Original Article

# A Theoretically Based Behavioral Nutrition Intervention for Elderly Women: A Cluster Randomized Controlled Trial

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## SUMMARY

Background: Nutritional behavior is one of the main criteria for determining health in the elderly. Health Belief Model (HBM) is most commonly used theory in the interventional programs. This study was aimed to determine efficacy of HBM-based nutritional educational intervention on knowledge, belief and behavior of the elderly women.
Methods: The sample of this randomized controlled trial study was 100 elderly women who attended to four health care centers of Urmia, Iran. Data were collected using self-administered questionnaire included demographic characteristics and some HBM constructs. The experiment group participated to HBM-based trainings classes twice per week for 12 weeks. The educational strategies were consisted of lecture, focus-group discussion, and video showing. The questionnaire was completed before and after 3 and 6 months intervention. Data were analyzed using two way repeated measure ANOVA at the significant level of $\alpha < 0.05$.
Results: The mean scores of benefit, severity, susceptibility, and self-efficacy were not different between the two groups before the educational training ($p > 0.05$). However, the aforementioned scores changed significantly between two group after 3 months intervention and follow-up ($p < 0.001$). Furthermore, intervention group improved significantly on HBM constructs through three times measurements ($p < 0.001$).
Conclusion: This study confirms the effectiveness of HBM-based nutritional education on healthy nutritional perception, belief and behavior among elderly women.

## 1. Introduction

Population ageing has become a challenge for both developed and developing countries[1]. The rapid changes in the number of aged people create important concern, particularly in relation to the health of seniors[2]. Ageing is associated with reduction in both physiological and psychological function[3] that may lead to a significant level of dependency[4]. The incidence of age-related diseases has largely increased over time[5]. So, most patients admitted into the hospitals are older adults and two-thirds of them have two or more chronic illnesses[6].

The adoption of lifestyle behaviors such as smoking, poor nutrition, physical inactivity has resulted in higher levels of risk factors for non-communicable diseases (NCDs).[7] Elderly population are more prone to NCDs.[8] Studies showed that these diseases highly overcome in Iranian elderly[9] and its prevalence in elderly women are more than men[10]. Burden of NCDs and the role of socio-demographic and behavioral predictors among these group of population need to be investigated in detail[8].

The hazardous effects of behavioral and nutritional risk factors on NCDs have been established in the cohort and randomized trials studies[11,12]. Health educational program can help older people to adopt healthy lifestyle behaviors and prevent and control age-related diseases[13]. To change the behavior, however, it is essential to understand and apply the widely used models to predict healthy behavior. Older people have limited knowledge about health threatening behaviors[14]. In this line, various studies have used the educational models such as Health Belief Model (HBM), planned behavior and social cognition theory[15]. HBM model was applied much more than other models for behavioral changes and

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prevention of diseases[16,17]. Hence, the HBM was used as the framework of this study to explain effective factors to change nutritional behavior (perceived severity, perceived susceptibility, perceived benefit, perceived barrier, and self-efficacy) of the elderly women.

## 2. Material and methods

This study was approved by the Ethics Committee of Urmia medical Science University (P6/92/4/47647) as well as Universiti Putra Malaysia [UPM/TNCPI/RMC/1.4.18.1 (JKEUPM)/F1].

The sample of this randomized controlled trial study was 100 elderly women who attended primary health centers in the Urmia city from October 2013 to May 2014. This study included women aged 60 years and older who have been resident of Urmia city at least for 5 years and were independent in basic activities of daily living. The volunteers with NCDs diagnosis or <6 scores on the abbreviated mental test scale were excluded from this study.

The elderly women were recruited using multi-stage cluster random sampling technique. First, Urmia was divided into four districts. Then, one health center was selected randomly from each district. A total of 200 elderly women were randomly selected from the list of all households under the cover of these four health care centers. A number of 100 out of 200 elderly women were qualified and interested to participate in this randomized controlled trial study. They were allocated into intervention (n = 50) or control (n = 50) groups randomly. The written consent was signed by the participants after informing about the aim, benefits and drawbacks of the study.

The following equation was used for determining the sample size.

$$n = \frac{\left(\sigma_1^2 + \sigma_2^2/\kappa\right)\left(z_{1-\alpha/2} + z_{1-\beta}\right)^2}{\Delta^2}$$

$n1$ = sample size of Group 1, $n2$ = sample size of Group 2, $\sigma1$ = standard deviation of Group 1. $\sigma2$ = standard deviation of Group 2, $\Delta$ = difference in group means, $\kappa$ = ratio = n2/n1. $Z1-\alpha/2$ = two-sided Z value, $Z1-\beta$ = power.

