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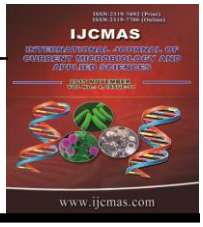

Original Research Article

Effect of Mobile Based Educational Technology on Prevention of Osteoporosis among Child bearing Women at Eldemerdash Hospital

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Keywords

Mobile, educational technology, osteoporosis, prevention, childbearing, women, and Eldemerdash hospital.

A B S T R A C T

World Health Organization ranks osteoporosis as one of the most important health issues among noninfectious diseases (WHO, 2003). The aim of this study was to evaluate the effect of mobile-based educational technology on prevention of osteoporosis among childbearing women at Eldemerdash hospital. Quazi-experimental design was utilized for conducting the study. A purposive sample of 190 adult childbearing women at obstetric outpatient clinic in Eldemerdash hospital, Cairo, Egypt, were randomly divided into study and control groups (95women each). Data were collected through; Self-Administered Structured Questionnaire to assess demographic characteristics and menstrual history of studied women, knowledge regarding osteoporosis**,** women's osteoporosis Preventive measures. There was statistically significant improvement of knowledge regarding prevention of osteoporosis, preventive measures for prevention of osteoporosis as diet, exercises, sunlight and smoking cessation and serum level of blood calcium in the study group after implementation of mobile-based educational technology when compared to the control group. A mobile based educational technology improve the women's knowledge regarding prevention of osteoporosis, preventive measures for prevention of osteoporosis as diet, exercises, sunlight and smoking cessation and serum blood calcium level. It is suggested to apply this mobile-based educational technology on the childbearing women and to replicate the study on a larger study sample in different settings to generalize the results.

Introduction

Osteoporosis is a serious and growing public health issue and a major cause of bone fractures worldwide. Osteoporotic fractures results in significant morbidity, mortality, reductions in quality of life and higher healthcare costs (Kanis *et al.*, 2013). It expected to affect 200 million women worldwide and causes more than 8.9 million fractures annually. This disease is three times more common in women as compared to men and osteoporosis related fractures occur in one out of every two women (Lin *et al.*, 2015).

Many factors are regarded as risks for osteoporosis which include several changeable and unchangeable risk factors. The unchangeable factors are gender, family history, ethnicity and race, advancing age, postmenopausal status and body frame size (El-Tawab *et al.,* 2015).

Environmental risk factors (changeable) include low activity level, sedentary lifestyles over many years, smoking, alcohol abuse, and poor nutritional behaviors including eating disorders, low vitamin D intake and low calcium intake. Extreme consumption of soft drinks and caffeinated drinks cause calcium loss via the kidney. Caffeine use of more than three cups of coffee every day might increase calcium excretion in the urine and it affects bone health (National Osteoporosis Foundation 2011).

Globally, public awareness of osteoporosis persists to be low, particularly in developing countries (Elayeh *et al.,* 2014). Improving knowledge about osteoporosis has been shown to be effective among different age groups of female population (Hossein, 2014).

Education is important strategy in the prevention of osteoporosis, and many studies have been performed to enhance knowledge of women, using workshops and group discussions. The challenge for osteoporosis prevention programs is to promote early detection of risk factors and to encourage the adoption of risk-reducing behaviors in women from adolescence to perimenopause to develop a healthy lifestyle (Malak and Toama, 2015).

Osteoporosis is preventable and curable, and an important point in preventing the disease is to modify thinking, lifestyle, and daily habits in such a way that improves the quality of life and efficiency of individuals. Therefore, teaching preventive behaviors such as balanced diet like a simple and efficient means can help us prevent the disease and promote and maintain our health (Baheiraei *et al.,* 2005 and Sedlak *et al.,* 2005).

Recently, technology has developed to be one of the primarily considerable means by which to acquire health and medical information (Mouton and Cloes, 2013). Additionally, innovations in mobile and electronic healthcare are revolutionizing the participation of both doctors and patients in the modern healthcare system. It creates new opportunities for individuals to join actively in monitoring and improving their health (Appelboom *et al.,* 2013).

Mobile health (mHealth) explains the use of portable electronic devices with software applications to provide health services and manage patient information. With approximately 5 billion mobile phone users worldwide, opportunities for mobile technologies to play a formal role in health services, particularly in low- and middle-income countries, are increasingly being documented (Källander *et al.,* 2013). Using new technologies in osteoporosis prevention must focus on younger people either by promoting more primary or secondary preventive actions and older people, they must be modified to produce their interest when they have osteoporosis or are at a high risk of fracture (i.e. tertiary prevention). As it has been shown in the literature, the two solutions are suitable in a (pre)- menopausal population (Slomian *et al.,* 2014).

Significance of the Study

World Health Organization ranks osteoporosis as one of the most important health issues among noninfectious diseases (WHO, 2003). Women are eight times more at risk of osteoporosis than men are

accordingly, about 200 million women suffer from the disease worldwide (Jeihooni *et al.,* 2015). Osteoporosis is considered a health problem in Egypt, as Egyptian women generally have lower bone mineral density compared with women in Western countries (Mohamed and Tayel, 2012). Constructed bone mineral density charts for Egyptian women showed that they have a lower bone mineral density compared to their western counterparts. According to the recent International Osteoporosis Foundation (IOF) report, 28.4% of postmenopausal women in Egypt are estimated to have Osteoporosis (Isma'il *et al.,* 2015).

