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THE EFFECT OF MOBILE LEARNING ON NUTRITION KNOWLEDGE AND BEHAVIOR OF PREGNANT WOMEN.

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ABSTRACT

Background:With the advent of new methods and modern technologies, the traditional methods of teaching and learning are gradually losing their effectiveness
This study aimed to investigate the effects of mobile based learning on the knowledge and behavior of pregnant women compared with lectures based learning .
Methods: This quasi-experimental study was conducted on pregnant women referring to health centers in Neyriz. The sample was consisted of 180 pregnant women referring to urban health care centers of Neyriz, who were experiencing their first pregnancy and were at their first or second trimester. They were divided into the intervention (mobile based) and control (the lecture) groups, randomly. Two groups justified by age, gestational age, economic status and education level.
pre-test- post test in both groups was done by using awareness and feeding behavior questionnaire , the intervention group was trained and followed through mobile learning and short message service for 3 consecutive months. The educational materials for the control group were taught in 4 lecturing sessions of 60-90 minutes as well. Four weeks after the 3-month intervention period, a post-test was conducted for both groups.
Results :The results show an increase in awareness and behavior of the pregnant women in the intervention group after undertaking training and following up through mobile based learning ; whereas there was no significant difference between the pre-test and post-test scores of awareness and feeding behavior of individuals in the control group ($p>0.05$).
Conclusion: Training and following up nutritional issues remotely via cell phone and SMS has a greater impact on awareness and behavior of pregnant women. Given the availability of this device, it is recommended to use it in order to help different groups of people and patients to be trained more effectively.

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Introduction

Education and learning is one of the areas that have undergone a rapid development of information technology, with the aim of fundamental changes, in recent years(1).

With the advent of new methods and modern technologies, the traditional methods of teaching and learning are gradually losing their effectiveness. In order to keep pace with the constantly changing environment, the learners need fresh, inexpensive, fast and secure ways to.

Like other technologies, mobile phone technology is one of the aspects of communication and information technology which has found its way in the field of education(2).

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Knowing how to work with a mobile phone has become an integral part of the educational process to enhance learners' satisfaction that enriches their interactions and will help learners to maintain more effective communications(3, 4).

Making use of cell phone and texting help to enrich learning experience and provide people with helpful and free outdoor activities so that they can learn anytime and anywhere(In other words, using a cell phone reduces learning location restrictions. So it is important due to the fact that access to learning materials is possible anywhere(6).

Another important advantage of mobile phone and texting is to prevent the isolation of people who are undergoing training, which plays an important role in education and in flexibility of individuals(7).

Hartnel and colleagues, in a study investigated how to apply and get help from your cell phone in learning in secondary schools which showed positive results(8).

Given that today's medical education systems around the world have a desperate need to using information and communication technologies in order to provide the best learning conditions for their students while most people are tired of the traditional methods of teaching and are willing to use modern technologies, the role and utilization of cell phones, due to its ease of use and accessibility for learning, has become one of the new areas of researching and theoretical explorations in medical educations(9).

In recent years the development of cell phones and mobile networks has become one of the significant technologies in health care around the world. These new technologies have been used for remote health monitoring and self-health management by people(10).

Proper cultural and infrastructural bases should be set in order to materialize cell phones' potential benefits.

On the other hand, giving lectures is the predominant form of training in training centers with which a huge amount of information can be conveyed to a large group of people in the shortest possible time and at the lowest cost. Moreover teachers and educators have mastered this method, which is a teacher-centered teaching method; and it has made it one of the most conventional methods of education compared to the other ones. Despite the emergence of new techniques and expanding knowledge, it still remains as an important educational method (11).For it is the safest and easiest way of learning which provides more control over the class(12).

In spite of its benefits such as cost-effectiveness, providing direct orderly and logical educational materials, teachers' speaking skills and note-taking by students, this method also has disadvantages including the fact that it is a passive teaching method and may cause deactivated learning; on the other hand it is not appropriate for the practical and mental skills in higher levels of learning and does not take individual differences into consideration. In addition, there is always a possibility of early content oblivion for the learners(13).

