The effect of mobile phone short messaging system on healthy food choices among Iranian postmenopausal women

Mahdis Vakili, Parvin Abedi[1], Poorandokht Afshari[1], Nayereh Esmael Kaboli

Department of Nutrition, School of Paramedicine, Ahvaz Jundishapur University of Medical Sciences, [1]Department of Midwifery, Menopause Andropause Research Center, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran

ABSTRACT

Introduction: Central adiposity and metabolic syndrome are quite common among postmenopausal women. Dietary diversity and healthy food choices have essential role in health and also in prevention of obesity. The main objective of this study was to evaluate the impact of mobile phone short messaging system on healthy food choices among Iranian postmenopausal women.

Materials and Methods: This was a randomized controlled trial in which 100 postmenopausal women aged 40-60 years were recruited and assigned to two groups (50 each in the intervention and control groups). Food frequency consumption was measured using a questionnaire. A total of 16 text messages including information about modification of food selection (healthy choices, benefits, methods, etc.,) were sent to participants in the intervention group during 4 months follow-up (1/week). The Chi-square and independent *t*-test used for data analysis. Ninety-two women completed the study.

Results: The consumption of Vitamin A rich fruits and vegetables significantly increased in the intervention group compared to the control group (*P* < 0.001). More women in the intervention group consumed fish after intervention (*P* = 0.02). The consumption of green leafy vegetables showed a nonsignificant increase in the intervention group.

Conclusion: Using mobile phone short messaging system can improve the healthy food choices regarding Vitamin A rich fruits and vegetables and fish among postmenopausal women.

Key Words: Healthy food choices, postmenopausal women, short message system

INTRODUCTION

Menopause is the constant cessation of ovarian activity that leads to cease the menstruation of a woman and diagnostic span of this phenomenon is 12 months after the last menses. The mean age of menopause in Iranian women is 47 years[1]

Address for Correspondence: Dr. Parvin Abedi, Department of Midwifery, Menopause Andropause Research Center, Ahvaz Jundishapur University of Medical Sciences, P. O. Box 61357-15794, Ahvaz, Iran. E-mail: parvinabedi@ymail.com

while, in Western countries, it is approximately 51 years.[2] Because of changes of life expectancy, menopause period has a more salient role in a woman's life. Generally, menopause has psychological and physiological impacts on woman's health, but among the physical changes, obesity is one that underlies many other health problems.[1] Menopause can lead to central adiposity development and metabolic syndrome.[3] Dietary diversity and healthy food choices have essential role in health

and also in prevention of obesity. A study in Iran showed that only 79.2% of Ahvaz' high school girls consumed dairy products and also 16% and almost 20% of girls consumed fish and Vitamin A rich fruits, respectively.[4] In 2009, the majority of postmenopausal osteoporotic women in Iran had calcium, Vitamin D, and magnesium deficiencies. Furthermore, intake of folate and Vitamin C was lower than dietary reference intake.[5] A study in Gaza showed that postmenopausal women had not any information about nutritional requirements of their own and significant calcium and Vitamin D deficiency was observed among them.[6]

Telemedicine is a communication method to provide health care services at distances and it is widely used in all aspects of medicine.[7] Using telemedicine or telecare to make behavioral improvements has the potential to be worthwhile and beneficial.[8] Using telemedicine for improving eating practices and food choices through health behavior changes has been examined in Australia, the UK, the USA, and the Netherland.[9]

In the Netherland, a compact, integrated two-component intervention based on an Internet-administered could positively change knowledge and awareness of schoolchildren regarding the intake of fruit and vegetables.[10] A theory-based, internet-delivered module with the aim of educating adults in nutrition could improve the knowledge, confidence, and motivation of participants.[11]

Moreover, in Glasgow, a Mediterranean diet promotion website was designed with the aim of promoting healthy diet with educating female participants about issues such as food safety, better cooking, and buying tips. Login frequency decreased after 6-month of the study, and they found it useful and encouraging.[12]

Mobile phone short message system is one of the common telemedicine methods[7] that is demonstrated by Gerber *et al*. as a feasible and acceptable method to promote healthy behaviors regarding weight maintenance.[13]

On the best of researchers' knowledge, there is a lack of information about the impact of telemedicine on behavioral changes, especially among postmenopausal women. Therefore, the primary aim of this study was to evaluate the impact of mobile phone short messages system on healthy food choices among postmenopausal women.

