

# The Effect of an Educational Intervention on Health Literacy and the Adoption of Nutritional Preventive Behaviors Related to Osteoporosis Among Iranian Health Volunteers

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**Objectives:** Given the increase in osteoporosis among health volunteers and the effect of health literacy on the adoption of nutritional preventive behaviors, this study aimed to determine the effects of an educational intervention on health literacy and the adoption of nutritional preventive behaviors related to osteoporosis among health volunteers.

**Methods:** This was a quasi-experimental, interventional study of health volunteers conducted in 2020. In this study, 140 subjects (70 in both intervention and control groups) were selected using the random multi-stage sampling method. An educational intervention was conducted using the Telegram application, and educational messages were sent to the health volunteers in the intervention group across 6 sessions. Data were collected via a demographic questionnaire, the Health Literacy for Iranian Adults survey, and a nutritional performance questionnaire, which were completed before and 3 months after the intervention. The data were collected and analyzed using SPSS version 23.

**Results:** Before the intervention, there were no significant differences in the mean scores for health literacy variables and the adoption of nutritional preventive behaviors between the intervention and control groups ( $p > 0.05$ ). After the intervention, there was a significant change in the mean scores for health literacy and the adoption of preventive behaviors in the intervention group ( $p < 0.05$ ) as opposed to the control group.

**Conclusions:** Interventions aimed at increasing health literacy are effective for promoting the adoption of preventive and healthy nutritional behaviors related to osteoporosis.

**Key words:** Behavior, Educational, Osteoporosis, Health literacy

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## INTRODUCTION

Osteoporosis is one of the chronic diseases that most significantly affects individuals' lives worldwide, especially those of women and girls [1-3], and it poses a major problem for public health [1,3].

In a systematic study conducted in Iran, the reported prevalence of low bone density among women was 51%, and the prevalence of osteoporosis was 32% [4]. According to the Tehran Rheumatology Research Center, over 6 million have osteo-

porosis [5-7]. Furthermore, approximately 1 woman in 3 women and 1 man in 12 men have osteoporosis in Iran [6,8].

Osteoporosis leads to a wide range of complications [9]. For example, pain related to a fracture can persist for a long time and lead to loss of mobility [10].

Strategies to prevent osteoporosis include maximizing bone mass and minimizing the loss of bone mass through health education and health promotion programs [11]. Risk factors for this disease are divided into 2 categories: immutable (age, gender, race, and genetic characteristics) and variable (weight, smoking status, low physical activity, long-term glucocorticoid use, and insufficient calcium intake) [12]. A healthy lifestyle, including proper nutrition and physical activity, plays an important role in osteoporosis prevention [13].

An important and basic condition for the success of health programs is participation by women, including their comprehensive involvement in the decision-making process and the implementation of projects with broader societal relevance. Accordingly, the "Health Volunteers" project was implemented [14]. Health volunteers consist of interested and socially engaged women who wish to play an active role in promoting their own health, as well as the health of their families and neighbors [15].

The most critical action for reducing osteoporosis is to prevent occurrence of the disease through health education [16]. The purpose of health education is to influence individuals' health behaviors in order to maintain and promote his or her health [3].

One of the most effective components for preventing osteoporosis among women is health literacy [17], which is a global issue that plays a pivotal role in creating health inequities in both poor and rich countries. Researchers believe that health literacy is a stronger predictor of health than variables such as age, income, and race [18]. As such, the World Health Organization has identified health literacy as the primary determinant of an individual's health status [19].

People with a low health literacy level tend to have poor health and a high incidence of chronic disease. In addition, they tend to use prevention and screening services less and incur more medical costs [20-24]. Studies have shown that people with poor health literacy are less likely to understand health information and follow instructions than those with good health literacy [20]. Some studies have found that health literacy among women is at an insufficient or borderline insufficient level [21,22].

