suggested diet tables for mothers and infants. This awareness app was placed in the mobile phone applications on Google Play. The application consists of eight main topics; breastfeeding, artificial breastfeeding, the appropriate age for introducing food, Complementary feeding, infant sleep, growth rate and motor development, 14 health problems with solutions, and weaning. It is the first application in the Arabic language that provides this information to mothers. The application answers most of the questions that come to mind for mothers, especially new mothers. They usually resort to those who have experienced motherhood before, and most of the answers are inaccurate or wrong. Table (1) details the app's content, and Figures (1 and 2) show some screens of the Saghiri app.

4- Study Design

The study included 147 mothers, aged 20 and 40 years, and their infants' ages ranged from one day to 24 months. Some data were collected from them. They were explained what they had to do, and a link two forms (the knowledge form and the practice form) was sent to them. After they filled out the two forms, the Saghiri application was sent to the mothers, explaining its content

and how to use it. After three months of using the application, they were asked to do the post-test.

5- Statistical analysis

Data obtained will be entered in Excel spreadsheets, followed by analysis using SPSS, and the results were analyzed statistically using a paired sample t-test, effect size, and correlation.

Table (1): Topics and contents in the Saghiri app

Topics	Contents	Topics	Contents
Breastfeeding	<ul style="list-style-type: none"> - Introduction - Benefits of breastfeeding for the child - Benefits of breastfeeding for the mothers - Preparation for breastfeeding - The first breastfeeding in the child's life - When the child needs to be breastfed (signs of hunger) - The number and duration of breastfeeding - The method and conditions of breastfeeding - The difficulties facing mothers during breastfeeding (small or sunken nipple, cracked nipple, fullness and engorgement of the breasts, blockage of the milk ducts, breast abscess, delayed milk let-down, the mother's return to work, lack of milk and not being enough to feed the infant, the weak ability of the child to suck, The child refuses to breastfeed, the child refuses one of the breasts) - Is it - Size of the infant's stomach - Signs of fullness and the child's breast-feeding well - Nutrition for the breastfeeding mother - Ways to increase breast milk - Store breast milk - Methods for burping the child - When visiting the doctor. 	Complementary feeding	<p>1-Complementary feeding and its importance.</p> <p>2-Forbidden foods for infants in their first year.</p> <p>3-Nutrition at 5 – 6 months; it consists of several sub-axes; 1- Advice when offering food to an infant for the first time. 2- The permitted foods and their quantity.3- A model of meals for infants aged 5 – 6 months. 4- Methods for preparing meals.</p> <p>4-Nutrition at 7-9 months, consists of; 1- advice when serving food to an infant at that age. 2- Daily meals, 3- A model for daily meals, 4- Methods for preparing meals.</p> <p>5-Nutrition at 10 to 12 months consists of; 1- tips when providing food to infants at 10 to 12 months, 2- daily meals, and 3- a model for daily meals.</p> <p>6-Signs of hunger and satiety in children.</p> <p>7-Vitamins and minerals.</p> <p>8-Nutrition at 12-24 months contains; 1- advice for providing food to infants at 12-24 months, 2- foods appropriate for a child at the age of one year, 3- foods that are not appropriate for a child at the age of one year, 4- daily nutritional meals, 5- a model for daily meals, 6- Nutritional errors that the family makes.</p>
Artificial breastfeeding	<ul style="list-style-type: none"> - The advantages and disadvantages of artificial breastfeeding - The types of artificial milk - The method of preparing the artificial milk - Determining the quantity of artificial milk and the method of presenting it to the infant - Comparing the components of natural milk and artificial milk. 	Infant sleep	<ul style="list-style-type: none"> - Hours and types of sleep - Ways to help infants sleep - Infant sleeping positions and specifications of their bedding - Tips to help infants relax before sleep - Foods that help infants sleep - Forbidden foods before sleep.
The appropriate age for introducing food	<ul style="list-style-type: none"> - The appropriate age and signs of readiness - Advice on feeding the infant before the completion of the sixth month - The harms of introducing foods before the completion of the fourth month - The harms of delay in introducing foods to the infant - Important tips when introducing food to infants 	Growth rate and motor development	<ul style="list-style-type: none"> - The rate of increase in the child's weight - The rate of increase in the child's height - Linguistic and skill development according to age, and it contains the linguistic and skill development of the child from the one day – 24 months
14health problems and their solutions	<ol style="list-style-type: none"> 1. Constipation at infants 2. Dermatitis under the diaper 3. High temperature 4. Heat cramps 5. Food allergies 6. Food refusal 7. Anorexia or weakness of appetite 	Weaning	<ul style="list-style-type: none"> - The concept of weaning - Advice for final weaning from breastfeeding - Weaning methods

