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Effect of a Health-Related Education Program on Food-Related Behaviors of Vulnerable Women in Zanjan: A Pilot Randomized Clinical Trial

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Background: The deteriorating food safety and security situation of many Iranian families, primarily due to economic challenges, has raised concerns. Education programs can solve these issues in a cost-efficient way. The current study aimed to determine the impact of an extensive education program focusing on food safety and nutrition among low-income women who are the heads of households covered by the welfare system in Zanjan City.

Methods: A total of 120 women who scored the highest levels of food insecurity were randomly divided into two intervention and control groups. The intervention group attended in six 1.5-h educational sessions focusing on improving diet quality, food security, food safety, and physical activity. Both groups filled out a researcher-designed and validated questionnaire at the beginning of the study and one month after the intervention.

Results: The intervention group demonstrated significant improvements in scores related to diet quality, food security, and physical activity. However, no significant difference was observed in the food safety score. In contrast, in the control group, there were no notable changes in the scores of the studied factors.

Conclusion: The findings indicate that a comprehensive food and nutrition education program can effectively enhance the nutritional habits and food security of low-income individuals.

1. Introduction

Food insecurity is characterized by the limited or uncertain ability of individuals to obtain desirable foods through socially acceptable means, coupled with limited or uncertain access to adequate, healthy, and nutritious food [1]. The physical well-being of individuals is significantly impacted by hunger and malnutrition. Extensive research indicates that children from families experiencing food insecurity may experience a diverse range of developmental and mental disorders. As a result, they might encounter difficulties in acquiring knowledge within an educational setting, while also exhibiting an increased propensity towards obesity and various chronic as well as infectious ailments [2, 3]. Food insecurity has been associated with several chronic diseases in adults. Extensive research has established compelling connections between food insecurity and obesity, diabetes, high blood pressure, and cancer. Furthermore, studies have consistently identified a correlation between inadequate nutrition and iron deficiency anemia, reduced bone density, and subsequent development of osteoporosis due to insufficient calcium intake [4-6]. Iran's national currency has been sharply devalued in recent years and following the reimposition of sanctions, there has been sharp inflation in

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the food market. Notably, three crucial food categories, namely meat, fruits, and vegetables, have encountered an inflation rate exceeding 300 % [7]. Following the outbreak of the COVID-19 pandemic, a significant number of individuals lost their jobs, leading to a substantial decline in the purchasing power of a large portion of the population. This situation is expected to have a profound impact on the food safety and security of these individuals. It has been proven that a significant proportion of global fatalities resulting from foodborne diseases are linked to consumers with lower incomes, primarily due to the relatively limited attention given to food safety measures [8]. Moreover, the financial constraints associated with low income can drive individuals to adopt unhealthy dietary patterns, such as excessive consumption of starchy foods, simple sugars, and high-fat foods, which are often more affordable. In some cases, subsidies are provided for these items to maintain their affordability, as exemplified by subsidized bread prices. Income level and socioeconomic status are two aspects that are difficult to change. However, an effective and cost-efficient approach to the adverse health effects of poverty is nutrition education. Developed nations have implemented successful nutrition education initiatives, such as the Expanded Food and Nutrition Education Program (EFNEP) in the United States, which was established in 1969 and is now accessible nationwide. All low-income individuals who receive food assistance from the US government are covered by this program. Participants in the program engage in six to eight educational sessions, equipping them with essential knowledge and skills related to budgeting, shopping, and the selection of affordable and nutritious food options [9]. Numerous researchers have assessed the effectiveness and cost-benefits of these programs [10]. For instance, Dollahite *et al.'s* study found that for every $1 invested in the EFNEP, the US healthcare system gains $10 [11]. Given the current circumstances in Iran, there is a pressing need for nutrition education programs similar to EFNEP, particularly targeting individuals in vulnerable situations. Our literature review revealed a dearth of previous studies investigating the effects of educational interventions on food safety and security. Consequently, the present study aimed to examine the influence of a comprehensive educational program on food safety and nutrition among low-income women who serve as household heads and are beneficiaries of the Welfare of Zanjan city.

