

Health Belief Model-based intervention to improve nutritional behavior among elderly women

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BACKGROUND/OBJECTIVES: Nutrition is a determinant factor of health in elderly people. Independent living in elderly people can be maintained or enhanced by improvement of nutritional behavior. Hence, the present study was conducted to determine the impact of Health Belief Model (HBM)-based intervention on the nutritional behavior of elderly women.

SUBJECTS/METHODS: Cluster-random sampling was used to assess the sample of this clinical trial study. The participants of this study attended a 12-week nutrition education program consisting of two (2) sessions per week. There was also a follow-up for another three (3) months. Smart PLS 3.5 and SPSS 19 were used for structural equation modeling, determination of model fitness, and hypotheses testing.

RESULTS: The findings indicate that intervention had a significant effect on knowledge improvement as well as the behavior of elderly women. The model explained 5 to 70% of the variance in nutritional behavior. In addition, nutritional behavior was positively affected by the HBM constructs comprised of perceived susceptibility, self-efficacy, perceived benefits, and barriers after the intervention program.

CONCLUSION: The results of this study show that HBM-based educational intervention has a significant effect in improving nutritional knowledge and behavior among elderly women.

Nutrition Research and Practice 2016;10(3):352-358; doi:10.4162/nrp.2016.10.3.352; pISSN 1976-1457 eISSN 2005-6168

Keywords: Nutritional behavior, elderly women, Health Belief Model

INTRODUCTION

There has been rapid growth in the elderly population due to reductions in fertility and mortality rates, increased life expectancy, and improvements in the health system [1]. Iran is no exception to this issue [2]. This fast growth in the elderly has created significant challenges, particularly in relation to health [3]. As the proportion of older people increases, their health status becomes a concern [4]. Aging brings about an uneven increase in common illnesses such as degenerative disorders, stroke, cancer, dementia, and related disabilities [2]. As such, most patients admitted to hospital wards are older adults, and two-thirds of them have two or more chronic conditions [5]. Therefore, prevention of chronic conditions in the elderly is very vital to public health [6]. Nutrition is considered as an influential factor on health status of the elderly [7]. Improvement of nutritional behavior can help maintain independent living in the elderly and prevent age-related conditions [8].

Educational intervention has been shown to induce changes in the nutritional behavior of the elderly [9]. Numerous studies have investigated the efficacy of educational models such as

the Health Belief Model (HBM), theory of planned behavior, and social cognitive theory on the nutritional behavior of the aged [10]. The most frequently used model for investigating behavioral changes and preventing diseases in the elderly is the HBM method [11]. Furthermore, the HBM has been shown to be an important instrument for assessing an individual's health perception [12]. The HBM contains different constructs, including perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and perceived self-efficacy, and focuses on the cognitive aspects of an individual's belief such as perception, knowledge, and decisions [13]. The HBM asserts that elderly individuals should understand their elevated risk for potential severe health problems in order to induce a positive response [14]. Perceived barriers and benefits are the most influential variables of the HBM for predicting and explaining health-related behaviors [15]. Those who perceive more benefits than barriers are more probably to take action. In addition, self-efficacy plays a positive role in altering behavior of the elderly [12,14,16].

At the moment, little information is available on the nutritional status of older people. The majority of previous studies were conducted in aging centers or hospitals [17-19],

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Received: June 22, 2015, Revised: February 15, 2016, Accepted: February 16, 2016

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and a limited number involved community-dwelling older adults. As such, this study aimed to determine the effectiveness of intervention in improving the nutritional behavior of the elderly in Urmia City based on the HBM. This study attempted to prove three hypotheses:

- 1: Nutritional knowledge obtained by elderly women will significantly influence constructs of the HBM after 3 and 6 months of intervention.
- 2: In elderly women, nutritional knowledge will considerably induce alteration of nutritional behavior after 3 and 6 months of intervention.
- 3: The HBM constructs will significantly alter nutritional behavior of the elderly women after 3 and 6 months of intervention.