Figure (1): Topics and contents on the screens of Saghiri app



Figure (2): Topics and contents on the screens of Saghiri app



RESULTS AND DISCUSSION

Characteristics of the study subjects

Table (2) indicated that 27.9% of mothers their age were 20-25 years, while 42.9% were 26-30 years, 17.7% were 31-35 years and 11.6% were 36-40 years, with a mean of 28.47 ± 4.71 years. 53.1% of them were university graduates, concerning working status; about 103 (70.1%) of them were housewives and the majority of them had average income (87.1%). As for breastfeeding; only 24.3% of them practice breastfeeding, but 32.2% practice artificial breastfeeding, and 43.5% practice both. Their child's age was 35.4% of them One day-4months, 34.7% of them 10-12 months, 21% of them 5-6 months, 15.6% were 7-9 months, and 13.6% of those 12-24 months, with a mean of 8.01 ± 0.52 months.

Table (2): Characteristics of mothers and infants

Personal data	Answers	Frequencies n=147	Percent %
Mother's age (in years)	20-25	41	27.9
	26-30	63	42.9
	31-35	26	17.7
	36-40	17	11.6
Mean± SD = 28.47 ± 4.71 years			
Education level	Intermediate	24	16.3
	University graduate	78	53.1
	Postgraduate (diploma – master's – doctorate)	45	30.6
Breast feeding	Breastfeeding	36	24.3
	Artificial breastfeeding	51	32.2
	Both	60	43.5
Working status	Working	44	29.9
	Not working (Housewife)	103	70.1
Income	Enough	128	87.1
	Enough and saved	8	5.4
	Not enough	11	7.5
Child's age (in months)	One day-4months	52	35.4
	5-6 months	31	21.1
	7-9 months	23	15.6
	10-12 months	51	34.7
	12 – 24 months	20	13.6
Mean± SD = 8.01 ± 0.52 months			

The same table shows that 53.1% and 30.6% of women had education as university graduates and postgraduates, respectively, which, when compared to other studies from India, still makes our study population relatively more educated *Jaiswal et al., (2024)* show in their study that 28% of women had education above higher secondary level. And *Seyyedi et al.,(2021)* show in their study that 30% had an academic education. The acceptability of mHealth interventions (mobile health interventions) may be significantly influenced by education. As education among women improves, the adoption of technology improves as well. The more educated a woman is, the higher her awareness of health and her ability to take care of herself and her children (*Feinstein et al., 2008*).

Mothers' knowledge and practices about breastfeeding, artificial breastfeeding, and weaning

Table (3) shows the mean of mothers' answers to the questions regarding breastfeeding (BF), artificial breastfeeding (A BF), and weaning (W) in the two forms before and after using the Saghiri application.

Table (3): Mother's knowledge and practices about BF, A BF, and W pre and post using app (Mean±SD).