MATERIALS AND METHODS

This is a randomized controlled trial in which 100 postmenopausal women in Ahvaz, Iran, recruited randomly. The Ethics Committee of Ahvaz Jundishapur University of Medical Sciences approved the design of the study. This study started in September 2012 and completed in January 2013. Postmenopausal women were recruited from a public health center in the Eastern region of Ahvaz. Because there is no routine check-up or screening for postmenopausal women in the public health clinics, we have chosen the No. 1 Eastern Clinic in Ahvaz, in which postmenopausal women accompany their children or grandchildren for participation in the premarriage classes.

Inclusion criteria were age 40-60 years, basic familiarity with the usage of mobile phone and sending and receiving a short message, cessation of menstruation for at least 1 year, having basic literacy, and having a personal cell phone. A written informed consent was obtained from each participant prior to the intervention.

At the first visit, an inaugural meeting was held for women to inform them about menopause and its effects on woman's body. Women were visited in the health center at baseline and the end of the 4th month. The content of messages was prepared and checked by an expert team.

Randomization

Randomization was performed by parallel groups with a ratio of 1:1. A table produced by Excel program was used for randomization when A assigned for intervention and B assigned for the control group. The random recruitment of women into two groups was done by the third party who was not aware of study objectives.

Measures

A questionnaire was prepared for collecting information regarding sociodemographic characteristics. A valid qualitative food frequency questionnaire was prepared according to the Iranian food composition table containing of 700 food items. Food frequency consumption of participants was checked at baseline and was repeated after 4 months by same questionnaire.

Intervention

A total of 16 short messages were sent to each the participant in the intervention group during 4 months follow-up (1 each week). Short messages in the study were prepared according to Health guidelines on healthy diet for middle-aged women and postmenopausal women from Krause's Food and the Nutrition Care Process textbook[14] and were modified by two nutritionists in terms of habits and culture of Iranian women.

The main intimation of these messages was to motivate the subjects to enhance their consumption of dairy products, green leafy vegetables, Vitamin A rich fruits, and seafood to achieve their daily nutrient requirements of some micronutrients such as Vitamin A, folate, Vitamin C,

calcium, and eicosapentaenoic acid and docosahexaenoic acid essential fatty acids.

The short messages were classified into three types: Informing, instructions, and encouraging. Informing messages were sent in the 1st week of intervention and rarely during the intervention. Instructing messages were mostly sent after informing participants and encouraging messages were sent at regular intervals. Participants were requested to reply to our messages by a plane message after receiving them. All participants were provided a telephone card free of charge.

Some of the messages

1. Vitamin A is an important factor for healthy bones and immune system. If you have not yet tried the pumpkin, you lost it; it is very cheap and tasty. Buy a pumpkin today.
2. Calcium is absolutely important for bone health after menopause. You need three units of dairy products each day which you can take it from milk, yogurt, buttermilk, curd, or ice cream.
3. Low-fat milk and yogurt are less expensive! Take a look at low dairy prices in the supermarket today.

Statistics

Data entry and analyzing were done using data analyzer "*R*". The descriptive, independent *t*-test and Chi-square test were utilized for statistical purposes.

RESULTS

At the end of the study, eight women withdrew and 45 women in the intervention group and 47 in the control group completed the process. The reasons for withdrawing are listed in Figure 1.
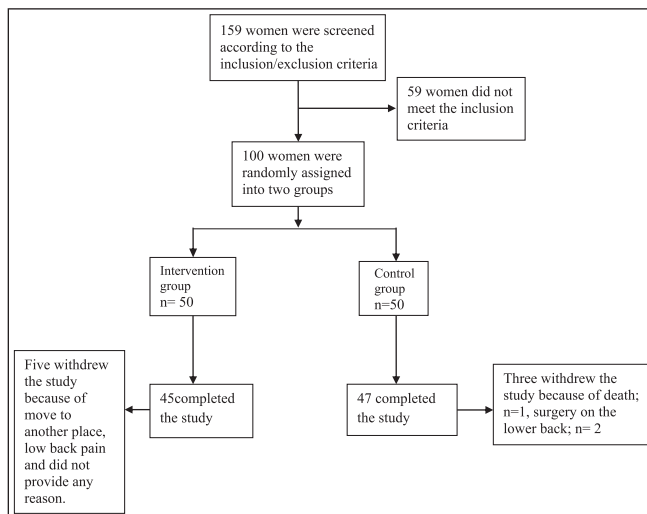