SUBJECTS AND METHODS

Subjects

The participants of this study were community-dwelling elderly women aged 60 years and above residing in the North West of Iran (Urmia). Cluster-random sampling was carried out to choose a representative sample for the purpose of this study. First, Urmia was divided into four areas: west, east, north, and south. Thereafter, one health center from all available ones in each area was randomly selected. Two hundred out of 800 total recruited elderly women met the study inclusion criteria comprising a minimum of 5-year Urmia residency, being independent in daily activities, and without diabetes and food regimen.

Instruments

Data were collected using a researcher-made questionnaire divided into four sections, including demographic characteristics, nutritional knowledge, HBM constructs, and nutritional behavior. Subjects' knowledge of healthy nutrition was measured based on six items. The HBM constructs consisted of perceived susceptibility (four items), perceived severity (five items), perceived benefits (five items), perceived barrier (five items), and perceived self-efficacy (four items). A 5-point Likert scale, ranging from 0 to 5, was utilized to measure the HBM constructs. In addition, 21 items were used to assess respondents' eating behaviors related to food groups comprising meat and its products, fruits, vegetables, dairy products, drinks, and oils.

To evaluate the validity of the content, the questionnaire was sent to a panel of 10 academic members consisting of experts in the fields of gerontology, epidemiology, nutrition, and health education. The reliability of the knowledge ($r = 0.98$) and behavior ($r = 0.87$) sections of the questionnaire were calculated using Spearman's correlation coefficient. Cronbach's alpha test was used to determine the reliability of the HBM constructs of the questionnaire ($r = 0.86$).

An ethical approval letter was obtained from the Ethics Committee of Urmia Medical Sciences University (P6/92/4/47647) as well as Universiti Putra Malaysia [UPM/TNCPI/RMC/1.4.18.1(JKEUPM)/F1]. All eligible subjects signed the informed consent form after being informed of the procedure, potential benefits, and drawbacks of the study.

Data were collected at health centers before and after 3 and

Table 1. Content of nutrition program for the elderly women over 3 months

Week	Session	Content of training
1	1	Role of Iranian food guidelines for prevention of chronic diseases
	2	Review of the last lecture & practice
2	1	Importance and amount of dairy product consumption by elderly women
	2	Review of the last lecture & practice
3	1	Importance and amount of consumption of meat products or its substitutes in elderly women
	2	Review of the last lecture & practice
4	1	Amount of bread, cereals, and nut needed for the elderly women
	2	Review of the last lecture & practice
5	1	Recommended intake of fruits and vegetables for the elderly women
	2	Review of the last lecture & practice
6	1	Recommended intake of water and drinks in the elderly women
	2	Review of the last lecture & practice
7	1	Importance of replacing liquid oil with saturated or solid animal oil. Reduction of consumption of fat and fried food.
	2	Review of the last lecture & practice
8	1	Importance of reduction of consumption of salt
	2	Review of the last lecture & practice
9	1	Introduce a variety of iron-rich foods
	2	Review of the last lecture & practice
10	1	Introduce nutrition regime for prevention of cardio-vascular diseases
	2	Review of the last lecture & practice
11	1	Different ways to intake fruits and vegetables in the elderly with dental problems
	2	Review of the last lecture & practice
12	1	The healthy cooking methods
	2	Review of the last lecture & practice
13-24		Weekly meeting for reporting their nutrition behavior to researcher

*** Ministry of Health and Medical Education of Iran, 2014

6 months of intervention through a face-to-face interview technique. Questions were read aloud by trained and qualified assessors to elderly women, and answers were carefully recorded and written on the questionnaires. After familiarization with the procedure, the subjects participated in the nutrition education program for two sessions per week for 12 consecutive weeks. Each educational session lasted an average of 120 min (Table 1). Educational brochures were also given to the participants to review the presented nutritional information. The contact number of the researcher was provided at the end of the information sheet for any questions related to the research.