Mobile phone interventions have improved preventive behaviors (Buller *et al.,* 2013). The advantages of mobile technologies may be a powerful media for providing individual support to health care consumers. The popularity of mobile technologies has directed to high and increasing ownership of mobile technologies, which means interventions can be delivered to large numbers of people. In 2009, more than two-thirds of the world's population owned a mobile phone and 4.2 trillion text messages were sent. In many high-income countries and low income countries (Free *et al.,* 2013).

The aim of this study was to evaluate the effect of mobile-based educational technology on prevention of osteoporosis among childbearing women at Eldemerdash hospital through; Evaluate knowledge regarding prevention of osteoporosis. Assess preventive measures for prevention of osteoporosis as diet, exercises, sunlight and smoking cessation. And also to Assess serum blood calcium level.

Hypotheses

In order to accomplish the research aim of this study the following hypotheses was suggested: The study group who receive mobile based educational technology will have significant higher Knowledge, preventive measures of osteoporosis and higher serum calcium than the control group who receive the routine care.

Subjects and Methods

Research Design

A quasi-experimental research design has been utilized in this study.

Research setting

The study was conducted at the outpatient obstetric clinic for follow up after delivery, at Eldemerdash hospital in Cairo - Egypt.

Subjects

Purposive sample of 190 adult women were included in this study. Women for this study were childbearing had one child or more; they from outpatient obstetric clinic for follow up after delivery, can read and write. Women divided randomly into two equal groups (95 patients each) to constitute the study and control groups.

Inclusion criteria include the following

Adult woman who had one child or more. Women or any one from their family should have smart phone, basic familiarity with the usage of mobile phone and sending and receiving a short message. Availability of mobile phone network in women' area of residence. In addition, they should be able to read, write and communicate with the researchers and understand the goals of the study. The sample size was estimated with STATA 10 program. The estimated required sample size was 95 women in each group, to achieve power of study 80%, power = 0-8000 and alpha=0.0500.

Study tools

The following tools were used to collect data related to this study;

Include the following Self-Administered Structured Questionnaire

It was written in a simple Arabic language and comprises 4 parts. The first part was concerned with demographic characteristics of studied women such as age, education, work and marital status, number of children, passive or active smoking, presence or absence of family history of osteoporosis, body mass index and serum calcium level. The second part include assessment of menstrual history of studied women such as age of menarche, regularity of menstruation, parity, abortion number, breast feeding and contraceptive using. The third part: It was developed by the researchers based on the related literature and validated by a group of five experts in medical surgical and community health nursing departments at Faculty of Nursing, Ain Shams University. It was used to assess woman's knowledge regarding osteoporosis included seven items related to definition, causes, symptoms, diagnosis ,prevention of osteoporosis, calcium and vitamin D resources. The forth part: It developed and constructed by the researchers based on the related literature and validated by a group of five experts in medical surgical and community health nursing departments at Faculty of Nursing, Ain Shams University. It was designed to assess women's Preventive measures regarding Osteoporosis. It included women's Preventive measures regarding (healthy dietary intake per week, risky dietary intake per day and exercises, sunlight exposure in right manner, calcium supplementary intake, active and passive smoking cessation).

Scoring systems

The total score of knowledge was 32 degree. The score one was given for each correct answer and zero for incorrect answer. For each area of knowledge, the scores of the items were summed-up and the total score divided by the number of the items. These scores were converted into a percent score. The total women's' knowledge was considered satisfactory if the percent score was 60% or more, and unsatisfactory if less than 60%.

The current study was carried out on three phases, preparatory phase, implementation phase and evaluation phase. The actual filed work of this study started at the beginning of November 2014 till May 2015.

Phase I: Preparatory phase

It included reviewing of related literature, and theoretical knowledge of various aspects of the study using books, articles, internet, periodicals and magazines to develop data collection tools and the educational guidelines content.

Educational guidelines and short messages

Educational guidelines and a total 48 short messages were designed by the researchers based on the needs of the studied women to improve women's knowledge and preventive measures of osteoporosis based on the related literature .It was written in Arabic language.

The guidelines were revised by a group of five experts in Medical Surgical and community health nursing at faculty of Nursing, Ain Shams University for the content validity and applicability. It included two parts. The first part: it included

knowledge regarding osteoporosis included seven items related to definition, causes, symptoms, diagnosis, prevention of osteoporosis, calcium and vitamin D resources. The second part: it included women's Preventive measures regarding healthy dietary intake, the women's Preventive measures regarding risky dietary intake and women's Preventive measures regarding exercises, sunlight exposure in right manner, calcium supplementary intake, active and passive smoking cessation.

Validity and Reliability

Testing validity of the study tools was done by a jury of 7experts from different academic categories (professors and assistant professors) of the medical –surgical nursing at the faculty of nursing. Testing reliability of the proposed tools was done statistically by Cronbach alpha test.