Training programs should be in such a way that raise people's satisfaction, or in other words, reduce their discontent level. Therefore, if the programs are set and offered in a way that they meet these needs, it can be expected that people participate actively in the training courses for longer periods.

Therefore, nowadays, distance learning program technology can also be used so that individuals can get tips from different places and at any time and have the opportunity to review the material at a desired time(14). These days, due to the creation of new communicative methods and environments and use of information technology, people are encouraged to self-learning and learning in general is improving(15).

The issue of improving the quality of pregnant women learning has always been emphasized and attained more importance ever since(16).

Several studies have shown that pregnant women awareness of nutrition during pregnancy is low; while education and awareness of family nutrition, especially of mothers, is one of the major strategies in the development programs to improve their food and nutrition intake(17).

Because of mothers' interest to their babies during pregnancy to maintaining their health, they are more eager to learn different aspects of health and are actively seeking health information, including information related to nutritional issues(18). Their knowledge and attitude in this period is very important to plan changes in eating habits(19).

This phase provides the opportunity for training to upgrade their knowledge and improve their feeding behavior. Therefore, efforts to improve the nutrition of women during pregnancy are a program of the Ministry of Health, Treatment and Medical Education(17).

Accordingly, the awareness of the community and health staff is used to improve and increase positive food behaviors while reducing undesirable ones(20,21).

The first step in nutrition education is to raise awareness about the importance of nutrition and how to eat correctly, because this awareness leads to changes in feeding behavior. That is the correct behavior to replace inappropriate or false nutrition behavior.

Despite all these efforts, studies show that in recent years the nutritional status of pregnant women in our country has not been in a good situation yet and the amount of required training which has been offered according to the standard of care during pregnancy is not adequate[21]. The development of prenatal preparation classes with different methods for pregnant women including nutrition education in these classes is required and can be a good solution to resolve such problems.

According to the literature and to the fact that using mobile phones and SMS is available and cheap in our country, distance health education via cell phone especially for pregnant women has been neglected. And with respect to the above-mentioned

subjects, this study aims to compare the effect of mobile learning and lecture on nutrition knowledge and behavior of pregnant women.

Methods

This research is a quasi-experimental study with two groups of two variables to determine the independent effect of mobile phones and lecture method of teaching on the dependent variable of the nutrition knowledge and feeding behavior of pregnant women that started in Neyriz Town in December 2014 and ended in March 2015.

The study population consists of 180 pregnant women in three urban health centers of Neyriz in Fars (southern Iran) who were on their first pregnancy and in first or second trimester of it and formed with convenience sampling.

The population was a group of 90 pregnant women who were qualified enough to participate in this research and were selected by convenience sampling.

30 pregnant women were randomly selected from each center and divided into two groups; case group (M- learning) and control group (lecture method), by use of "pregnant women continuous-care booklet" available in all health care centers. Accordingly, the even numbers were assigned to case group and the odd numbers to the control group.

Among the inclusion criteria were nulliparous pregnant women, 20 to 35 years old, gestational age (in the first or second trimester), educational status from high school to associate degree, and also having the "**care for the pregnant patient**" health files in one of the three urban health centers of Neyriz.

Exclusion criteria: changing the coverage health center or unwillingness to continue cooperation. Similarly, people who had a record about previously known diseases such as cardiovascular, renal, respiratory, gastrointestinal, hematological, autoimmune diseases, diabetes and cancer and patients who were treated by specific drugs or with a history of bleeding and threats of abortion or using diet therapy for a chronic systemic disease were excluded.

Subjects, at least with respect to age, gestational age, education level and economic status, were split into two peer groups (45 cases and 45 controls) and after being fully explained and giving consent were enrolled.

In both groups, the research tool for data collection was the awareness and feeding behavior questionnaire and data collection was performed before and after training the entire set of contents.