Data analysis

Data were analyzed using the Statistical Package for the Social Sciences version 19 (SPSS® IBM, New York, U.S.A) and Partial Least Square (PLS). The significance level was set at 0.05. Descriptive statistics were used to report the means (m) \pm standard deviations (SD) of baseline scores of the variables. Smart PLS was applied for testing the model fitness and hypotheses. The analytical method of PLS is a relatively new method in regression analysis [20]. PLS is a useful soft modeling approach to SEM, when there is a limited sample size or the data distribution is skewed [21]. Similar to structural equation modeling, PLS has two sub-models. The structural model specifies relationships between the latent variables while the measurement model specifies relationships between latent variables and their indices. Furthermore, it is possible to determine the standard regression coefficients for the paths by Smart PLS modeling. The fit indices in Smart PLS equal to or greater than 0.50 are acceptable [22]. The dependent variables scores at baseline were compared by one way ANOVA to detect any significant differences. All data were normally distributed using the Shapiro-Wilk test, Skewness, kurtosis, and histogram.

Adherence rate

The adherence rate for all subjects was calculated by the following formula:

$$(\text{Sessions attended} / \text{total number of sessions}) \times 100.$$

The compliance rate of the intervention groups was 86%. This high adherence 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 nutrition education.

RESULTS

Baseline scores

Table 2 shows the baseline scores for knowledge, behavior, and belief of the participants. As depicted in this Table, there were no significant differences in scores of the dependent variables among the subjects from the four areas of Urmia.

Outcomes of intervention

Tables 3, 4, and 5 present the path analysis for testing the hypotheses in the form of path coefficients at baseline and 3 or 6 months after intervention.

Based on Table 3, an increase in nutritional knowledge influences HBM constructs, consisting of perception of benefits, barrier, severity of disease, and self-efficacy (hypothesis one). However, the second and third hypotheses are not supported by the information in this Table. Fig. 1 shows that the HBM constructs predicts 5.5% ($R^2 = 0.055$) of nutritional behavior changes among elderly women before the intervention.

The information in Table 4 supports hypotheses 1 and 2. Furthermore, Table 4 shows that only self-efficacy is effective in improving the nutritional behavior of elderly women. Fig. 2 shows that 43.9% of nutritional behavior can be explained by the HBM constructs after 3 months of intervention ($R^2 = 0.439$).

Based on the information in Table 5, hypotheses 1 and 2 are supported after 6 months of intervention. In terms of hypothesis 3, only perceived susceptibility, perception of benefits, and

Table 2. Baseline scores for knowledge, behavior, and belief of the participants

	Sum of squares	Mean square	F	P-value
Nutritional knowledge	6.420	2.140	0.738	0.530
Nutritional behavior	6.378	2.126	0.414	0.743
Perceived benefit	0.354	0.118	0.213	0.887
Perceived barrier	2.784	0.928	1.316	0.271
Perceived severity	0.694	0.231	0.814	0.488
Perceived susceptibility	0.402	0.134	0.520	0.669
Self-efficacy	1.813	0.604	1.331	0.266

Table 3. Path coefficients of the study variables before intervention

Hypotheses	β	Sample mean	Standard deviation	T statistics	P-value
Knowledge \rightarrow Barrier	0.16	0.16	0.07	2.34*	0.02
Knowledge \rightarrow Benefit	0.24	0.24	0.07	3.17*	0.001
Knowledge \rightarrow Susceptibility	0.13	0.13	0.07	1.77	0.07
Knowledge \rightarrow Severity	0.28	0.28	0.07	3.93*	0.001
Knowledge \rightarrow Self-efficacy	0.27	0.27	0.06	4.09*	0.001
Knowledge \rightarrow Behavior	0.08	0.09	0.06	1.29	0.19
Barrier \rightarrow Behavior	-0.11	-0.11	0.06	1.76	0.07
Benefit \rightarrow Behavior	0.07	0.07	0.07	1.03	0.30
Susceptibility \rightarrow Behavior	0.08	0.08	0.07	1.22	0.22
Severity \rightarrow Behavior	0.06	0.06	0.07	0.79	0.43
Self-efficacy \rightarrow Behavior	0.02	0.02	0.07	0.34	0.73

* The criterion for factor confirmation is a higher value of T than ± 1.96 .