Ethical consideration

Human rights and ethical permission were obtained to conduct the study. Women were fully informed about the purposes of the study. The voluntary nature of participation was stressed as well as confidentiality. Consent was obtained from each woman. Head of outpatient clinic gave permission to perform the study. Each woman has the Wright to withdraw at any time.

Phase 2: Implementation phase

A pilot study was carried out by 10 women to test the clarity, applicability, objectivity and feasibility of the tools to conduct the study. Changes and modifications were done accordingly. The subjects included in the pilot study were excluded from the study. Women in the obstetric outpatient clinic who met the study criteria were included immediately after their Permission. Women's assessment data sheet was fulfilled as a baseline pre data. The researchers were available 3 days per week at the morning shift in the previously mentioned setting. Educational guidelines were loaded to each woman mobile. Additionally 48 short messages directed to each woman in the study group during 4 months follow-up (3 each week). Short messages in the study were prepared according to preventive measures of osteoporosis among childbearing women. The short messages categorized to three parts; firstly knowledge, after that preventive measures and in between motivation messages.

Phase 3: Evaluation phase

The evaluation of this study was measured two times after intervention, the first time was immediate and the second time was one month after educational intervention as a follow up by measuring knowledge and awareness regarding preventive measures that essential for prevention of osteoporosis. The study group who receive mobile-based educational technology will have significant higher knowledge and awareness regarding preventive measures essential for prevention of osteoporosis than the control group who receive the routine care. Also the study group had serum calcium higher than the control group.

Data analysis

Data entry, validation and analysis were done with the statistical package for social science version 17.0; the statistical tests used are chi-square test. A value of $p<0.05$ was considered to be statistically significant.

Results and Discussion

Regarding personal information, table 1 shows that nearly half (50.5% and 46.3%) of the study and control groups aged 30 to 40 years respectively, (38.23±5.46) and

(36.58±6.76) were means and standard deviation of both groups**.** Nearly half (54.7 % and 49.5 %) of them had secondary education, also nearly three quarters (77.9% and 73.7%) had work. The majority (88.4% and 87.4%) of them were married and (72.6%) of both groups had one to three children. As regard family history the minority (8.4% and 15.8%) of them had family history of osteoporosis, in addition; minority (12.6% and 15.8%) of both groups were smokers whereas nearly half (50.5% and 47.4%) of them exposed to passive smoking.

Table 2 indicates that more than two-fifths (44.2% and 46.3%) of women in both groups menarche' age was 12 years to 14 years. Also nearly, two thirds (70.5 % and 65.3%) had regular menstruation and minority of them (8.4% and 6.3%) aborted more than 3 times, additionally nearly three quarters (82.1%, 73.7% and 70.5%, 76.8%) of them breast fed their children and used contraception methods respectively. Regarding Serum blood calcium level, table 3 shows that, there was improvement in serum calcium level in the study group at post and follow up. While there was no significant difference between two groups before, after implementation and follow up assessment.

Regarding knowledge of osteoporosis table 4 shows that both groups had unsatisfactory knowledge pre intervention. Also it shows that there was a highly significant difference (P> 0.000) throughout the intervention program (pre, post and in the follow up) among women of study group comparing to women of control group regarding knowledge about osteoporosis; definition, Causes and risk factors, symptoms, Diagnosis, Preventive measures, Calcium sources and Vitamin D sources.

Regarding mean of knowledge of both groups before, after and follow up program implementation, figure 2 shows that women in study group had poor knowledge were means of knowledge before implementation was (7.34) while after and follow up implementation was (28.36) and(27.93) respectively. While (8.53), (9.07) and (8.99) were means of knowledge in the control group before, after and follow up implementation respectively.

Regarding dietary intake table 5 shows that (12.6% and 10.5%) of two groups eat dairy products ≥ 3 three times/week pre implementation; while (58.9% and 10.5%) of two groups eat it respectively post implementation also (61.1% and 12.6%) in the follow up. There was statistical significant difference between two groups in post and follow up. Also (30.5% and 20%) of two groups consume eggs ≥ 3 three times/week pre implementation; (50.5% and 24.2%) of two groups consume eggs ≥ 3 three times/week respectively post implementation with highly statistical significant difference. In the follow up (52.6% and 20%) of two groups consume eggs ≥ 3 three times/week. Regarding protein intake (chicken/meat) there was a slightly increase in study group intake (36.8%) compared to control group (23.2%) post intervention. In the follow up 36.8% and 23.2% in the study and control groups respectively. As well as there was significant improve in percentage of women of study group eating fish, legumes compared to control group in post and follow up intervention.

Regarding intake of Vegetables, table 5 shows that nearly two-thirds (63.2 % and 60.0%) of the study and control groups respectively consume vegetables ≥ 3 three times/week pre intervention. There was statistical significant difference between two groups in post and follow up. Also

Regarding intake of fruits this table shows that there was no statistical significant difference between two groups in post intervention, while there was highly statistical significant difference between them in follow up intervention.