Items	Pre-awareness app	Post-awareness app	Paired-t-test	P value
Mother's knowledge				
1- Breastfeeding, artificial breastfeeding and weaning	8.93±0.79	21.93±1.36	84	<0.001**
Mother's practices				
1- Breastfeeding	7.82±0.81	12.03±0.82	41.6	<0.001**
2- Weaning	4.04±0.79	8.04±0.84	41	<0.001**

- <0.001** : High significant
- SD: Standard Deviation

Table (3) indicated that highly statistically significant differences were found between the mother's knowledge and practices pre- and post-using the Saghiri application. The mothers' total scores were in the axis related to BF, ABF, and W (8.93±0.79 and 21.93±1.36), respectively pre and post-using the

app in mother's knowledge form, while total scores in the items of breastfeeding and weaning at mother's practices form were (7.82 ± 0.81 , 12.03 ± 0.82 , 4.04 ± 0.79 and 8.04 ± 0.84), respectively. There was a significant improvement in these gaps post-using the Saghiri application, all having a $P < 0.01$, showing statistically significant improvement.

The results show that the majority of mothers did not have good knowledge about breastfeeding, the importance and benefits of exclusive breastfeeding, storing breast milk, infant needs from colostrum and breast milk, especially in the first days, the difference between ingredients of breast milk and artificial breast milk and when the mothers started the weaning. Also, the results show that the majority of mothers are not keen on eating foods that help produce milk, they do not store milk, they do not make sure to wake the infant after two hours of sleep to breastfeed him and they breastfeed the infant from both breasts at every session, etc. before using the application.

The results of the current study agreed with *Thabet et al., (2024)* who indicated that the majority of mothers had an unsatisfactory level of knowledge regarding preparation for motherhood in the pre-awareness programs but in the post-awareness programs, almost all of them had a satisfactory level of knowledge. Our findings corroborated those of the *Jaiswal et al., (2024)* study, which revealed that there were notable gaps in knowledge regarding the advantages of colostrum as well as the significance of starting breastfeeding within the first hour. *Curan et al., (2024)* showed a mobile app promoted breastfeeding self-efficacy in preterm infants' mothers. According to a study by *Seyyedi et al. (2021)*, breastfeeding self-efficacy was considerably increased by the smartphone app that taught new mothers how to breastfeed. On the other hand, the infant's health improved when mothers were aware of the benefits of exclusive breastfeeding for the first six months of life and when to start supplemental feeding (*World Health Organization, 2023*). Women can breastfeed for up to 24 months. But by the sixth month, breastfeeding's components are no longer sufficient to meet the infant's needs, so the introduction of supplemental feeding becomes an unavoidable choice (*Lassi et al., 2013*).

This emphasizes the importance of having an Arabic language application that provides mothers with information about breastfeeding. In the current study, the majority of mothers were very interested in receiving evidence-based educational materials for the better development of their children. The Saghiri application, which was widely accepted among mothers, also helped them discover solutions while breastfeeding. In our study, 43.5% of mothers were breastfeeding and artificial breastfeeding together. After using the Saghiri app, they were able to find a solution to their problem and gradually became dependent on breastfeeding only.

Mothers' knowledge and practices about complementary feeding and infant nutrition

Table (4) shows the mean of mothers' answers to the questions regarding complementary feeding before and after using the Saghiri application. Table (4) reveals that highly statistically significant differences ($P < 0.01$) were found between the mother's knowledge and practices regarding complementary feeding before and after using the Saghiri application.

Table (4): Mother's knowledge and practices about CF and infant nutrition pre and post-using app (Mean±SD)

Items	Pre-awareness app	Post-awareness app	Paired-t-test	P value
Mother's knowledge				
2- Complementary feeding	6.13±1.02	17.9±0.78	90	<0.001**
Mother's practices				
3- Infant nutrition	9.85±0.80	16.97±0.81	80	<0.001**

- <0.001** : High significant
- SD: Standard Deviation

The mothers' total scores were in the axis related to complementary feeding (6.13±1.02 and 17.9±0.78), respectively pre and post-using the app in the mother's knowledge form, while total scores in the axis of infant nutrition at the mother's practices form were (9.85±0.80 and 16.97±0.81), respectively. The results show that most mothers did not have good knowledge about introducing food to a newborn for the first time, giving water to

infants, allowed and not allowed foods for infants, and the quantity of meal that a child needs. The results also showed that many mothers do not commit to providing appropriate food to infants daily and that mothers provide family food to infants, and do not prepare, store, and use a quantity of appropriate food for infants daily.