Table 4. Path coefficients of the study variables after 3 months of intervention

Hypotheses	β	Sample mean	Standard deviation	T statistics	P-value
Knowledge → Barrier	0.49	0.49	0.05	10.28*	0.001
Knowledge → Benefit	0.61	0.61	0.04	16.65*	0.001
Knowledge → Susceptibility	0.39	0.39	0.07	5.88*	0.001
Knowledge → Severity	0.48	0.49	0.05	9.11*	0.001
Knowledge → Self-efficacy	0.51	0.50	0.05	9.91*	0.001
Knowledge → Behavior	0.17	0.17	0.07	2.43*	0.016
Barrier → Behavior	0.09	0.09	0.07	1.37	0.17
Benefit → Behavior	0.14	0.14	0.07	1.86	0.06
Susceptibility → Behavior	0.08	0.08	0.07	1.12	0.26
Severity → Behavior	0.16	0.17	0.08	1.93	0.06
Self-efficacy → Behavior	0.20	0.19	0.07	2.83*	0.005

*The criterion for factor confirmation is a higher value of T than ± 1.96 .

Table 5. Path coefficients of the study variables after 6 months of intervention

Hypotheses	β	Sample mean	Standard deviation	T statistics	P-value
Knowledge → Barrier	0.63	0.64	0.03	17.31*	0.001
Knowledge → Benefit	0.64	0.65	0.03	16.31*	0.001
Knowledge → Susceptibility	0.58	0.59	0.05	10.19*	0.001
Knowledge → Severity	0.63	0.64	0.04	14.78*	0.001
Knowledge → Self-efficacy	0.56	0.57	0.04	13.19*	0.001
Knowledge → Behavior	0.15	0.15	0.05	2.68*	0.001
Barrier → Behavior	0.29	0.30	0.05	5.91*	0.001
Benefit → Behavior	0.15	0.15	0.05	2.65*	0.001
Susceptibility → Behavior	0.18	0.17	0.05	3.23*	0.001
Severity → Behavior	0.12	0.12	0.06	1.85	0.06
Self-efficacy → Behavior	0.09	0.08	0.05	1.73	0.08

*The criterion for factor confirmation is a higher value of T than ± 1.96 .

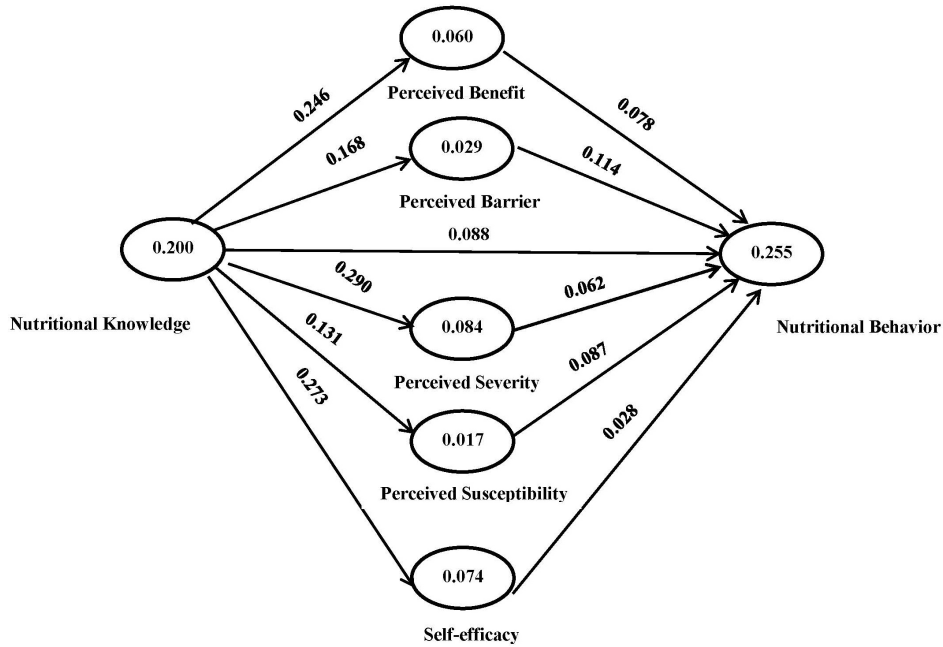


Fig. 1. Structural model of nutritional behavior for the elderly women before intervention