Regarding risky dietary habits table 6 shows that (26.3% and 23.2%) of two groups intake coffee ≥ 3 three times/day pre implementation; while (15.8% and 23.2%) of two groups intake coffee ≥ 3 three times/day respectively in post and follow up implementation with statistical significant difference. Regarding soft drink (20.0% and 23.2%) of two groups intake soft drink ≥ 3 three times/day pre implementation; while (9.5% and 23.2%) of two groups intake soft drink ≥ 3 three times/day respectively post implementation with statistical significant difference between them in post and follow up intervention. Regarding salts and salty food intake (63.2%) of two groups intake salts ≥ 3 three times/week pre implementation; while no one of study group intake salt and salty food ≥ 3 three times/week compared to (60%) of control group intake salts ≥ 3 three times/week respectively post implementation with highly statistical significant difference between them. As well as significant decrease of intake of coffee and tea of study group compared to control group post and follow up intervention.

Regarding preventive measures of osteoporosis table 7 reveals that improvement of women in study group post and follow up intervention regarding practice of different preventive measures of osteoporosis as exercise, exposure to sunlight in right manner, intake of calcium tablets, stop smoking and non-exposed to passive smoking comparing to control group with highly significant difference ($p > 0.000$).

Concerning personal characteristics, the findings of this study showed that nearly half of the study and control groups aged 30 to 40 years. The same findings was proved by Eshra *et al* (2012) who stated that their study age chosen was during the reproductive years because at this age it was expected that there is lower risk for osteoporosis among this age group. Nevertheless they found that young women had poor knowledge regarding risk factors and prevention of osteoporosis. Therefore young women awareness of the risk factors is one contributor to osteoporosis preventive behaviors which helping women to retain bone minerals density.

Our findings revealed that the minority of study and control groups had family history of osteoporosis, A study done by Robitaille *et al* (2008) to measure prevalence, family history, and prevention of osteoporosis in U.S. women their findings indicated that family history is a significant, independent risk factor for osteoporosis in U.S. women aged ≥35 years.

In addition our results reflected that minority of both groups was smokers and nearly half of them exposed to passive smoking. Gao *et al.*,2011 reported that many studies found that smoking was a risk factor for osteoporosis. Meta-analyses of the effects of smoking on bone status have demonstrated decreased bone mass in current smokers compared to non-smokers. Furthermore a study done by Holmberg *et al* investigates an association between phalangeal bone mineral density (BMD) and self-reported passive smoking using data on 15,038 persons. It reported that Subjects who exposed to passive smoking at home as an adult had significantly lower BMD than unexposed subjects.

Regarding obstetric history our findings proved that nearly three quarters of both group breasts fed their children and used contraception methods. Kojima *et al* (2002) examined the impact of parity and breastfeeding on BMD in pre- and post-menopausal women in a cross-sectional study. They declared an inverse correlation between total breastfeeding period and BMD in premenopausal women but found no association between them in the postmenopausal women.

Regarding knowledge of osteoporosis our results showed that highly significant improvements (P> 0.000) post the program intervention among women of study group comparing to women of control group.

In similar line Asakawa *et al* (2013) investigate educational program by new mobile phones technologies in relation to osteoporosis. Their study assessed a program to promote calcium intake and physical activity through sending emails over 6 months for women aged 18–25 years. They found that the study group had a significantly increased calcium intake and did more exercise compared to the control group.

Another study conducted by Drieling *et al* (2011) who randomized 121 women to receive either personalized internet based tutorials with behavior modification strategies or standard information. The study group significantly increased general osteoporosis and calcium awareness and knowledge compared with the control group.

Additionally A quasi experimental study conducted by Ibrahim *et al* (2014) to evaluate osteoporosis knowledge among menopausal women. The findings conclude that there is a significant improving in women knowledge whereas. As well, there were improvements in women's knowledge about the prevention and management of the disease after the implementation of the program.

Another recent study carried out by Ninan *et al.,* 2015 to examine the impact of video-assisted teaching module on knowledge of osteoporosis among Women in Selected Hospitals, Chennai. The findings revealed that significantly improvement in osteoporosis knowledge and health belief of women post intervention.

Concerning dietary intake we observed that our results proved the effectiveness of the education program, which promoted dietary enhancement of study group especially dairy products intake which the main sources of calcium comparing to control group. The findings was consistent with Jeihooni *et al* (2015) who conducted a quasi-experimental study to evaluate effects of an osteoporosis prevention program based on health belief model among females. It is found the mean scores of nutrition and exercise performances in the study group significantly increased compared to those of the controls both immediately and six months after the intervention. It indicates the positive effects of education on subject's performance regarding osteoporosis preventive behaviors.

Moreover; a study was conducted by Bhurosy *et al* (2013) to examine the impact of a theory-based educational intervention in improving the calcium intake, self-efficacy, and knowledge of older Mauritians. The study group received Calcium poster and pamphlet to improve calcium intake among postmenopausal women and older adults aged above 40 years. The results reflected that improve their calcium intake, daily milk intake, and positive health beliefs and revealed higher knowledge scores than those of the control group after intervention. In addition, physical activity in the intervention

group also improved significantly from baseline to post-test.