Health literacy leads women to engage in health-promoting activities, adopt nutritional preventive behaviors [24], and improve their knowledge and ability to follow clinical care programs [22]. Given the aforementioned points and the widespread insufficient or borderline insufficient level of health literacy among women [22], increased health literacy among women is also likely to promote osteoporosis prevention. Due to the increasing number of people with osteoporosis [8], the high cost of treatment [4], the need for health literacy awareness related to osteoporosis prevention, as well as the high susceptibility of Iranian women to osteoporosis compared to women in other countries [3], this study aimed to determine the effects of an educational intervention on health literacy and the adoption of nutritional preventive behaviors related to osteoporosis among health volunteers.

## METHODS

This was a randomized controlled study conducted in a non-randomly selected community setting. The sample population in this study was composed of active health volunteers who worked at health centers in Qazvin, Iran, from whom 140 subjects (70 individuals in the intervention group and 70 individuals in the control group) were selected using multi-stage sampling. First, a list of health centers in Qazvin was prepared and divided into 2 geographic areas—north and south—based on a map. From each area, 2 health centers (50%) for the intervention group and 2 health centers (50%) for the control group were randomly selected. At each health center (25%), health volunteers were randomly selected using a list of names via a lottery. The participation rate was 94.6%.

The inclusion criteria were as follows: the ability to read and write, Iranian citizenship, an age range of 18 years and 65 years old, working as a health volunteer at the time of the study, having an active presence at weekly or monthly volunteer meetings at one of the healthcare centers, providing informed written consent, and not having attended an osteoporosis training class within the previous 6 months. Unwillingness to continue participating in the study, absence during the intervention, a history of participation in similar research, and incomplete answers on the questionnaires were considered the exclusion criteria.

According to the results of a study by Panahi et al. [25], considering values of prevalence of behavior before intervention = 0.42 and prevalence of behavior after intervention = 0.66

for the adoption of preventive behaviors, the sample size for each group was estimated using the kappa formula, a test power of 80%, and a statistical confidence level of 95%; the ideal sample size for each group was estimated to be 64 participants. To ensure accuracy and account for a possible 15% dropout rate, the sample size was determined to be 74 people for each group.

A questionnaire consisting of the following 3 parts was used to collect data: (1) A demographic questionnaire collected information related to age, weight, height, marital status, education level, employment status, weekly physical activity, monthly family income, smoking history, history of giving birth, breast-feeding history, family history of osteoporosis, and history of bone density measurements; (2) A standard questionnaire, the Health Literacy of Iranian Adults, was conducted to measure the health literacy of adults aged 18 years to 65 years old in urban regions of Iran [26]. This questionnaire was designed and psychometrically analyzed by Montazeri et al. [26] in Iran in 2014, and its validity and reliability have been confirmed. A desirable level of construct validity was obtained for the 5 subdomains, with an overall value of 53.2%, and the reliability of the instrument was indicated by a Cronbach's alpha coefficient of 0.72 to 0.89 [26]. This questionnaire consists of 33 items across 5 subdomains, including access (6 items), reading skills (4 items), comprehension (7 items), assessment (4 items), and decision-making and behavior (12 items). For the reading skill subdomain, answers are given using a 5-point Likert scale, with a score of 5 indicating "quite easy," a score of 4 indicating "easy," a score of 3 indicating "neither easy nor difficult," a score of 2 indicating "difficult," and a score of 1 indicating "quite difficult." For other dimensions of health literacy, answers are given using a 5-point Likert scale with 5 points indicating "always," 4 points indicating "most of the time," 3 points indicating "sometimes," 2 points indicating "rarely," and 1 point indicating "never" or "not at all." The raw scores for each respondent in each domain are added together. To calculate the total score, the

scores of all subdomains (based on a range of 0 to 100) are added and divided by the number of subdomains (5 subdomains). Scores ranging from 0 points to  $\leq 50$  points indicate "inadequate health literacy,"  $> 50$  points to  $\leq 66$  points indicate "somewhat adequate health literacy,"  $> 66$  points to  $\leq 84$  points indicate "adequate health literacy," and  $> 84$  points to  $\leq 100$  points indicate "excellent health literacy" [18]; (3) Ten questions about nutritional performance were asked on the type and amount of food the respondent consumed during the previous week (scored between 0 and 14). Individuals' responses were self-reported. The validity of the tool in the previous studies was shown by a Cronbach's alpha value of 0.7, while its reliability was higher, with a Cronbach's alpha of 0.79 [27,28].