The sample size was estimated 38 subjects in intervention and 38 for control group. However, considering a 30% possible attrition rate, 50 participants were finalized for each group.

### 2.1. Data collection

Data were collected using a self-administered and validated questionnaire which was prepared for evaluation the nutrition behavioral change based on Health Belief Model among Iranian elderly[18,19]. The questionnaire consisted of four parts. The first part was demographic characteristics such as age, marital status, employment, educational level, housing status and living arrangement. The second part was knowledge of healthy nutrition that was measured by 10 items. The third part consisted of 21 items to evaluate the respondent's nutrition behavior for all of food groups. Each item measured the number of servings of the various food per day. Each correct response was scored one point and a wrong response was given zero point. Then, the total score was computed. Finally, beliefs of the participants were measured using (24) items. A 4-point Likert scale, ranging from 0 to 4 (0 = completely disagree, 1 = disagree, 2 = I don't know, 3 = agree, and 4 = completely agree) was used to measure the beliefs including perceived susceptibility (4), perceived severity (5), perceived benefits (5), perceived barriers (5), perceived self-efficacy (5). The reliability of this questionnaire was checked and

**Table 1**
Result of reliability test on HBM scale for the nutrition questionnaire.

| Variable | Number of items | Spearman's correlation | Cronbach's alpha |
|---|---|---|---|
| Nutritional knowledge | 10 | 0.980 | |
| Nutritional behavior | 21 | 0.868 | |
| Perceived benefit | 5 | | 0.894 |
| Perceived barriers | 5 | | 0.827 |
| Perceived severity | 5 | | 0.895 |
| Perceived susceptibility | 4 | | 0.798 |
| Self-efficacy | 5 | | 0.920 |

reported in Table 1. The questionnaire was completed by both groups before, at 3 and 6 months after the intervention program.

### 2.2. Intervention

The intervention group were trained in 24 sessions of 120 min each. Training sessions were conducted in groups of individuals and consisted of lecture, focus group discussion, question and answer, and showing video. The intervention group was provided pamphlets and educational booklet which were designed base on HBM to review the provided topics and to ensure educational continuity.

The intervention program was designed based on the components of the HBM for nutrition behavior improvement purpose. The program provided a blueprint for CVD prevention among elderly women. Therefore, the consideration of the program was improving the nutritional status and creating positive perception's changes of the elderly women.

The topics of the program's contents consisted of the importance of consumption of dairy products, meat and meat substitutes, fruits and vegetables, water and drinks, and reduction of consumption of salt for the elderly health promotion. Furthermore, the healthy nutritional behavior including non-using solid oils and using the alternative methods of cooking (steaming, boiling, and grilling) were explained. The recommendation of the lifestyle guidelines for Iranian elderly was used to instruct the subjects about consequences of unhealthy nutrition.

During the study, no educational program was implemented for the elderly women in the control group. However, for ethical consideration, the same educational program was provided for the control group at the end of the intervention program.

### 2.3. Data analysis

Data were analyzed using SPSS version 20 (SPSS® IBM, New York, U.S. A). Descriptive statistics were used to report the means (m) ±standard deviations (SD) of the variable scores at three times measurements. Two way repeated measure ANOVA was used to detect mean differences between and within groups. The independent $t$-test was used to compare mean scores for the benefit, severity, susceptibility, and self-efficacy between the intervention and control groups before the intervention. All data were normally distributed using the Shapiro-Wilk test, Skewness, kurtosis, and histogram. Significance level was set at $\alpha < 0.05$.

## 3. Results

A total of 86 out of 100 elderly women (41 in the nutrition and 45 in the control group) completed six months' study program. Table 2 indicates the socio-demographic characteristics of the study subjects. As depicted in this Table, there was no significant