At first all the necessary explanations, objectives and how to run the plan were explained by a nutritionist to all participants.

Selected individuals in each health center completed the unnamed encoded pre-test questionnaires at health centers in appropriate conditions without being trained.

After being planned and verified by midwifery and nutrition teachers, educational content was set in a simple language and in a way that it was understandable by the mothers.

The content of nutrition education in the first session includes: Introduction to the Food Guide Pyramid, major food groups and their recommended amounts in pregnancy, respecting diversity and balance in the diet.

The educational content in the second session includes: the necessity and the use of nutritional supplements, vitamins and minerals during pregnancy.

Educational content at the third meeting includes: Introduction to common problems during pregnancy and some guidelines to deal with them, as well as nutritional tips to deal with problems and diseases in this period.

In the fourth session, the content includes: modifying eating habits and behaviors of pregnant women.

The control group received educational materials in lecture method using whiteboard over a period of 3 months in 4 sessions of 90-60 minutes.

In the study group, after the completion of the pre-test questionnaires by subjects, explanations on how to get educational materials via cell phone and SMS service were given followed by receiving their personal phone numbers (a landline and a cell phone number); finally the problems and the questions were answered.

During the coordination, which was done by researchers with the Department of Telecommunication in Neyriz, messages related to pregnancy nutrition supplements and problems such as morning nausea, constipation, gastric irritation, etc., were sent to the participants via mobile phone (SMS) during a period of 3-month intervention.

During the intervention period, every two days people were sent a short message so that 45 messages were sent within 3 months.

Text messages were not longer than a maximum of 160 characters; a number was assigned to any messages and each delivered message was checked in front of its inquiry.

If more than two messages were not sent, the researcher contacted the participant with the landline number and she was asked for an explanation then, if necessary, another cell phone number of the individual was received and the rest of the text messages were sent to the new number.

During this time, phone calls to follow up the correct implementation of the program were done by the researcher once a week with the participants' landline numbers.

Four weeks after the 3-month intervention period, throughout a telephone call and after coordination with pregnant women, under appropriate conditions in the health care centers, the unnamed encoded post-test questionnaire, which contains the same nutrition awareness and feeding behavior questions that was previously raised in the pre-test, were completed.

Data were collected by a researcher-made questionnaire. The Questionnaire was presented to 9 members of the faculty, which consists of 5 members of the faculty of midwifery and 3 of dietitians and a gynecologist, to determine the content validity of the questionnaire and then the necessary reforms were done.

To determine the reliability of it in two phases and with an interval of two weeks by 15 pregnant women, who were eligible for the main study, the questionnaire was completed and its reliability was verified using Spearman-Brown coefficient ($r = 0.8$). The internal consistency using Cronbach's alpha coefficient was confirmed respectively ($\alpha = 0.82$ and $\alpha = 0.87$ Cronbach's alpha for awareness and feeding behavior).

The questionnaire consisted of 54 questions that 17 questions related to public information, including: (age of the mother, pregnancy history, education and jobs of mothers, the family income, occupation, age and education level of spouse); 21 questions evaluated the knowledge about food groups, supplements taken during pregnancy and the most common problems during this period and 16 questions in individual nutritive performance part were about the use of nutritional supplements and food groups and dealing with problems common to this period and 16 questions formed the feeding behavior in the "personal performance field" in terms of how to consume the food and supplements and how to deal with common problems in this period.

Since the number of options for answers in awareness and feeding behavior part ranged from two to six different options and people could choose more than one option per question; therefore to uniform all the questions, all of them were standardized. So that if all the questions were answered correctly, they would score 100 and if none of the answers were correct, they would score zero and if some correct options were selected, they would score somewhat between 100-0.

In this study, after collecting data, the data were analyzed using SPSS software and descriptive and inferential statistical methods.

To compare the mean score of awareness and performance before and after the intervention in each group the T-paired test was used.