This is consistent with previous research, as *Prasetyo et al., (2023)* who analyzed the effect of mothers' nutritional education and knowledge on children's nutritional status, his results showed the effect of nutrition education on mothers affects children's nutritional status, namely in the form of changes in the average birth weight of children, increasing 0.257 kg/0.26 kg compared with birth weight. Our results were in agreement with *Lokossou et al., (2021)* who studied exclusive breastfeeding, first-year diet, healthy diet, and growth foods, and the results showed that mothers had limited knowledge about nutrition and their source of information remains the elders.

Also, *Akinrinmade et al.,(2019)* reported that complementary feeding nutrition education significantly improved the caregivers' complementary feeding knowledge which enhanced the attitudes of the caregivers toward complementary feeding. Also *Pradanie et al., (2020)* said that appropriate types, amounts, and methods of feeding are crucial for the growth and development of babies at the age of 6 to 24 months.

The study by *Capra et al., (2024)* emphasized the importance of healthy complementary feeding and mentioned in his study that complementary feeding is an essential milestone in infant nutrition. It is a critical period in which positive or negative insults can have implications for long-term outcomes later in life, such as development, non-communicable diseases, and food allergies. These are the same results that *Herman et al., (2023)* reached and mentioned through his study, as he explained that infant nutrition plays an essential role in preventing malnutrition in children, and mothers' knowledge regarding infant nutrition and nutrition is essential for appropriate complementary feeding.

The belief that infants' stomachs could not tolerate varieties of food led to poor dietary diversity among the caregivers. The misconception hindering the appropriate infant feeding practices

can be corrected by infant feeding education *Sethi et al., (2017)*. *WHO reports (2003)* confirmed that the lack of knowledge about the proper way to feed infants and young children was the prominent cause of widespread malnutrition in many of the developing countries *Dewey and Adu-Afarwuah (2008)*.

The Saghiri application is not limited to breastfeeding only like other foreign applications, but it includes many topics, as complementary feeding, which is the most difficult topic for many mothers, and through it mothers can learn about the infant's nutritional needs, the number and quantity of meals, and how to cook them. The suggested feeding schedules were praised by mothers, as mothers reported that they follow the suggested feeding schedules when preparing meals for their infants, and they mentioned that it made the task easier for them, so there was a noticeable improvement in the answers of mothers participating in using the Saghiri application.

Mothers ' knowledge and practice scores regarding sleep and physical and skill development of infants

Table (5) shows the mean of mothers' answers to the questions regarding sleep and physical and skill development (S and PKD) of infants before and after using the Saghiri application. Table (5) showed highly statistically significant differences were found between the mother's knowledge and practices regarding (S and PKD) of infants before and after using the Saghiri application.

Table (5): Mother's total knowledge and practices about S and PKD of infants, pre and post-using the app (Mean±SD)

Items	Pre-awareness app	Post-awareness app	Paired-t-test	P value
Mother's knowledge				
3- Sleep and physical and skill development of infants	3.85±1.01	11.51±0.50	59	<0.001**
Mother's practices				
4- Sleep and physical and skill development of infants	5.96±0.78	12.37±1.1	54.9	<0.001**

- <0.001** : High significant
- SD: Standard Deviation

The mothers' total scores were in the axis related to S and PKD (3.85 ± 1.01 and 11.51 ± 0.50), respectively pre and post-using the app in the mother's knowledge form, while the total score for the same item at the mother's practices form were (5.96 ± 0.78 and 12.37 ± 1.1), respectively. There was a significant improvement in these gaps post-intervention by the mobile application Saghiri, all having a $P < 0.01$, showing statistically significant improvement. The results show that most mothers did not know about hours and types of sleep, ways to help infants sleep, infant sleeping positions and specifications of their bedding, how she can help infants to relax before sleep, the foods that help infants sleep, and forbidden foods before sleep.