Regarding risky dietary habits we observed significantly higher reduction in consumption of unhealthy food of study group comparing to control one.

Similarity Eshra *et al* (2012) found that modification of risk behavior program was significant decreased the intake of unhealthy drinks after their counseling .Whereas the mean daily tea (cups) consumption was (3.1033 + 1.65) before counseling compared to only (1.0900 + 0.77) after counseling. In relation to coffee intake mean daily coffee (cups) consumption was (1.2000 + 0.49) before counseling compared to (0.5000+0.037) after counseling.

Table.1 Personal information of study and control groups

Variables	study group =95		control group =95		Test X^2	P value
	No	%	No	%		
Age/years						
20-	7	7.4	11	11.6	1.063	0.588
30-	48	50.5	44	46.3		
40+	40	42.1	40	42.1		
Mean and standard deviation of age	38.23±5.46		36.58±6.76			
Education						
Basic education	38	40	39	41.1		
Secondary	52	54.7	47	49.5	1.408	0.495
Higher	5	5.3	9	9.5		
Work status						
Work	74	77.9	70	73.7	0.459	0.498
Not Work	21	22.1	25	26.3		
Marital status						
unmarried	11	11.6	12	12.6	0.049	0.824
Married	84	88.4	83	87.4		
Number of children						
0	17	17.9	15	15.8	0.325	0.850
1-3	69	72.6	69	72.6		
4+	9	9.5	11	11.6		
Family history						
Yes	8	8.4	15	15.8	2.424	0.120
No	87	91.6	80	84.2		
Smoking						
Yes	12	12.6	15	15.8	0.389	0.533
No	83	87.4	80	84.2		
Passive smoking						
Yes	48	50.5	45	47.4	0.190	0.663
No	47	49.5	50	52.6		

Table.2 menstrual and obstetric history of study and control groups

variables	study group 95=		control group =95		Test X^2	P value
	No	%	No	%		
Age of menarche/years						
Before 12	14	14.7	20	21.1		
12-	42	44.2	44	46.3	2.02	0.364
14+	39	41.1	31	32.6		
Regularity of menstruation						
Regular	67	70.5	62	65.3	1.185	0.553
Irregular	12	12.6	11	11.3		
No menses	16	16.8	22	23.2		
Parity					0.325	0.850
0	17	17.9	15	15.8		
1-3	69	72.6	69	72.6		
4+	9	9.5	11	11.6		
Abortion						
No	76	80	70	73.7		
1-2	11	11.6	19	20	2.66	0.264
3+	8	8.4	6	6.3		
Breastfeeding						0.162
Yes	78	82.1	70	73.7	1.956	
No	17	17.9	25	26.3		
Contraceptive						
Yes	67	70.5	73	76.8	0.977	0.323
No	28	29.5	22	23.2		

Table.3 Serum blood calcium levels of two groups before, after and follow up of intervention

Parameters	Pre implementation				Post implementation				Follow up			
	study group N=95		control group N=95		study group N=95		control group N=95		study group N=95		control group N=95	
	No	%	No	%	No	%	No	%	No	%	No	%
Blood Ca level												
Normal (8.2 to 10)	69	72.6	78	82.1	82	86.3	75	78.9	84	88.4	75	78.9
Low < 8.2	26	27.4	17	17.9	13	13.7	20	21.1	11	11.6	20	21.1
X^2	2.435				1.797				3.122			
P value	0.119				0.180				0.077			

Table.4 Differences between two groups regarding their Knowledge before, after and follow up of intervention

variables	Pre implementation				Post implementation				Follow up			
	study group N=95		control group N=95		study group N=95		control group N=95		study group N=95		control group N=95	
	No	%	No	%	No	%	No	%	No	%		
Def.												
Satisfactory	17	17.9	15	15.8	95	100	15	15.8	90	94.7	15	15.8
Unsatisfactory	78	82.1	80	84.2	0	0	80	84.2	5	5.3	80	84.2
X2	0.150				1.38				119.748			
P Value	0.698				0.000				0.000			
Causes												
Satisfactory	0	0	0	0	81	85.3	2	2.1	78	82.1	2	2.1
Unsatisfactory	95	100	95	100	14	14.7	93	97.9	17	17.9	93	97.9
X2	No available test				1.33				124.709			
P Value					0.000				0.000			
Symptoms												
Satisfactory	2	2.1	4	4.2	88	92.6	10	10.5	85	89.5	9	9.5
Unsatisfactory	93	97.9	91	95.8	7	7.4	85	89.5	10	10.5	86	90.5
X2	0.688				1.282				121.613			
P Value	0.341				0.000				0.000			
Diagnosis												
Satisfactory	7	7.4	9	9.5	95	100	10	10.5	88	92.6	9	9.5
Unsatisfactory	88	92.6	86	90.5	0	0	85	89.5	7	7.4	86	90.5
X2	0.273				153.810				131.448			
P Value	0.601				0.000				0.000			
Preventive measures												
Satisfactory	4	4.2	3	3.2	88	92.6	7	7.4	82	86.3	9	9.5
Unsatisfactory	91	95.8	92	96.8	7	7.4	88	92.6	13	13.7	86	90.5
X2	0.148				1.381				112.389			
P Value	0.722				0.000				0.000			
Calcium sources												
Satisfactory	24	25.3	28	29.5	95	100	29	30.5	90	94.7	28	29.5
Unsatisfactory	71	74.7	67	70.5	0	0	66	69.5	5	5.3	67	70.5
X2	0.424				101.129				85.965			
P Value	0.515				0.000				0.000			
Vitamin D sources												
Satisfactory	16	16.8	20	21.1	95	100	19	20	90	94.7	19	20
Unsatisfactory	79	83.2	75	78.9	0	0	76	80	5	5.3	76	80
X2	0.548				66.02				108.482			
P Value	0.459				0.000				0.000			