barrier of the model are supported (Table 5). In addition, Fig. 3 indicates that the HBM constructs explain 69.5% of nutritional

behavior in elderly women 6 months after intervention ($R^2 = 0.695$).

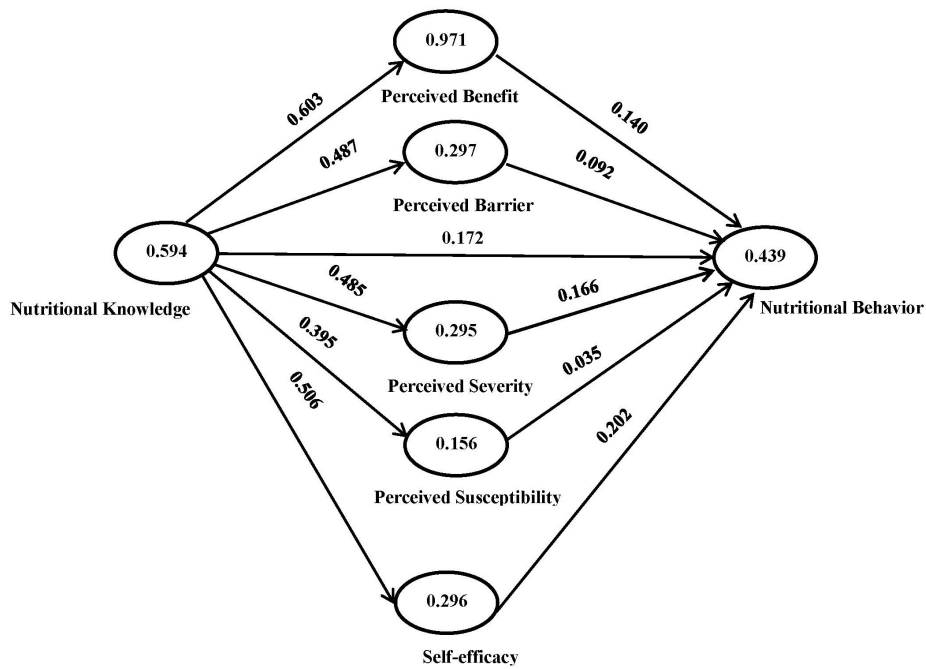


Fig. 2. Structural model of nutritional behavior for the elderly women 3 months after intervention