**Table 2**
Socio demographic characteristics of participants.

| | Nutrition group | | Control group | | Test value | p-Value |
|---|---|---|---|---|---|---|
| | No | (%) | No | (%) | | |
| Age (Mean ± SD) | (70.54 ± 5.80) | | (70.09 ± 5.06) | | T = 2.239 | 0.086 |
| **Marital status** | | | | | | |
| Married | 22 | 53.7 | 21 | 46.7 | $X^2 = 1.375$ | 0.711 |
| Widowed | 19 | 46.3 | 24 | 53.3 | | |
| **Occupation status** | | | | | | |
| Housewife | 39 | 95.1 | 44 | 97.8 | $X^2 = 7.284$ | 0.058 |
| Retired | 2 | 4.9 | 1 | 2.2 | | |
| **Educational level** | | | | | | |
| literate | 3 | 7.3 | 3 | 6.7 | $X^2 = 4.083$ | 0.256 |
| Illiterate | 38 | 92.7 | 42 | 93.3 | | |
| **Housing status** | | | | | | |
| Private | 38 | 92.7 | 40 | 88.9 | | |
| Rented | 3 | 7.3 | 5 | 11.1 | $X^2 = 9.822$ | 0.119 |
| **Living arrangement** | | | | | | |
| Alone | 11 | 26.8 | 13 | 28.9 | | |
| With spouse only | 13 | 31.7 | 16 | 35.6 | | |
| With spouse & children | 8 | 19.5 | 4 | 8.9 | $X^2 = 14.241$ | 0.281 |
| With children only | 9 | 22 | 12 | 26.7 | | |

Note: SD = Standard deviation, No = Number.

**Table 3**
Baseline knowledge, belief, and nutritional behavior of intervention and controls groups.

| | Nutrition | Control | t | p Value |
|---|---|---|---|---|
| | (n = 41) | (n = 45) | | |
| Nutritional knowledge | 4.00 ± 1.76 | 4.11 ± 1.18 | 0.738 | p = 0.530 |
| Nutritional behavior | 6.34 ± 1.98 | 6.57 ± 1.22 | 0.414 | p = 0.743 |
| Perceived benefit | 2.97 ± 0.70 | 3.00 ± 0.71 | 0.213 | p = 0.887 |
| Perceived barrier | 2.52 ± 0.71 | 2.53 ± 0.79 | 1.316 | p = 0.271 |
| Perceived severity | 3.33 ± 0.42 | 3.51 ± 0.62 | 0.814 | p = 0.488 |
| Perceived susceptibility | 3.37 ± 0.43 | 3.43 ± 0.64 | 0.520 | p = 0.669 |
| Self-efficacy | 3.32 ± 0.62 | 3.52 ± 0.74 | 1.331 | p = 0.266 |

difference between two groups at the baseline. It should be noted that no one of the participants was smoking or drinking alcohol.

Table 3 shows the participants' knowledge, behavior, and belief at the baseline. As depicted in this Table, there were no significant differences in scores of the dependent variables between intervention and control groups.

Compliance or attendance rate for intervention group was 82%. This high response rate might be related to regular contact and reminding of the subjects to join the intervention sessions. Another reason may be associated with the social aspect of this program and the subjects' satisfaction with the nutritional education.

### 3.1. Outcomes of intervention

Before the intervention, the elderly women showed low level of the nutritional knowledge. After the intervention, nutritional group showed a significant improvement on nutritional knowledge compared to baseline (F = 168.544, p < 0.001, partial η2 = 0.501) (see Fig. 1).

The statistical analysis for nutritional behavior showed a significant main effect for time (F = 153.727, p < 0.001, partial η2 = 0.478) and group (F = 69.036. p < 0.001, η2 = 0.552) for nutritional group, indicating a significant improvement in nutritional behavior scores across the three measurements and compared to the control group (Fig. 2).

After intervention, perceived benefit increased significantly in the intervention group vs. control group (mean differences in the intervention vs. control group: 1.576vs. 0.200 respectively, p < 0.001). The results were the same for perceived barrier (mean

differences in the intervention vs. control group: 1.663 vs. 0.129 respectively, p < 0.001), severity scores (mean differences in the intervention vs. control group: 1.39 vs. 0.156respectively, p < 0.001), susceptibility (mean differences in the intervention vs. control group: 1.189 vs. 0.122 respectively, p < 0.001), and self-efficacy (mean differences in the intervention vs. control group: 1.449vs. 0.022respectively, p < 0.001). However, perceived barrier scores decreased significantly in the intervention group compared to the control group (mean differences in the intervention vs. control group: 1.663 vs. 0.129 respectively, p < 0.001). Furthermore, all the mentioned variables changed significantly from pre-to post-test 1 and 2 and from post-test 1 to 2 only in the intervention group (p < 0.001, Table 4).