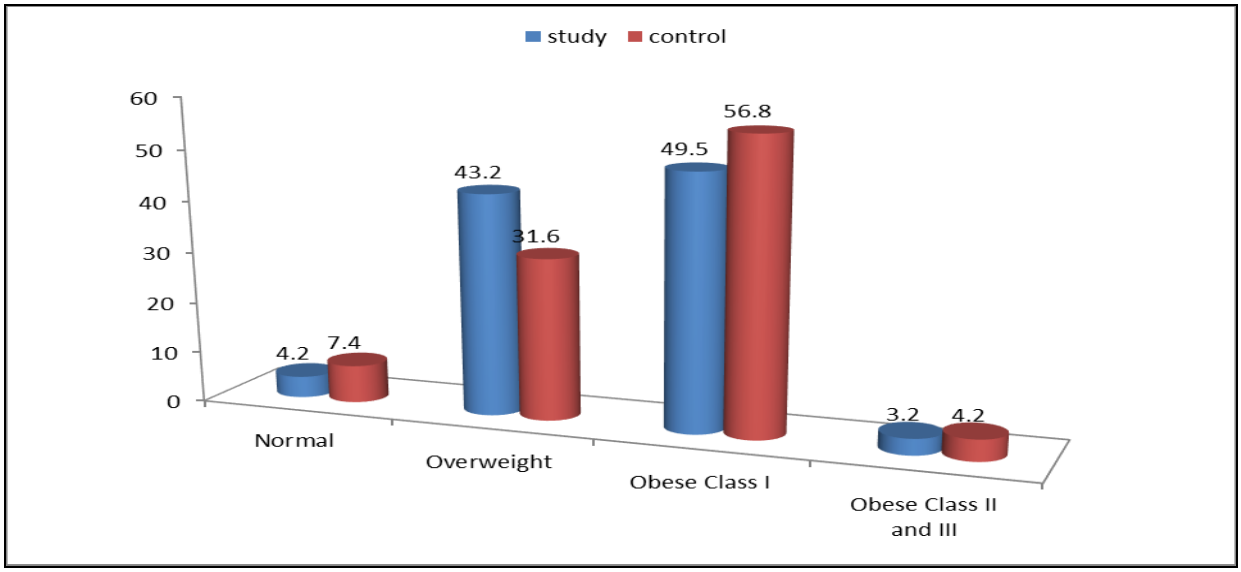
Table.5 Differences of healthy dietary intake per week in two groups before, after and follow up of intervention

Parameters	Pre implementation				Post implementation				Follow up			
	study group N=95		control group N=95		study group N=95		control group N=95		study group N=95		control group N=95	
	N	%	N	%	N	%	N	%	N	%	N	%
Dairy products ≥ 3 T / week	12	12.6	10	10.5	56	58.9	10	10.5	58	61.1	12	12.6
< 3 T / week	42	44.2	40	42.1	24	25.3	40	42.1	27	28.4	40	42.1
<Once monthly	41	43.2	45	47.4	15	15.8	45	47.4	10	10.5	43	45.3
X^2 P value	0.417 0.812				51.061 0.000				53.298 0.000			
Eggs ≥ 3 T / week	29	30.5	19	20.0	48	50.5	23	24.2	50	52.6	19	20.0
< 3 T / week	38	40.0	42	44.2	36	37.9	42	44.2	30	31.6	42	44.2
<Once monthly	28	29.5	34	35.8	11	11.6	30	31.6	15	15.8	34	35.8
X^2 P value	0.468 0.239				18.069 0.000				23.295 0.000			
Chicken/ Meat ≥ 3 T / week	20	21.1	22	23.2	40	42.1	22	23.2	35	36.8	22	23.2
< 3 T / week	35	36.8	28	29.5	20	21.1	28	29.5	25	26.4	28	29.5
<Once monthly	40	42.1	45	47.4	35	36.8	45	47.4	35	36.8	45	47.4
X^2 P value	1.167 0.558				7.809 0.020				4.385 0.112			
Fish ≥ 3 T / week	19	20.0	22	23.2	56	58.9	10	10.5	60	63.2	15	15.8
< 3 T / week	41	43.2	48	50.5	24	25.3	40	42.1	24	25.3	35	36.8
<Once monthly	35	36.8	25	26.3	15	15.8	45	47.4	11	11.6	45	47.4
X^2 P value	2.437 0.296				51.061 0.000				49.694 0.000			
Legumes ≥ 3 T / week	48	50.5	35	36.8	75	78.9	35	36.8	78	82.1	35	36.8
< 3 T / week	44	46.3	44	46.3	20	21.1	44	46.3	17	17.9	44	46.3
<Once monthly	3	3.2	16	16.8	0	0.0	16	16.8	0	0.0	16	16.8
X^2 P value	0.788 0.674				39.545 0.000				44.314 0.000			