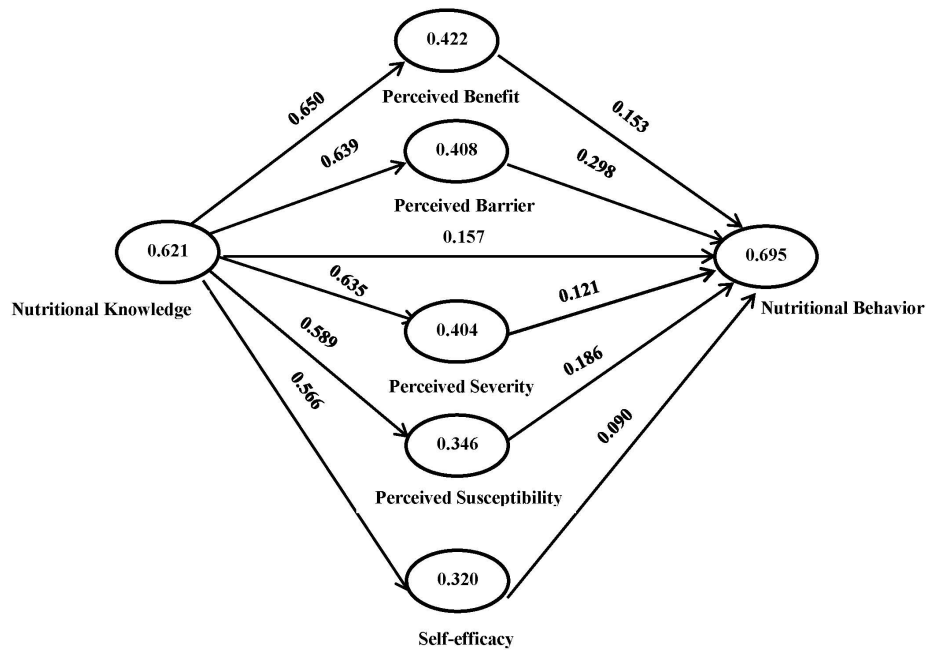


Fig. 3. Structural model of nutritional behavior for the elderly women 6 months after intervention

DISCUSSION

Health education is a low-cost intervention technique for reducing the incidence, morbidity, and mortality of chronic disorders. Implementation of behavioral change theories into health education is fundamental for achieving desired behavioral changes leading to positive health outcomes [23].

The results of this study indicate that the intervention had

direct effects on improving elderly women’s knowledge and behavior related to healthy nutrition. Specifically, 5 to 70% of the nutritional behavior of elderly women could be explained by the HBM constructs. These findings are consistent with those who observed significant improvement in the poor nutritional behavior of the elderly [24-26]. However, in a similar study using HBM-based intervention for prevention of osteoporosis in menopausal women, Torshizi *et al.* [27] did not observe a

significant difference between the intervention and control groups. This insignificant result may be related to the program duration (2 months), which was not long enough to alter healthy behaviors at a significant level.

On the other hand, the respondents showed poor scores for the HBM constructs at baseline (Table 3), although scores improved significantly after 3 months of intervention (Table 4). In addition, all HBM constructs except for perceived severity and self-efficacy significantly increased after a 3 month follow-up (Table 5). Likewise, Bayat *et al.* [28] reported a significant positive effect on the HBM constructs after a similar intervention duration. Furthermore, Sharifirad *et al.* [29], Khabazian & Rezaei [30], and Aghamolayee *et al.* [31] reported that all HBM constructs were important factors for improvement of health behavior. The lack of change in perceived severity may be related to the current study sample, who were healthy elderly subjects without any chronic conditions. Many previous studies have examined only a limited number of HBM constructs and focused on perceived self-efficacy. For instance, Swaim *et al.* [32] stated that self-efficacy has a positive effect on calcium intake among menopausal women. Equally, Rejeski *et al.* [33] in a clinical trial study observed significant improvement of nutritional behavior by increasing self-efficacy in elderly women. However, the present study considered a broad range of HBM constructs in three different occasions. Before the intervention, none of the constructs had a significant effect on the nutritional behavior of elderly women (Fig. 1). However, a 3 month educational program undertaken by elderly women resulted in increased and improved nutritional knowledge. Interestingly, in this stage, only self-efficacy had a positive effect on nutritional behavior (Fig. 2). After 6 months, perceived susceptibility, benefits, and barrier improved nutritional behavior considerably.

The results of this study support the strong effect of educational intervention on improving knowledge, belief, and behavior of elderly women. The HBM serves as an effective framework for modifying educational interventions for promoting preventive behavior in elderly women. Therefore, using a model-based education program and providing required facilities will help to maintain self-dependence in the elderly.

ACKNOWLEDGEMENTS

We would like to express our gratitude to the professors at the Medical Faculty of UPM, Malaysia as well as Tarbiat Modares University, Iran for careful and timely supervision of this project, which is part of a PhD dissertation. We would also like to extend our thanks to the Medical University of Urmia, Iran for their generous cooperation at the time of sampling.

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