Figure 1: Flow diagram of the recruitment and retention of participants in the study

Table 1 shows the sociodemographic characteristics of participants. As evident in this table, the mean age of participants was 54.16 and 53.27 in the intervention and control groups, correspondingly. The average age of menopause was 47.51 and 48 in the intervention and control groups, respectively.

The consumption of dairy products, Vitamin A rich vegetable, green leafy vegetable, and seafood did not have any significant difference between two groups before intervention [Table 2].

As evident in Table 3, the consumption of Vitamin A rich fruits and vegetables including peach, apricot, and melon significantly increased in the intervention group compared to the control group ($P < 0.001$).

More women in the intervention group consumed fish after intervention ($P = 0.02$). The consumption of dairy products showed a nonsignificant increase in the intervention group. The consumption of green leafy vegetable was increased in the intervention group; however, these changes did not reach significant level.

DISCUSSION

This study designed to evaluate the effects of mobile

Table 1: Sociodemographic characteristics of intervention and control groups

Variables	*n* (%) or mean ± SD		*P*
	Intervention (*n* = 45)	Control (*n* = 47)	
Age	54.16±4.56	53.27±3.77	0.31
Menopause age	47.51±4.02	48.00±3.92	0.43
Education			
Primary	16 (35.6)	16 (34.04)	0.11
Secondary	14 (31.1)	14 (29.7)	
Diploma	14 (31.1)	16 (34.04)	
University education	1 (2.2)	1 (2.12)	
Income (Tuman)*			
<500,000	31 (68.8)	28 (49.1)	0.06
500,000-1,000,000	11 (24.4)	17 (36.17)	
>1,000,000	3 (6.7)	2 (3.5)	
Household number			
1-4	26 (57.7)	20 (42.5)	0.44
5-8	19 (42.2)	27 (57.4)	
Marital status			
Single	1 (2.2)	0	0.40
Married	39 (86.7)	38 (80.85)	
Widow	5 (11.1)	9 (10.6)	
Job			
Working	1 (2.2)	2 (4.25)	0.16
House maker	44 (97.8)	45 (95.7)	

*Every $ was equal of 3100-3200 Tuman in time of data collection.
SD: Standard deviation

phone short messages on healthy food choices among postmenopausal women. The consumption of Vitamin A rich vegetable and fruits and fish were significantly increased among intervention group. The consumption of green leafy vegetable showed a nonsignificant increase among intervention group.

In a study, Rodgers *et al*. aimed to evaluate the effectiveness of a mobile phone text messaging on smoking cessation in which 1705 smokers were enrolled; results showed that more participants who received text messages for 6 weeks quit smoking (relative risk = 2.20, confidence interval = 1.79-2.70, $P < 0.0001$).[15] Telemedicine (Short Message Service [SMS] and Web-based Program), in a study by Benhamou *et al*., could decrease the amount of glycated hemoglobin, mean glucose values during 6 months periods among patients with long-standing poorly controlled diabetes with an average age of 24 ± 13 years.[16] Our results are in line with Rodgers *et al*. and Benhamou *et al*.

Joo and Kim in a community-based anti-obesity program using SMS messaging about diet, exercise, and behavior modification once a week found that after 12 week, a significant reduction in weight (1.6 kg, $P < 0.001$), waist circumference (4.3 cm, $P < 0.001$), and body mass index (0.6 kg/m², $P < 0.001$) have been observed.[17]

Although we did not assess the effect of short messages on anthropometric measure, the healthy food choices of postmenopausal women were improved significantly.