Table.5 The rate of isolation of *P. aeruginosa* from the various clinical samples

Parameters	Pre implementation				Post implementation				Follow up			
	study group N=95		control group N=95		study group N=95		control group N=95		study group N=95		control group N=95	
	N	%	N	%	N	%	N	%	N	%	N	%
Vegetables ≥ 3 T / week	60	63.2	57	60.0	75	78.9	35	36.8	80	84.2	57	60.0
< 3 T / week	16	16.8	32	33.7	20	21.1	44	46.3	15	15.8	32	33.7
<Once monthly	19	20.0	6	6.3	0	0.0	16	16.8	0	0	6	6.3
X^2 **P value**	0.296 0.862				39.545 0.000				16.010 0.000			
Fruits ≥ 3 T / week	50	52.6	44	46.3	60	63.2	44	46.3	62	65.3	40	42.1
< 3 T / week	19	20.0	16	16.9	16	16.8	16	16.9	18	18.9	15	15.8
<Once monthly	26	27.4	35	36.8	19	20.0	35	36.8	15	15.8	40	42.1
X^2 **P value**	1.968 0.374				7.202 0.027				16.381 0.000			

Fig.1 Body mass index of two groups before intervention



As regard body mass index figure one illustrates that nearly half (49.5% and 56.8%) of women in both groups were obese.

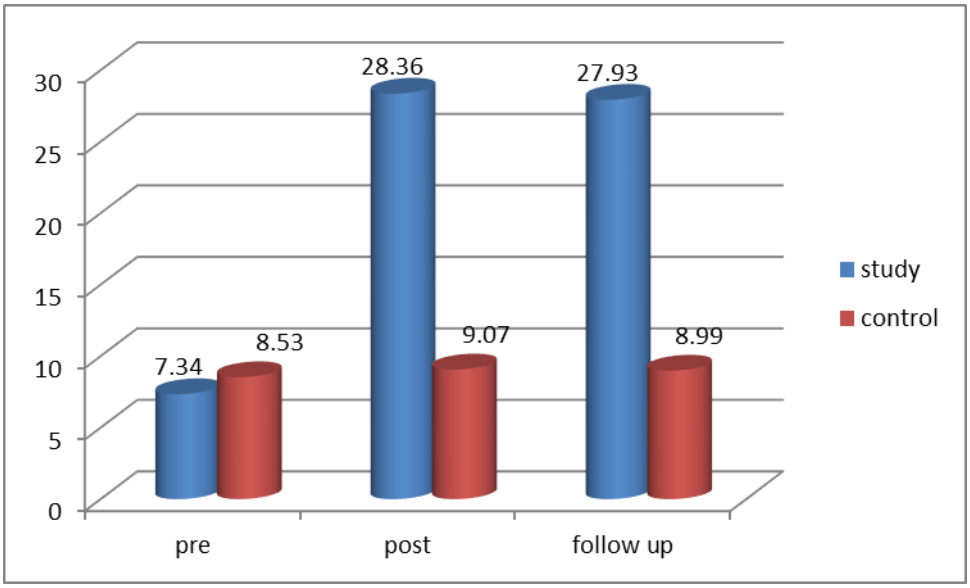
Table.6 Daily Risky Dietary intake of two groups; before, after implementation and follow up of intervention

Parameters	Pre implementation				Post implementation				Follow up			
	study group N=95		control group N=95		study group N=95		control group N=95		study group N=95		control group N=95	
	N	%	N	%	N	%	N	%	N	%	N	%
Coffee ≥ 3 T / day	25	26.3	22	23.2	15	15.8	22	23.2	15	15.8	22	23.2
Once daily	35	36.8	44	46.3	20	21.1	44	46.3	30	31.6	44	46.3
Never	35	36.8	29	30.5	60	63.2	29	30.5	50	52.6	29	30.5
X^2 P value	1.779 0.411				21.122 0.000				9.555 0.008			
Tea ≥ 3 T / day	60	63.2	60	63.2	20	21.1	60	63.2	20	21.1	60	63.2
Once daily	25	26.3	16	16.8	65	68.4	16	16.8	68	71.6	16	16.8
Sometimes	10	10.5	19	20.0	10	10.5	19	20.0	7	7.4	19	20.0
X^2 P value	4.769 0.092				52.435 0.000				57.729 0.000			
Nescafe ≥ 3 T / day	20	21.1	23	24.2	6	6.3	23	24.2	5	5.3	20	21.1
Once daily	20	21.1	22	23.2	33	34.7	22	23.2	29	30.5	25	26.3
Never	55	57.8	50	52.6	56	58.9	50	52.6	61	64.2	50	52.6
X^2 P value	0.543 0.762				12.505 0.002				10.386 0.006			
Salts and salty foods High	60	63.2	60	63.2	0	0.0	60	63.2	0	0.0	52	54.7
Moderate	12	12.6	20	21.1	15	15.8	20	21.1	15	15.8	20	21.1
Low	23	24.2	15	15.8	80	84.2	15	15.8	80	84.2	23	24.2
X^2 P value	3.684 0.158				105.188 0.000				84.258 0.000			
Soft Drinks Daily	19	20.0	22	23.2	9	9.5	22	23.2	5	5.3	20	21.1
< 3 T / week	41	43.2	44	46.3	10	10.5	44	46.3	8	8.4	40	42.1
Sometimes	35	36.8	29	30.5	76	80.0	29	30.5	82	86.3	35	36.8
X^2 P value	0.888 0.641				47.897 0.000				49.214 0.000			