Our result agreed with the study conducted by *Alzubaidi et al., (2022)* who studied mothers' knowledge of correct infant sleep practices and sudden infant death syndrome in al-Najaf province, and reported that the women had limited understanding of sudden infant death syndrome (SIDS), non-supine sleeping postures and bedsharing. Higher frequencies of women utilizing soft mattresses, pillows, and cot buffers for baby cribs, are connected with an increased risk of SIDS. Also, our results agreed with *Martins et al., (2018)* who assessed the impact of maternal education on the development of infants' sleep habits and showed that early maternal education contributes to the development of pediatric sleep quality. Similarly, a review carried out by *Sulasdi, (2023)* found that baby massage can improve the quality and duration of baby sleep. In addition, baby massage is also one of the colic treatments experienced by babies.

As for mothers' knowledge and practices scores regarding S and PKD were low and that is appeared in the results show that most mothers did not have any knowledge about the rate of increase in the child's weight, rate of increase in the child's height, linguistic and skill development according to age, the linguistic and skill development of the child from the one day to 24 months. There was a significant improvement in the mother's answers post-intervention by the mobile application Saghiri at ($P < 0.01$).

Similar results were found by *Abd El-Star et al., (2022)* that showed that 98% of mothers had unsatisfactory total

knowledge about the underweight pre-educational intervention program while, 71.5% of them had satisfactory knowledge about the underweight post-program. *Mohammed et al., (2022)* assessed the knowledge and practices of mothers regarding their underweight infants, assessing physical assessment of infants, Designing, implementing, and evaluating educational intervention programs for mothers regarding their underweight infants. They found highly significant differences between the total practices of mothers in pre and post-educational intervention programs. As for *Saudia et al., (2022)* revealed that before the intervention, most of the mothers had poor knowledge about the growth and development of babies aged 3 to 6 months (50%). After the intervention, there was an increase in their knowledge; there were 97% of respondents had good knowledge. *Angraini et al., (2020)* his study determined the effect of giving pocketbooks on mother's knowledge of the development and stimulation of children 0-24 months and the results showed an increase in significant knowledge, between before and after treating the group intervention ($p = 0,000$). The overall mothers' knowledge item level had high significant differences between pre and post-using mobile applications ($P < 0.001$), except for some items ($P = 0.005$).

The effect size of the mobile application

The results of Table (6) clarify that the calculation of the effect size showed that the app's effects on increasing knowledge scores were (0.98, 0.982, and 0.96) (i.e., large).

Table (6): Effect size of the mobile application

Items	Pre-awareness app	Post-awareness app	Effect size	P value
1-Breastfeeding, artificial breastfeeding and weaning	8.93±0.79	21.93±1.36	0.980	<0.001**
2- Complementary feeding	6.13±1.02	17.9±0.78	0.982	<0.001**
3- Sleep and physical and skill development of infants	3.85±1.01	11.51±0.50	0.960	<0.001**

- <0.001**: Highly significant
- SD: Standard Deviation

Correlation between total knowledge and total practices

Table (7) showed that the majority of mothers had a poor total knowledge score (18.91 ± 2.54) while the majority of mothers had a good total knowledge score (51.34 ± 5.25), respectively before and after using the app. The total practices score was recorded (27.67 ± 2.49 and 49.41 ± 3.65), respectively before and after using the app. There was a highly statistically significant relation between mothers' total knowledge and practice scores ($p \leq 0.001$) pre- and post-using the mobile application (Saghiri). The same table illustrates that there is a highly significant statistically positive correlation between total knowledge and total practices at $r = 0.94$ at $p = 0.0000$.