2. Materials and Methods

2.1 Study population and design

A total of 400 women were randomly selected from households headed by females who were beneficiaries of the welfare program in Zanjan City. They were required to complete a standardized and dependable questionnaire consisting of six items related to food safety and security [12]. Based on the results of the questionnaire, 120 women who scored the highest in unsafe and insecure nutritional behavior were recruited. They were randomly allocated into two groups: intervention and control (60 participants in each group). At enrollment, the Food Behavior Questionnaire was completed by both groups. The intervention group took part in a 6-session education program that lasted 1.5 h each once a week after completing the questionnaire. Instruction on the qualities of a healthy diet, methods for preparing healthy meals within different budget constraints, essential shopping skills, financial resource management, and food safety guidance was delivered by academic staff members affiliated with the nutrition as well as food safety and hygiene departments of Zanjan University of Medical Sciences. The educational program's content followed EFNEP. However, the cultural, socioeconomic, and lifestyle characteristics of the study population were taken into account when the program was being developed. Both groups were asked to complete the Food Behavior Questionnaire once more a month after the educational program ended, and the corresponding scores for each section (improved diet quality, safe and secure food, and physical activity) were compared within each group as well as between the two groups under investigation. The study protocol was approved by the ethical committee of Zanjan University of Medical Sciences (IR.ZUMS.REC.1398.259).

2.2 Development of food behavior questionnaire

To construct the questionnaire items, the EFNEP Food Behavior and Physical Activity Questionnaire served as the initial framework. Additionally, extensive research was conducted, drawing from both domestic and international information sources, while taking into account the cultural, dietary customs, and social characteristics specific to our nation. Through a process of item refinement, 22 items were retained in the questionnaire after eliminating redundant or overlapping items. Based on the opinions of 10 members of the expert panel, the validity of the questionnaire was assessed and examined. Cronbach's alpha, which was equal to 0.857 for 20 samples, was calculated to assess the reliability of the questionnaire.

2.3 Statistical analysis

Quantitative data are reported as mean ± standard deviation and qualitative data as frequency (%). An independent sample t-test was used to compare the Food Behavior Questionnaire results in the two groups if the distribution of data was normal, and the paired t-test was used to compare the change in behavior within each group. Corresponding non-parametric tests were used if the data did not have a normal distribution. The statistical analyses were performed using IBM-SPSS software version 22.

3. Results and Discussion

3.1 The intensity of unsafe and insecure nutritional behavior in participants

All participants were asked to complete a 6-item standard

food security questionnaire. Based on the results, the participants were divided into six groups. The participants who scored six were classified as the most severe food insecurity group, and the ones who scored 1 had the lowest food insecurity. The results of the severity of food insecurity in participants are presented in Table 1.

Table 1. The intensity of unsafe and insecure nutritional behavior in female-headed households covered by the Welfare of Zanjan city

	Score of unsafe and insecure nutritional behaviors in female-headed households (n = 400)					
	1	2	3	4	5	6
Frequency (%)	21 (5.25)	32 (8)	83 (20.75)	76 (19)	65 (16.25)	123 (30.75)

Participants with scores of five and six were considered the most severe food insecurity group. This group was selected for the education program. The estimated sample size for the present study was 120 people (60 people for each group). However, due to the possibility of losing participants in the intervention group, 90 people were invited to participate in the classes.

3.2 Allocation of participants to intervention and control groups

In the intervention, a total of 60 participants took part in the program, attending all the sessions and completing the food behavior questionnaire both at the beginning and end of the study. The baseline characteristics of the participants in both the intervention and control groups are presented in Table 2.

Table 2. Characteristics of participants in the study at the baseline

Variables	Intervention group (n = 60)	Control group (n= 60)	*p*-value
Age (year±S.D)	44.73 ± 11.26	45.63 ± 9.63	0.639
Family size (n)	3.37 ± 1.01	3.37 ± 1.07	1
Education			
Illiterate	6 (10)	9 (15)	0.179
Primary school	9 (15)	17 (28.3)	
High school	39 (65)	32 (53.3)	
University	6 (10)	2 (3.3)	