Data were collected using questionnaires completed at 2 separate points: before the intervention and 3 months after the intervention. Participants in the control group completed the questionnaires at the same time as those in the intervention group, but they did not attend an intervention. Participation in the study was voluntary, and there was no obligation for subjects to continue participating if they wanted to withdraw from the study at any point. After data were collected at the pre-test stage, the intervention group participated in an e-learning activity via social media software across 6 weekly sessions (once per week for 6 weeks). In addition, the intervention group was provided with an educational booklet and pamphlet [28]. The intervention was performed via social media (Telegram or WhatsApp) by sharing the software download link, the relevant website address, and a Telegram channel through social media, sending motivational messages to encourage participants, and providing questions and answers in the virtual space.

The contents of the training sessions for health volunteers are presented in Table 1. In each session, in addition to training, items such as questions-and-answers and bug fixes were also provided. At the end of each session, the training booklet for the session was given to each individual. Researchers were

**Table 1.** Training sessions

Session	Educational content	Duration (min)
1	Introducing the researcher and colleagues and expressing the educational goals, starting the training with the definition of osteoporosis and its causes, symptoms, risk factors, diagnosis, and complications	110
2	Healthy lifestyle, various strategies to prevent osteoporosis, the role of nutrition in preventing osteoporosis	120
3	Dietary benefits and barriers, following dietary recommendations	120
4	Self-efficacy in following a proper diet	110
5	Role of exercise and walking in preventing osteoporosis	120
6	Summarizing and reviewing all of the training materials and answering patients' questions	120

present to monitor and conduct the training sessions. To facilitate the education process, an educational manual was prepared by the researcher based on up-to-date books and scientific resources, and educational PowerPoint files were used for the intervention (Table 1).

Answers to the questionnaires were self-reported. After data collection, the data were entered into IBM SPSS version 23 (IBM Corp., Armonk, NY, USA). For data analysis, the Kolmogorov-Smirnov test was conducted to determine the normality of the data distribution. The data distribution was non-normal for health literacy and normal for behavior. The paired *t*-test (for normal data) and the non-parametric Wilcoxon test (for non-normal data) were used to examine the groups for changes in the dependent variable. To compare the intervention group with the control group, the independent *t*-test (for normal data) and the non-parametric Mann-Whitney test (for non-normal data) were used for quantitative variables. A general linear model was used to determine the *p*-values for the interaction between time and group (the term of the interaction of time × group).

To compare qualitative variables between the groups, the chi-square test (height, education level, physical activity per week, monthly family income, history of giving birth, breastfeeding history, history of bone density measurement) and Fisher exact test (weight, marital status, employment status, history of smoking, family history of osteoporosis) were used. Statistical significance in this study was considered to have been indicated by *p*-value < 0.05.

### Ethics Statement

Ethical approval (IR.QUMS.REC.1398.380) was received from the Vice-Chancellor for Research and Technology of Qazvin University of Medical Sciences, and the necessary steps were taken with the selected health centers to obtain their approval. Moreover, the purpose of this study was explained to the health volunteers, and their written consent was obtained. The subjects were informed that participation in the study was voluntary and that the questionnaires would remain anonymous to ensure their confidentiality.

## RESULTS

Seventy people in the intervention group and 70 people in the control group completed the study course. As such, statistical analyses were performed for 140 health volunteers total.