In line with our findings, an interventional study according to Internet-based, by using an interactive, stage-tailored nutrition education website, in a sample of young adults from four states could produce positive shifts in several indicators and mediators of vegetable consumption.[11]

In another study by Shaharil *et al*., a total of 417 university students who had participated in a cluster randomized study was divided into two groups, control group (not receiving any intervention) and intervention group (which received nutrition education through conventional lecture, brochures, and text messages) for 10 weeks. Participants received three brochures after an hour conventional lecture and also a total number of 13 text messages were sent once in every 5 days. Participants in the intervention group significantly improved their dietary intake by increasing their energy intake from carbohydrate, calcium, Vitamin C, thiamine, fruits and 100% fruit juice, fish, egg, milk, and dairy products and could decrease the consumption of processed food. There were not any significant changes in vegetable intake.[18] Our results are in line with Shahril *et al*. except for consumption of the dairy product. This

Table 2: Distribution of women who consumed dairy products, Vitamin A rich fruits and vegetables, seafoods, and green leafy vegetables before intervention

Variables	Intervention (*n* = 45)			Control (n = 47)			*P* value between group
	n (%)			*n* (%)			
	Never	1-4 times per month	>5 per week	Never	1-4 times per month	>5 per week	
Vitamin A rich fruit and vegetable							
Peach	12 (26.6)	25 (55.5)	8 (17.7)	11 (23.4)	27 (57.4)	9 (19.1)	0.8
Apricot	12 (26.6)	28 (62.2)	5 (11.1)	17 (36.1)	26 (55.3)	4 (8.5)	0.7
Melon	25 (55.5)	19 (42.2)	1 (2.2)	29 (61.7)	17 (36.1)	1 (2.1)	0.8
Squash	42 (93.3)	3 (6.6)	0	46 (97.8)	1 (2.1)	0	0.4
Carrot	8 (17.7)	31 (68.8)	6 (13.3)	8 (17.0)	34 (72.3)	5 (10.6)	0.6
Tomato	5 (11.1)	9 (20)	31 (68.8)	3 (6.3)	13 (27.6)	31 (65.9)	0.2
Green leafy vegetable							
Broccoli	42 (93.3)	3 (6.6)	0	42 (89.3)	1 (2.1)	1 (2.1)	0.2
Lettuce	8 (17.77)	30 (66.6)	7 (15.5)	10 (21.2)	32 (68.0)	5 (10.6)	0.8
Spinach	29 (64.4)	16 (35.5)	0	30 (63.8)	14 (29.6)	3 (6.3)	0.1
Mixed green leafy vegetable	15 (33.3)	22 (48.8)	8 (17.7)	10 (21.2)	30 (63.8)	7 (14.8)	0.08
Seafoods							
Fish	13 (28.8)	30 (66.6)	2 (4.4)	17 (36.1)	28 (59.5)	2 (4.2)	0.3
Shrimp	37 (82.2)	7 (15.5)	1 (2.2)	38 (80.8)	9 (19.1)	0	
Dairy products							
Milk	21 (46.6)	23 (51.1)	1 (2.2)	19 (40.4)	26 (55.3)	2 (4.2)	0.1
Yogurt	1 (2.2)	33 (73.3)	11 (24.4)	3 (6.3)	25 (53.1)	19 (40.4)	0.8
Cheese	2 (4.4)	18 (40)	25 (55.55)	5 (10.6)	15 (31.9)	27 (57.4)	0.6
Curd	38 (84.4)	6 (13.3)	1 (2.2)	37 (78.7)	10 (21.2)	0	0.6

Table 3: Distribution of women who consumed dairy products, Vitamin A rich fruits and vegetables, seafoods, and green leafy vegetables after intervention