Independent T-tests was used to compare mean scores of learning via lectures with learning via cell phone and paired T-test was used to compare differences in scores within each group of cell phone and lecture learning.

In addition to creating an intimate atmosphere in the group with regard to the ethical requirements, we tried to draw people's consent to participate in the group.proposal extracted from title confirmed by ethical committee.

Results:

In this study, 90 pregnant women who were either in the first or second trimester of their first pregnancy completed the pre-test questionnaire.

Variables related to demographic and pregnancy data were similar between groups.

More than half of the participants (61.1%) in both groups (57.8% in the study group and 64.4% in the control group) were housewives; about a third of them (32.2%) had secondary education (28.9% in the study group and 35.6% in the control group).

The mean age of participants in cell phone group and lecture group was 27.8 and 26.8 years, respectively.

Most of the mothers in both groups (73.3%) were willing to learn through distance learning methods (booklet - pamphlet - cell phone, etc.) (77.8 and 68.9 percent, respectively in the study and control group) and 26.7 percent of women in both groups preferred direct training classes (22.2 and 31.1 percent respectively in the study and control groups).

In learning via cell phone group, the major concerns of mothers in the field of nutritional intake during pregnancy were, respectively: how to deal with physiological problems such as constipation (28.9%), how to properly use supplements (26.7%), food prohibitions in pregnancy (22.2%) and proper food to increase their baby intelligence (22.2%, respectively).While in the lecture group they were: how to use supplements properly (31.1%), food prohibitions during pregnancy (28.9), how to deal with physiological problems such as constipation (22.2%), and proper food to increase their baby intelligence (17.8%).

More than half of the participants in both groups (71.1%) were untrained about nutritional issues during pregnancy (73.3% in case group and 28.9% in control group) and those who were trained (28.9%), mentioned books, magazines and newspapers as the main source of their information, secondly their friends, thirdly dietitians, lastly the health care centers and radio or TV equally.

The Table 1 & Figure 1 summarizes the descriptive statistics for variables of awareness and feeding behavior of the two groups in the pre-test and post-test.

Table 1: The compare of the effect of mobile based learning and lecture to pregnant women

Group	Index Variable	n	Mean	SD	Min	Max
Mobile based group	Pre-test awareness	45	16.86	5.636	6.40	**30.08**
	Post-test awareness	45	21.94	8.892	0	**36.29**
	Feeding behavior pre-test	45	13.46	8.418	1.43	**39.52**
	Feeding behavior post-test	45	22.17	9.558	0	**41.07**
Lecture Based group	Pre-test awareness	45	23.78	8.617	7.19	**43.41**
	Awareness post-test	45	22.58	8.367	0	**38.97**
	Feeding behavior pre-test	45	22.70	13.906	0	**46.07**
	Feeding behavior post-test	45	24.89	11.513	0	**44.88**