Table.7 assessment of preventive measures in two groups before, after implementation and follows up of intervention

Parameters	Pre implementation				Post implementation				Follow up			
	study group N=95		control group N=95		study group N=95		control group N=95		study group N=95		control group N=95	
	No	%	No	%	No	%	No	%	No	%	No	%
Exercise												
Adequate	11	11.6	8	8.4	64	67.4	12	12.6	54	56.8	8	8.4
Inadequate	84	88.4	87	91.6	31	32.6	83	87.4	41	43.2	87	91.6
X^2	0.526				59.29				50.660			
P value	0.468				0.000				0.000			
Sun Exposure in right manner												
Adequate	29	30.5	30	31.6	90	94.7	32	33.7	85	89.5	30	31.6
Inadequate	66	69.5	65	68.4	5	5.3	63	66.3	10	10.5	65	68.4
X^2	0.025				77.04				66.638			
P value	0.875				0.000				0.000			
Ca supplementary intake												
Adequate	8	8.4	10	10.5	85	89.5	13	13.7	60	63.2	13	13.7
Inadequate	87	91.6	85	89.5	10	10.5	82	86.3	35	36.8	82	86.3
X^2	0.245				1.09				49.141			
P value	0.620				0.000				0.000			
Smoking cession												
Adequate	0	0	0	0	6	50	0	0	8	66.7	2	13.3
Inadequate	12	100	15	100	6	50	15	100	4	33.3	13	86.7
X^2	No available test				9.643				8.132			
P value					0.003				0.004			
Passive smoking cession												
Yes	0	0	0	0	29	60.4	0	0	20	41.7	0	0
No	48	100	45	100	19	39.6	45	100	28	58.3	45	100
X^2	No available test				39.50				23.887			
P value					0.000				0.000			

Fig.2 Mean knowledge difference of study and control group before, after, and follow up of intervention



Additionally one study carried out by Mahmoud *et al* (2008) on 275 school and college students in Daubi, where findings confirmed that soda drinking was associated with higher risk of obesity and decreasing levels of blood calcium and increasing urinary calcium excretion which may lead osteoporosis. Thus evidence also supports an association between soft drinks consumption and decreased bone mineral density (Ma and Jones, 2004).

Regarding prevention of osteoporosis our results indicated that highly significant enhancement of women in study group post intervention regarding practice of different preventive measures of osteoporosis as exercise, exposure to sunlight in right manner, intake of calcium tablets, stop smoking and non-exposed to passive smoking comparing to control group.

The finding comes in congruence with Ansari *et al* (2014) who evaluated the primary prevention of osteoporosis among adolescent females. It found that the mean percentage of desirability of sun exposure quality and quantity improved 13.8% in mother centered group and 8.34% in daughter centered group after 4 weeks, but this rising was more significant in group B than group A.

Bollenbacher (2014) they declared that interventions that focus on osteoporosis awareness, calcium self-efficiency, health motivation, in addition to overcoming personal barrier to calcium intake, may be the mainly helpful methods for osteoporosis prevention. They also stated that adolescent osteoporosis preventive behaviors (e.g. daily calcium intake, daily physical activity time, and sun exposure time) were improved significantly after the intervention.
In accordance Jeihooni *et al* (2015) who revealed that the positive effects of the education program based on health belief model on preventing osteoporosis in on women's performance. Furthermore they reported that there was no significant difference between the mean score of women on osteoporosis prevention behaviors before intervention, and both groups had low performance in maintaining

proper diet and walking. Immediately after and 6 months after intervention, the mean performance score of the women in the intervention group significantly improved compared to controls.

In contrast to our findings concerning frequency of women's taking calcium supplementation. Eshra *et al* (2012) found that counseling was ineffective regarding frequency of women's taking calcium supplementation .Whereas all the women in the study did not intake calcium tablets during pre and post counseling.

In conclusion, a mobile based educational technology improve the women's knowledge regarding prevention of osteoporosis, preventive measures for prevention of osteoporosis as diet, exercises, sunlight and smoking cessation and serum blood calcium level.

Recommendations

It is suggested to apply this mobile-based educational technology on the childbearing women and to replicate the study on a larger study sample in different settings to generalize the results.

Limitations

The only limitation of this study that the test of bone density was expensive, for this reason the researchers constitute it with serum calcium level.

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