## 4. Discussion

The results of the present study showed the efficacy of a HBM-based nutritional education on the elderly women's knowledge, belief and behavior. Before the intervention, mean of nutritional knowledge for both groups was fairly poor. The nutritional knowledge grades in the previous studies were also in the low levels[20,21]. After the intervention, the results of the present study are in accordance with findings of some studies[22,23] that found a significant improvement in participants' knowledge after a nutritional education program. The method of training including face to face discussion, interactive lessons, showing video, group presentations, and question and answer sessions may be the key elements of effectiveness of the intervention used in this study[24].

After the intervention, in the present study, the mean values of the HBM components including perceived susceptibility, severity, benefits increased and perceived barriers decreased significantly in the intervention group compared to the controls. Similarly, researchers[20] applied a HBM based education intervention and observed a significant improvement in perceived susceptibility, severity, benefits and barriers for calcium intake. Likewise, another in Iran[25] stated that the educational intervention program had a significant effect on HBM constructs after 3 and 6 months intervention. One study[26] also showed that perceived susceptibility, benefit, and severity significantly increased and perceived barrier decreased in the nutritional education group. These results may be caused by the effectiveness of HBM-based educational program on improvement of participants' perception about healthy behavior.
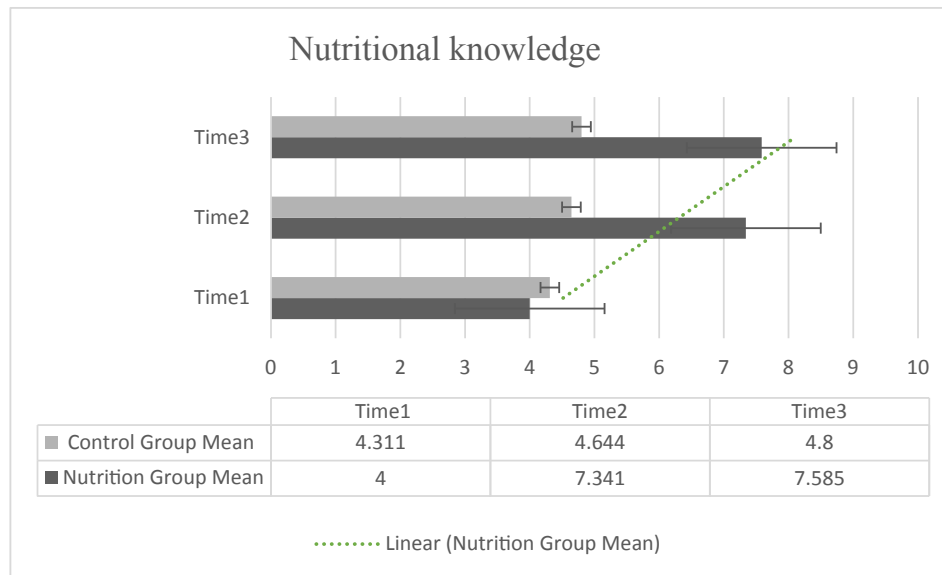
## Nutritional knowledge

| | Time1 | Time2 | Time3 |
|---|---|---|---|
| ▇ Control Group Mean | 4.311 | 4.644 | 4.8 |
| ▇ Nutrition Group Mean | 4 | 7.341 | 7.585 |

········· Linear (Nutrition Group Mean)

**Fig. 1.** Nutritional knowledge of intervention and controls groups during intervention.

## Nutritional Behavior

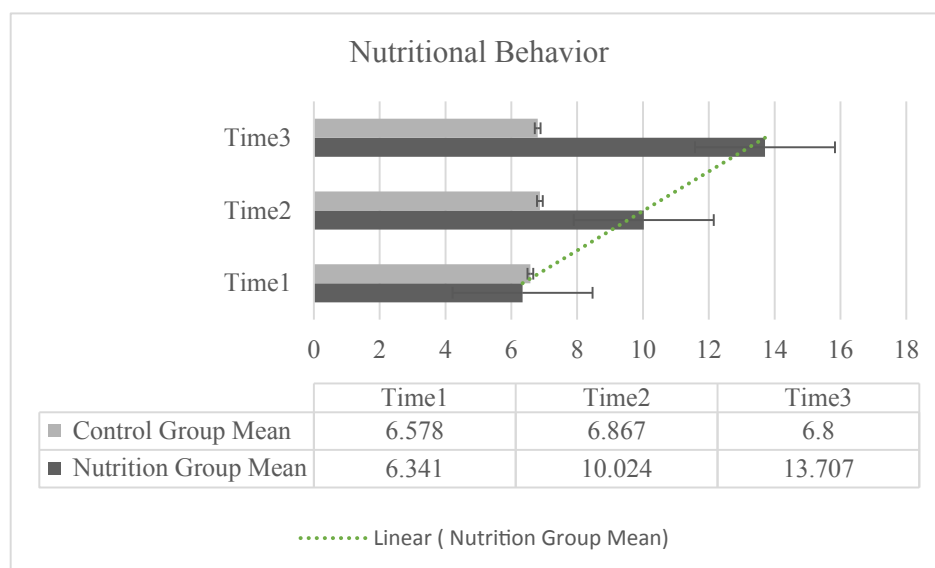| | Time1 | Time2 | Time3 |
|---|---|---|---|
| ▇ Control Group Mean | 6.578 | 6.867 | 6.8 |
| ▇ Nutrition Group Mean | 6.341 | 10.024 | 13.707 |