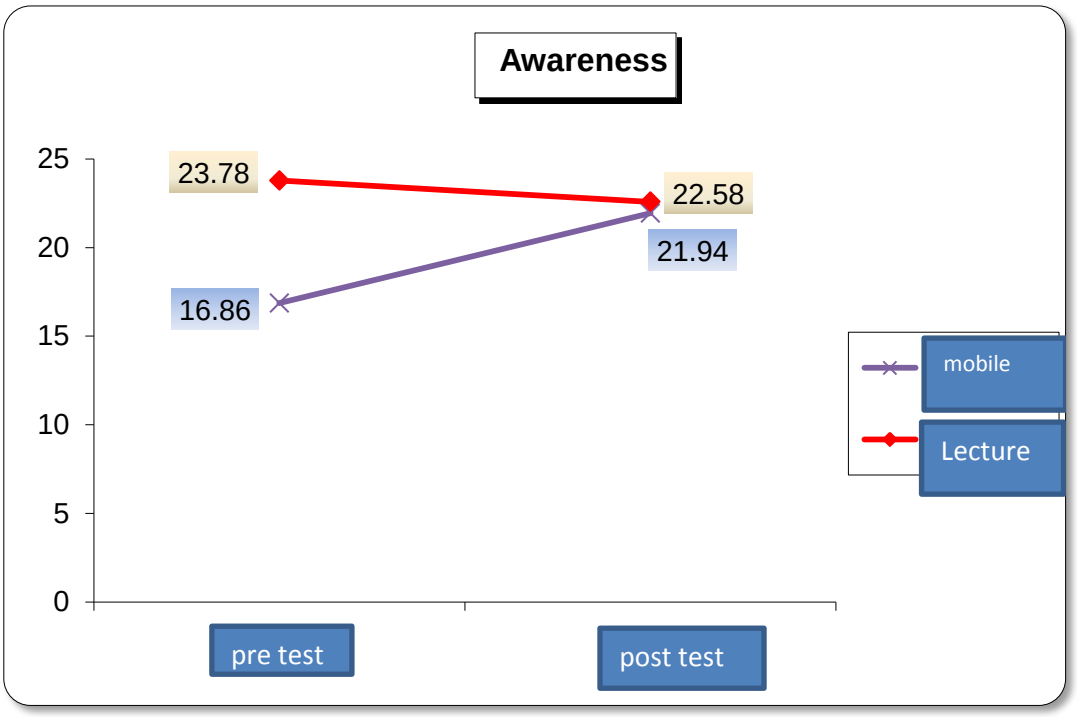

Figure 1: Average Awareness in both groups for pre-test and post-test

The graph above shows the average awareness for the lecture group at pre-test and post-test for pregnant women were close, while the cell phone group shows a significant increase in post-test.

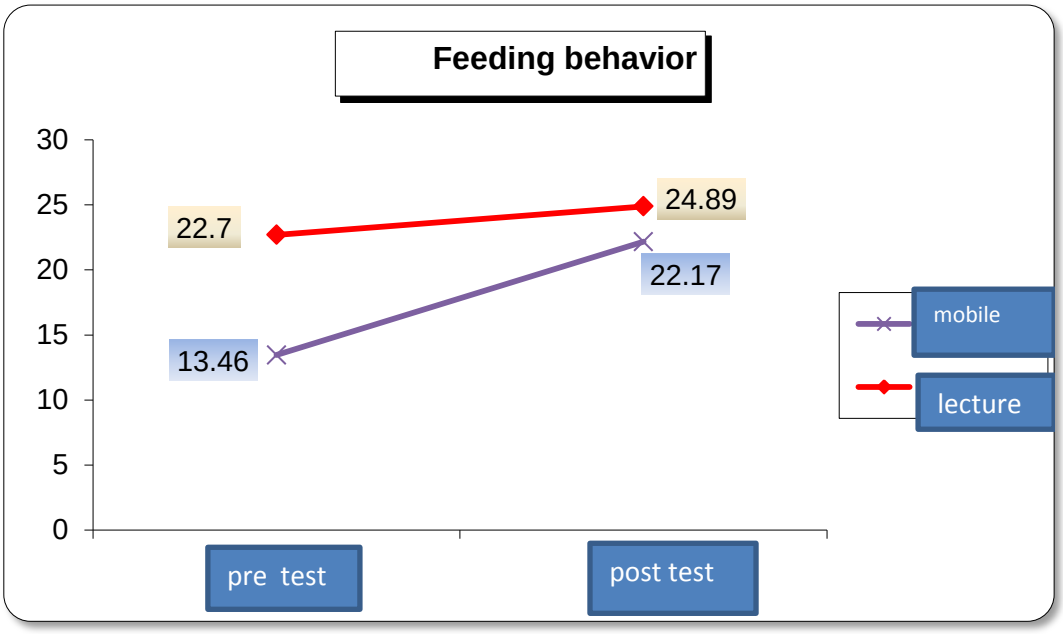

Figure 2: Average feeding behavior of the two groups in pre-test and post-test

The other results shows that in the lecture group the average behavior of pregnant women in pre-test and post-test was close, while the post-test in the cell phone group increased significantly comparing to the pre-test.(Figure 2)
To compare the average scores of pre-test and post-test of study and control groups paired t-test was used. The results are presented in table 2.