Variables	Intervention (*n*=45)			Control (*n* = 47)			P value between group
	n (%)			*n* (%)			
	Never	1-4 times per month	>5 per week	Never	1-4 times per month	>5 per week	
Vitamin A rich fruits and vegetable							
Peach	35 (77.7)	6 (13.3)	4 (11.1)	43 (91.4)	2 (4.2)	2 (4.2)	<0.001
Apricot	35 (77.7)	8 (17.7)	2 (4.4)	45 (95.7)	2 (4.2)	0	<0.001
Melon	35 (77.7)	5 (11.1)	5 (11.1)	44 (93.6)	3 (6.3)	0	<0.001
Squash	41 (91.1)	4 (8.8)	0	44 (93.6)	2 (4.2)	1 (2.1)	0.1
Carrot	5 (11.1)	33 (73.3)	7 (15.5)	4 (8.5)	32 (68.0)	11 (23.4)	0.8
Tomato	4 (11.11)	14 (31.1)	27 (60)	4 (8.5)	12 (25.5)	31 (65.9)	0.6
Green leafy vegetable							
Broccoli	30 (66.6)	12 (26.6)	3 (6.6)	32 (68.0)	13 (27.6)	2 (4.2)	0.9
Lettuce	7 (15.5)	24 (53.3)	14 (31.1)	7 (14.8)	30 (63.8)	10 (21.2)	0.2
Spinach	26 (57.7)	16 (35.5)	3 (6.6)	23 (48.9)	22 (46.8)	2 (4.2)	0.09
Mixed vegetable	9 (20)	29 (64.4)	7 (15.5)	7 (14.8)	36 (76.5)	4 (8.5)	0.1
Seafoods							
Fish	7 (15.5)	35 (77.7)	3 (6.6)	10 (21.2)	37 (78.7)	0	0.02
Shrimp	33 (73.3)	12 (26.6)	0	35 (74.4)	12 (25.5)	0	0.6
Dairy products							
Milk	15 (33.3)	23 (51.1)	7 (15.5)	9 (19.1)	28 (59.5)	10 (21.2)	0.6
Yogurt	3 (6.6)	31 (68.8)	11 (24.4)	5 (10.6)	27 (57.4)	15 (31.9)	0.7
Cheese	6 (13.3)	16 (35.5)	23 (51.1)	5 (10.6)	11 (23.4)	31 (65.9)	0.2
Curd	26 (57.7)	29 (64.4)	0	23 (48.9)	23 (48.9)	1 (2.1)	0.8

discrepancy may be due to the fact that at the time of data collection, the price of dairy products in Iran increased resulting from high inflation rate. Therefore, it was possible that postmenopausal women were unable to purchase these food items.

Haapala *et al.* conducted a study on 125 healthy overweight women in reproductive age. Women in the intervention group (*n* = 62) received a mobile phone operated weight-loss program and control group (*n* = 63) received no intervention. Results showed that after 12 months follow-up the intervention group lost more weight than the control group (4.5 vs. 1.1 kg, *P* = 0.006). The results also showed that the most significant predictors of weight loss were self-efficacy, contact frequency, and changes made in dietary habits.[19] These results are similar to what we found in our study except for that the changes we observed were not magnificent. This may because of few numbers of SMS that we sent for women (16 during 4 months). It seems with increasing the frequency of SMS; we might see more changes.

Strengths and limitations
This is the first time in Iran that we assessed the effect of short messages system on healthy food choices among postmenopausal women. We expected to see more

significant changes; however, this matter did not occur due to the following reasons. Only 33.3% of women in the intervention group had diploma or university education; this could be a reason for not to use mobile phone as much as educated individuals. Most of the participants in this study was house makers and did not enough communication with the society that it could be another reason why they did not pay attention to the mobile short messages. Furthermore, the age of participants could affect the educating process, especially using technology devices. Finally, there is no public health clinic for postmenopausal women in Iran; therefore, they are not routinely followed for their situation and even do not get essential information about menopause complications.

CONCLUSION

Using mobile phone short messages system can improve the healthy food choices regarding Vitamin A rich fruits and vegetables and fish among postmenopausal women. Using SMS for further training among postmenopausal women are recommended.