Table (7): Correlation between total knowledge and total practices

Items	Pre-awareness app	Post-awareness app	P value
Total knowledge	18.91 ± 2.54	51.34 ± 5.25	$<0.001^{**}$
Total practices	27.67 ± 2.49	49.41 ± 3.65	$<0.001^{**}$
R			
Total knowledge and total practices		0.91	0.000

The intervention of our study was effective and had a positive impact that improved mothers' knowledge and practices regarding breastfeeding, weaning, infant nutrition, sleep, and physical and skill development of infants (nutritional and cultural awareness). It should be noted that there are no previous studies in the literature review that disputed the results of our study.

These results align with the recognized global expansion of electronic and internet-based health promotion strategies *Almohanna et al., (2020)*. It is relevant due to the growing preference of mothers for e-resources *Silva et al., (2021)*.

From the researchers' point of view, this result reflects the positive effect of an awareness program, which meets the studied mother's, needs and provides them with sufficient knowledge. This result agreed with the study by *Fan et al., (2020)* about the knowledge, attitudes, and practices that reported that health behavior changes when gaining the right knowledge and adopting the practice. Also, a recent study by *Rana et al., (2020)* illustrated

that sufficient individual knowledge is associated with effective prevention, control of disease, and promotion of a person's health.

This study had a limitation; the app was programmed only for Android users, albeit very few people use iOS.

Conclusion

Mothers' nutritional and cultural knowledge significantly affects children's health status. Saghiri is the first Arabic language app for mothers with a topic-oriented and problem-based educational approach. This study helped mothers find solutions during breastfeeding, weaning, infant nutrition, sleep, and physical and skill development. The results indicated a considerable improvement in mothers' knowledge, attitudes, and practices post-using the Saghiri app. The study recommends conducting intensive awareness programs to improve maternal culture during pregnancy.

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تحسين الوعي الغذائي و الثقافي للأمهات اتجاه أطفالهن الرضع باستخدام تطبيقات الهاتف المحمول

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لمعرفة الأمهات بتغذية الأطفال دورًا حيويًا، وتعاني الأمهات وخاصة الجدد منهن من نقص في المعلومات الغذائية والثقافية، لا سيما فيما يتعلق بالمعلومات الأساسية اليومية المتعلقة برعاية الرضع. تعد السنوات الأولى من حياة الطفل هي الأساس لبناء عادات غذائية صحية طوال العمر وتجنبه عواقب المشاكل الصحية والأمراض المرتبطة بالغذاء. وللوالدين الدور الرئيسي في هذه المرحلة العمرية. وبالنظر إلى التكنولوجيا الحالية في كل مكان، هدفت الدراسة الحالية إلى تحسين الوعي الغذائي والثقافي للأمهات باستخدام تطبيق على الهاتف المحمول. شاركت 147 أمًا من محافظة أسيوط، تتراوح أعمارهن بين 20 -40 عاماً، وأعمار أطفالهن الرضع بين يوم إلى 24 شهراً. تم اختبار الأمهات قبل وبعد استخدام التطبيق لمدة ثلاث شهور. أظهرت النتائج تحسناً كبيراً في وعي وممارسات الأمهات حول رعاية الأطفال الرضع، حيث كشفت الدراسة عن وجود فروق ذات دلالة احصائية عالية بين وعي الأمهات فيما يخص الرضاعة الطبيعية والصناعية والفظام (8.93 ± 0.79 و 21.93 ± 1.36) وفيما يخص التغذية التكميلية (6.13 ± 1.02 و 17.9 ± 0.78)، أما نوم الرضع والتطور الجسماني والمهاري سجل (3.85 ± 1.01 و 11.51 ± 0.50) على التوالي قبل وبعد استخدام التطبيق. وكان إجمالي نتائج ممارسات الأمهات للرضاعة الطبيعية والفظام وتغذية الرضع ونوم الرضع والتطور الجسماني والمهاري (4.41 ± 3.63 و 27.67 ± 2.49) على التوالي قبل وبعد استخدام التطبيق. وتوصي الدراسة بعمل برامج توعية مكثفة للأمهات خلال فترة الحمل.

الكلمات المفتاحية: تطبيق صغيري- التنقيف الغذائي - الرضاعة الطبيعية -

التغذية التكميلية.