Table 2: The comparison of the means for of the awareness between pre-test and post-test in the Lecture group by paired t-test

Index Group	N	Mean	SD	standard error	Mean difference	calculated t	Degrees of freedom	significance level
Pre-test	45	23.78	8.617	1.284	1.20	0.842	44	0.404
Post- test	45	22.58	8.367	1.247				

Table 3: shows comparison of the means for feeding behavior between pre-test and post-test in the Lecture group by paired t-test

Index Group	N	Mean	SD	standard error	Mean difference	calculated t	Degrees of freedom	significance level
Pre-test	45	22.70	13.906	2.073	-2.19	-1.693	44	0.098
Post- test	45	24.89	11.513	1.716				

According to both **2** and **3** tables (p>0.05), the results show that there is no significant difference between awareness and feeding behavior of pregnant women before and after the lecture group. In other words, the lecture method of teaching pregnant women showed no significant effect on increasing their awareness and feeding behavior.(Table 2&3).

Table 4: Paired t-test to compare means of awareness between pre-test and post-test in the mobile based learning

Index Group	N	Mean	SD	Standard error	Mean differences	Calculate t	Degree of freedom	Significance level
Pre-test	45	16.86	5.636	0.840	-5.08	-3.509	44	0.001
Post- test	45	21.94	8.892	1.325				

Table 5: Paired t-test for comparing means of feeding behavior between the pre-test and post-test in the M- learning Group

Index Group	N	Mean	SD	Standard error	Mean differences	Calculate t	Degree of freedom	Significance level
Pre-test	45	13.46	8.418	1.254	-8.71	-5.351	44	0.001
Post- test	45	22.17	9.558	1.424				

According to both 4 and 5 tables (p <0.05), the results show that there is a significant difference between awareness and feeding behavior in the pre-test and post-test of Cell phone group. In other words, Cell phone method showed a significant effect on raising awareness and feeding behavior of pregnant women.(Table 4&5).
Individuals' satisfaction to attend the meetings was taken and they were reassured that all personal information and their contact numbers will be kept confidential.

Discussion

The findings of this study indicate that the awareness and feeding behavior of pregnant women in the pre-test and post-test for the lecture group were close to each other; in other words, lecturing had no significant effect on increasing the awareness and feeding behavior of pregnant women.
While M learning had significant effect on learning and helped increasing the awareness and feeding behavior of pregnant women.
The results of this study correspond with the findings of Mac Kunata et.al(22), and Wang(23).
The results of Anderson et.al in Scotland[24] and also Boyd[25] et.al in the United States showed that nutritional education can improve the nutritional understanding during pregnancy.
The results of a survey on changing the behavior of pregnant women in the United States represents a significant improvement of energy intake, folate, iron, calcium and a number of daily meals from vegetables and grains, after training the experimental group(26).
The results of some studies also reflect no positive impact or improvement of educational interventions on feeding behavior. The alteration between the results of different studies may be due to the method of presentation of training and educational interventions. On the other hand, we should note that although awareness for behavior change is necessary, it is not sufficient; in addition nutritional knowledge and feeding behavior do not have necessarily positive relationship with each other(27).
Thassri et.al in Thailand(28) had held nutritional education classes with discussion and giving lectures. No written training package was offered in those classes to pregnant women. The results showed no change in improving the nutritional status of pregnant women.
Lack of significant positive effect of nutritional education could be related to factors, other than just given information (awareness), such as lifestyle(29), the society beliefs[(24),] economic issues[30] and food availability (30 , 31).
Studies have shown that the use of diverse teaching methods can have a profound impact on the results in terms of technique and style of educational interventions.
The findings of this study can be confirmed by the results of Kummer et.al (32), and Hartnel et.al (8), also pointed out that the use of cell phone for learning, resulted in positive outcomes.