of this research work. We also would like thank staffs of Eastern health clinic in Ahvaz and also all postmenopausal women who participated in this study.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Asadi M, Jouyandeh Z, Nayebzadeh F. Prevalence of menopause symptoms among Iranian women. J Fam Reprod Health 2012;6:1-3.
2. Mushtaq S. Post-menopausal women: A study of their psycho-physical changes with an impact on family. Anthropologist 2011;13:131-5.
3. McCarthy JJ. Gene by sex interaction in the etiology of coronary heart disease and the preceding metabolic syndrome. Nutr Metab Cardiovasc Dis 2007;17:153-61.
4. Vakili M, Abedi P, Sharifi M, Hosseini M. Dietary diversity and its related factors among adolescents: A survey in Ahvaz-Iran. Glob J Health Sci 2013;5:181-6.
5. Hejazi J, Mohtadinia J, Kolahi S, Ebrahimi-Mamaghani M. Nutritional status among postmenopausal osteoporotic women in North West of Iran. Asia Pac J Clin Nutr 2009;18:48-53.
6. Al-Dalou AR, Swairjo AH, Taleb M. Assessment of nutritional status among post menopause women in Gaza city. Res Rev BioSci 2011;5:42-9.
7. Ilias S. Image and Medical Data Communication Protocols for Telemedicine and Teleradiology (Dissertation), Department of Computer Science, Technical University of Darmstadt, Germany; July, 2008.
8. Graves N, Barnett AG, Halton KA, Veerman JL, Winkler E, Owen N, *et al.* Cost-effectiveness of a telephone-delivered intervention for physical activity and diet. PLoS One 2009;4:e7135.
9. Maon S, Edirippulige S, Ware R, Batch J. The use of web-based interventions to prevent excessive weight gain. J Telemed Telecare 2012;18:37-41.
10. Mangunkusumo RT, Brug J, de Koning HJ, van der Lei J, Raat H. School-based internet-tailored fruit and vegetable education combined with brief counselling increases children's awareness of intake levels. Public Health Nutr 2007;10:273-9.
11. Park A, Nitzke S, Kritsch K, Kattelmann K, White A, Boeckner L, *et al.* Internet-based interventions have potential to affect short-term mediators and indicators of dietary behavior of young adults. J Nutr Educ Behav 2008;40:288-97.
12. Papadaki A, Scott JA. Process evaluation of an innovative healthy eating website promoting the Mediterranean diet. Health Educ Res 2006;21:206-18.
13. Gerber BS, Stolley MR, Thompson AL, Sharp LK, Fitzgibbon ML. Mobile phone text messaging to promote healthy behaviors and weight loss maintenance: A feasibility study. Health Informatics J 2009;15:17-25.
14. Mahan LK, Escott-Stump S, Raymond JL. Krause's Food & Nutrition Care Process. St. Louis, MO: Elsevier/Saunders; 2012.
15. Rodgers A, Corbett T, Bramley D, Riddell T, Wills M, Lin RB, *et al.* Do u smoke after txt? Results of a randomised trial of smoking cessation using mobile phone text messaging. Tob Control 2005;14:255-61.
16. Benhamou PY, Melki V, Boizel R, Perreal F, Quesada JL, Bessieres-Lacombe S, *et al.* One-year efficacy and safety of Web-based follow-up using cellular phone in type 1 diabetic patients under insulin pump therapy: The PumpNet study. Diabetes Metab 2007;33:220-6.
17. Joo NS, Kim BT. Mobile phone short message service messaging for behaviour modification in a community-based weight control programme in Korea. J Telemed Telecare 2007;13:416-20.
18. Shahril MR, Wan Dali WP, Lua PL. A 10-week multimodal nutrition education intervention improves dietary intake among university students: Cluster randomised controlled trial. J Nutr Metab 2013;2013:658642.
19. Haapala I, Barengo NC, Biggs S, Surakka L, Manninen P. Weight loss by mobile phone: A 1-year effectiveness study. Public Health Nutr 2009;12:2382-91.

Announcement

"QUICK RESPONSE CODE" LINK FOR FULL TEXT ARTICLES

The journal issue has a unique new feature for reaching to the journal's website without typing a single letter. Each article on its first page has a "Quick Response Code". Using any mobile or other hand-held device with camera and GPRS/other internet source, one can reach to the full text of that particular article on the journal's website. Start a QR-code reading software (see list of free applications from http://tinyurl.com/yzlh2tc) and point the camera to the QR-code printed in the journal. It will automatically take you to the HTML full text of that article. One can also use a desktop or laptop with web camera for similar functionality. See http://tinyurl.com/2bw7fn3 or http://tinyurl.com/3ysr3me for the free applications.