········· Linear ( Nutrition Group Mean)

**Fig. 2.** Nutritional behavior of intervention and controls groups during intervention.

The results of this study are in agreement with the findings of the previous studies which indicated that the interventions positively influenced nutritional behavior among healthy[18,27−31]. Although some others have reported in unhealthy elderly[31−35]. An author[25] reported that the HBM-based nutritional education is more effective in positive behavioral changes compared to usual educational program (a lecture approach). This means that intervention group felt the hazards of poor adherence (the increase of perceived susceptibility) and the benefits of high adherence (the increase of perceived benefits) to the healthy diet that encouraged them to follow the healthy diet behaviors[29].

One study[36] although found a significant increase in the perceived susceptibility, benefits, and barriers of the healthy diet among the elderly residing in nursing home, but they could not observe a significant improvement in their nutritional behavior. Furthermore, another in Sweden[37] failed to detect nutritional behavior changes among 96 community-dwelling frail elderly women after the 12-week nutritional intervention program and a six-month period follow up. This non-significant results have possibly been related to source of the sample and the lack of supervision through the intervention period.

The results of this study are in agreement with the findings of the previous studies which have supported the incorporation of self-efficacy into HBM based educational program. Self-efficacy is an effective factor for encouraging to follow the health behavior[28,38,39]. For instance, a study[40] reported that weight loss intervention improved self-efficacy for the self-regulation of nutritional behavior among elderly people which influenced on their weight loss.

## 5. Conclusion

In conclusion, HBM-based education improved the knowledge, belief and behavior of the elderly. Therefore, the results of the

**Table 4**
Repeated measures ANOVA of belief of nutrition within groups.

| | Time (I) | Time(J) | Nutrition group | | Control group | |
|---|---|---|---|---|---|---|
| | | | Mean diff (J-I) | p value | Mean diff (J-I) | p value |
| Perceived Benefit | pre-test | postest1 | 1.307 | 0.001* | 0.187 | 0.064 |
| | pre-test | postest2 | 1.576 | 0.001* | 0.200 | 0.061 |
| | postest1 | postest2 | 0.268 | 0.001* | 0.013 | 0.824 |
| Perceived Barrier | pre-test | postest1 | 0.956 | 0.001* | 0.124 | 0.418 |
| | pre-test | postest2 | 1.663 | 0.001* | 0.129 | 0.380 |
| | postest1 | Postest2 | 0.707 | 0.001* | 0.004 | 0.969 |
| Perceived Severity | pre-test | postest1 | 0.976 | 0.001* | 0.147 | 0.069 |
| | pre-test | postest2 | 1.390 | 0.001* | 0.156 | 0.060 |
| | postest1 | postest2 | 0.415 | 0.001* | 0.009 | 0.877 |
| Perceived Susceptibility | pre-test | postest1 | 0.860 | 0.001* | 0.128 | 0.118 |
| | pre-test | postest2 | 1.189 | 0.001* | 0.122 | 0.13 |
| | postes1 | postest2 | 0.329 | 0.001* | 0.006 | 0.937 |
| Perceived Self-efficacy | pre-test | postest1 | 0.985 | 0.001* | 0.004 | 0.965 |
| | pre-test | postest2 | 1.449 | 0.001* | 0.022 | 0.839 |
| | postest1 | postest2 | 0.463 | 0.001* | 0.018 | 0.818 |

Note: Mean Diff = Mean Difference, * = p < 0.001.

present study support the efficacy of the HBM-based nutritional education among the community dwelling elderly people.

## Conflicts of interest

None.

## Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.ijge.2017.08.007.

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