In their study, Noohi et.al investigated training nursing through the lecture and electronic methods. Their results showed that nurses can replace electronic training with the traditional methods(33).
Another study showed that people usually spend 0-8 hours on continuous medical educational programs per day, while in cell phone and computer-based learning, the learning time would reach two to a maximum of three hours a day and the learners themselves can determine the time and place of their learning. So, not only can it save time and money but the educational institutions also can save the costs of such courses(34).
Studies show that training with short message service (SMS) has been welcomed by the learners and that it was effective in achieving the intended objectives and motivated the students to participate in discussion forums(35).
The majority of Iranian students' attitude towards the use of cell phones is positive. In other words, students are aware of the potential use of mobile phones in education(36).
Because of their mobility and availability at any time and place, with features such as the possibility of distance learning, active learning and participation, practice, repetition and presenting the content in small pieces, the cell phones are supported by theories of learning besides grasping the researchers attention in the learning context(37).
Persistent development of educational systems based on cell phone or E-learning is now a necessity in dealing with these new developments and leads to a knowledge-based society(38).
To have access and control over the information and communication technologies such as cell phones to take advantage of them for educational and strategic planning of the society is considered as one of the basic components of the educational system strength and capability.
However, due to the rapidly increasing pace of generating knowledge and the development of communication devices such as cell phones and because of the fact that currently such tools are scarcely used in teaching and learning environments, providing a context to use these technologies in educational fields in order to help improve the quality of teaching and learning is among the important and fresh issues (22 ,36).
Among the limitations of this study is that learners are not familiar with various usages of the cell phones as a training strategy; moreover they do not have the necessary information to use it.
On the other hand, suitable training packages to send educational text, in which the conditions of intended learners have been considered, are not sufficiently available.
Therefore, organizing some centers to send educational materials and set up or produce educational videos with concise and beneficial contents and educational objectives can contribute to the development of this method.
Also, those specialists whose ideas are consistent with the progression of today's world and with the target group can be applied for planning and production of educational contents, and thereby we can put an emphasis on reforming the country's educational system directions with respect to the circumstances and needs of modern science and technologies (37).
It is necessary to specify the role of new technologies in the educational system and to prepare educators to use them in the training process as well as providing appropriate cultural context for taking advantage of them appropriately in the health system. It is therefore recommended to generate a positive attitude towards learning through mobile phone, its role in the effectiveness of training programs and the quality of education.
Considering the conditions of health centers in the country and lack of access to appropriate learning environment plus the ease of such educational programs via mobile phone and its low cost, it is recommended to use it in all health centers.

Conclusion

Educational functions of cell phones reflect the fact that the world today makes use of such educational systems to suit the needs of the present time.
This pervasive media is and will be considered as a powerful status for those involved in the health system to promote the public health.
We should make the potential opportunities of cell phones come true by developing an appropriate culture and establishing mobile infrastructure technology.
The repetition of similar studies in different parts of the country, with respect to the influence of nutrition-culture, can lead to more information on providing training with this method. Exploring the long-term effect of interventions in this field can help achieving more accurate results.

Declarations

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Availability of data and materials

All data is available through the first author of the manuscript.

Authors' contributions

Khadijeh abdollahifard was the literature review and the study, and she was the primary contributors to the paper . Mitra Amini was the supervisor of the study. She was responsible for the conception and design of the research project. Leili mosalanejad was the supervisor also.All the authors were responsible for the analysis and interpretation of the data. Mitra amin and leili msalanejad were involved in the draft of the manuscript, critical revision of the manuscript and approval of the final version.

Competing interests

The authors declare that they have no competing interest.

Consent for publication

The participants of the study gave informed consent for their direct quotes to be published in a research article.

Ethics approval

The study was presented to The Regional Ethics Committee of the Shiraz University of Medical Sciences . All participating in this study signed the consent form.

Publisher's note

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