**Table 2.** Demographic and background characteristics related to health volunteers in the intervention and control groups

Variables	Intervention	Control	<i>p</i> -value
Weight (kg)			0.312
<60	29 (41.4)	31 (44.3)	
60-80	37 (52.9)	36 (51.4)	
>80	4 (5.7)	3 (4.3)	
Height (cm)			0.413
<160	29 (41.4)	32 (45.7)	
≥160	41 (58.6)	38 (54.3)	
Marital status			0.213
Single	10 (14.3)	11 (15.7)	
Married	57 (81.4)	55 (78.6)	
Divorced or widowed	3 (4.3)	4 (5.7)	
Education level			0.178
Below a high school diploma	15 (21.5)	13 (18.6)	
High school diploma	37 (52.8)	40 (57.1)	
Post-high school diploma and bachelor's degree	18 (25.7)	17 (24.3)	
Employment status			0.557
Not employed	48 (68.6)	47 (67.1)	
Employed	8 (11.4)	11 (15.7)	
Self-employed	4 (5.7)	2 (2.9)	
Other	10 (14.3)	10 (14.3)	
Physical activity per week			0.145
Every day	10 (14.3)	11 (15.7)	
Most days	11 (15.7)	14 (20.0)	
Sometimes	21 (30.0)	18 (25.7)	
Rarely	14 (20.0)	12 (17.1)	
Never	14 (20.0)	15 (21.5)	
Monthly family income (million Rial)			0.098
<20	13 (18.6)	16 (22.9)	
20-30	38 (54.3)	36 (51.4)	
>30	19 (27.1)	18 (25.7)	
History of smoking			0.316
Yes	4 (5.7)	1 (1.5)	
No	66 (94.3)	69 (98.5)	
History of giving birth			0.455
Yes	60 (85.7)	59 (84.3)	
No	10 (14.3)	11 (15.7)	
Breastfeeding history			0.288
Yes	55 (78.6)	51 (72.9)	
No	15 (21.4)	19 (27.1)	
History of osteoporosis in family			0.219
Yes	3 (4.3)	5 (7.1)	
No	67 (95.7)	65 (92.9)	
History of bone density measurement			0.186
Yes	14 (20.0)	11 (15.7)	
No	56 (80.0)	59 (84.3)	

Values are presented as number (%).

According to the results, there were no statistically significant differences between the intervention and control groups in terms of demographic and background variables ( $p > 0.05$ ). In other words, the groups were homogeneous in terms of demographic and background characteristics (Table 2). In addition, the results of the  $t$ -test showed that there was no statistically significant difference in the mean ages of the health volunteers between the intervention and control groups ( $p = 0.619$ ). The mean age ( $\pm$  standard deviation) of the health volunteers was  $41.24 \pm 3.48$  years old for the intervention group and  $40.18 \pm 3.58$  years old for the control group.

No significant differences were found in the mean scores for the variables related to health literacy and the adoption of nutritional preventive behaviors between the intervention and control groups before the intervention, according to the results of the Mann-Whitney test and independent  $t$ -test. Three months after the intervention, a statistically significant difference was observed between the mean scores of the variables related to health literacy and the adoption of preventive behaviors between the groups. In addition, the results of the Wilcoxon test and paired  $t$ -test show that, in the intervention group, there was a statistically significant difference between the mean scores of the variables related to health literacy and the adoption of preventive behaviors before and after the intervention ( $p < 0.05$ ), while no statistically significant difference was observed in the control group before and after the intervention ( $p > 0.05$ ) (Table 3). Moreover, the results of the general linear model showed that the interaction of group and time on the mean scores for health literacy ( $p = 0.204$ ) and the adop-

tion of preventive behaviors ( $p = 0.316$ ) was not significant before or 3 months after the intervention for both groups (Table 3).

## DISCUSSION

This study aimed to determine the effects of an educational intervention on health literacy and the adoption of nutritional preventive behaviors related to osteoporosis among health volunteers in 2020 in Qazvin, Iran.

The mean scores for health literacy increased significantly in the intervention group after the educational intervention, and a significant difference was observed in the mean scores for health literacy between the groups. Health literacy, like awareness, is a cognitive variable and can be enhanced by health education [29]. Therefore, the educational intervention, which was aimed at promoting health literacy, in turn improved the awareness of the health volunteers. As a result, individuals in the intervention group likely adopted some osteoporosis preventive behaviors following the intervention, such as periodic check-ups, a proper diet, and regular physical activity, and these items consequently affected their health literacy. These results are consistent with those of previous studies [29-31].

In addition, the results of the present study showed that the mean scores for the adoption of nutritional preventive behaviors related to osteoporosis in the intervention group increased significantly after the intervention. A significant difference in the mean scores for the adoption of nutritional preventive behaviors related to osteoporosis was also observed between the two groups. Health literacy is an effective component in osteoporosis prevention, which is likely due to the role of health literacy in the adoption of nutritional preventive behaviors related to osteoporosis and the relationship between health literacy and the adoption of preventive behaviors in general [17]. Furthermore, health literacy is one of the most important factors influencing the adoption of preventive behaviors, as it increases individuals' perception and understanding and leads them to assess the benefits of diagnostic and preventive behaviors [11]. These results were consistent with those of previous studies [11,28]. Similar results were observed in a study by Panahi et al. [23] that found that higher levels of health literacy led to a higher adoption rate of nutritional preventive behaviors related to osteoporosis. Likewise, in a study [32], women's health literacy was found to play a key role in strengthening women's ability to diagnose osteoporosis and encouraging women to practice preventive be-

**Table 3.** Comparison of the mean scores for health literacy and the adoption of nutritional preventive behaviors related to osteoporosis between health volunteers in the intervention and control groups during the study period

Variables	Before intervention	3 mo after intervention	$p$ -value <sup>1</sup>
Health literacy			
Intervention	59.898 $\pm$ 5.212	71.411 $\pm$ 6.554	<0.001
Control	60.585 $\pm$ 5.225	62.170 $\pm$ 6.414	0.297
$p$ -value <sup>2</sup>	0.314	<0.001	0.204
Preventive behavioral			
Intervention	7.398 $\pm$ 1.447	11.446 $\pm$ 1.244	0.009
Control	7.651 $\pm$ 1.222	8.333 $\pm$ 1.005	0.351
$p$ -value <sup>2</sup>	0.543	<0.001	0.316

Values are presented as mean  $\pm$  standard deviation.

<sup>1</sup>Mean changes during the course, separately in each group.

<sup>2</sup>Comparing the differences between the 2 groups.

haviors and administer individual self-tests to diagnose the disease, which increases the likelihood of receiving timely treatment.

The target group in this study was active health volunteers living in Qazvin, Iran. Therefore, the results of this study cannot be generalized to other groups of health volunteers, and similar studies should be conducted in other cities. One major limitation of this study was the use of the self-report method to measure participants' behaviors. In addition, the researchers did not examine the impact of training provided to health volunteers on the families they assist, which may be the topic of the research team's next study. This study was non-randomized at the community level (individuals were, but communities/centers weren't) and thus had a high risk of inherent bias. One of the advantages of this study was the adaptation of the research subject to the current needs of the health system and the implementation of the study among health volunteers, which can lead to positive changes in the families they assist. Future similar studies are recommended to examine different groups of women (in terms of education, age, and region of residence).

In general, the results confirmed that the educational intervention used in this study was able to increase health literacy and promote the adoption of nutritional preventive behaviors related to osteoporosis among health volunteers. Hence, it can be concluded that interventions aimed at increasing health literacy are suitable for promoting the adoption of preventive behaviors and healthy nutritional behaviors to prevent osteoporosis.

## CONFLICT OF INTEREST

The authors have no conflicts of interest associated with the material presented in this paper.

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## AUTHOR CONTRIBUTIONS

Conceptualization: LD, RP, EH, FH, FSS. Data curation: EH, FH. Formal analysis: RP. Funding acquisition: LD, RP, FSS, EH. Methodology: RP. Project administration: LD, RP, FSS, FH. Visualization: LD, RP, FSS. Writing – original draft: LD, RP, FSS. Writing – review & editing: LD, RP, FSS, FH, EH.

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