3.3 Nutritional behaviors of control and intervention groups

All participants in both groups had completed the Food Behaviors Questionnaire at baseline and one month after completing the education program. The corresponding scores of diet quality, physical activity, food security, and food safety in both groups and both times are presented in Table 3. As shown in Table 3, diet quality, physical activity, and food security scores of the participants in the intervention group have increased significantly ($p < 0.001$); however, there were no significant differences in food safety scores before and after the education program. In the control group, no significant changes were observed in the scores of any section. There were significant differences between the rate of changes in the quality of diet, physical activity, and food security scores, which is an indicator of the education program's effectiveness. Our results showed that the comprehensive nutrition education program had positive effects in the three areas of food security, diet quality, and physical activity among the targeted group of vulnerable women. However, the program did not yield statistically significant improvements in food safety. Numerous studies from all over the world in line with our study results have shown that nutrition education programs can be effective in improving food security, diet quality, and physical activity. For the low-income families of Tulare participating in a study by Srivastava *et al.* (2019), the researchers ran an extensive food and nutrition education program [13]. They had 239 families signed up for their nine-week educational program. Significant improvements were seen after the intervention was finished in all the areas that had been examined. Eighty percent of participants managed their food sources better. The caliber of diet improved by 94 %. Positive changes were seen in 55 % of cases and food safety-related issues in 85 % of cases, respectively. The researchers concluded that funding these programs is a great public investment strategy. Manios *et al.* (2007) examined the change in dietary quality scores and macronutrient, and micronutrient intake following a nutritional education intervention program in postmenopausal women [14]. The study was performed on 75 women aged 55-65 years in Athens. The women were divided into two intervention groups of 39 and control groups of 36. The intervention group received lessons during regular sessions for five months. In this study, a self-report method and the HEI Healthy Nutrition Index measured the nutrients consumed by postmenopausal women. The results of the study showed significant changes in the consumption of micronutrients and macronutrients. In the intervention group, milk consumption was increased ($p < 0.001$), and fat consumption was decreased ($p < 0.50$). Consumption of macronutrients such as protein also was increased ($p < 0.001$) [14]. In agreement with Manios *et al.* (2007), a significant increase in fruit and vegetable consumption was observed in our study in the intervention group. In a study conducted by Farrell *et al.* (2018), a total of 80 EFNEP participants received 80 lessons delivered over eight sessions. The lessons covered various topics including food management, food safety, and physical activity. According to the study's findings, participants' food security increased from 31 % at the beginning of the study to 71 % ($p = 0.022$). Moreover, participants reported consuming a greater quantity of fruits and vegetables and preparing healthier food. An advantage of this study was the implementation of a $10 gift card to motivate program participants [15]. To assess the sustainability of behavioral changes following the completion of an EFNEP course, Koszewski *et al.* (2011) conducted a study where participants' responses were examined six months after they graduated from the program [16]. According to the findings, 25 % of the participants were able to change and maintain their behaviors over the six months. Among the areas that were improved were exercise, grocery shopping, and money management.

Table 3. Scores of diet quality, physical activity, food safety, and food security in both studied groups before and after the education program (Mean ± S.D.)

Behaviors		Enrolment	One month after completion of the education program	Differences within each group *p*-value	Differences between the two groups *p*-value
Diet quality	Intervention	5.52±3.26	6.13±3.11	<0.001	<0.001
	Control	4.30±2.57	4.32±2.42	0.843	
Physical activity	Intervention	4.20±3.27	5.75±3.41	<0.001	<0.001
	Control	4.83±2.66	4.88±2.54	0.370	
Food safety	Intervention	16.48±2.51	16.30±1.40	0.396	0.460
	Control	15.10±2.14	15.08±1.96	0.799	
Food Security	Intervention	18.15±3.32	20.45±5.39	<0.001	<0.001
	Control	15.13±3.82	15.15±3.75	0.766	

The presented materials were also observed in terms of food safety and the proper methods for defrosting and storing food. To demonstrate that the program can result in long-term behavioral changes, more research is required. Some studies have shown that the researchers did not see the expected effects of their education program on improving food security. For instance, the results of Miller *et al.'s* study demonstrated that combining financial aid, food assistance, and nutrition education for low-income people would result in a more effective educational intervention [17]. Given that the majority of participants in the training sessions in the current study stated that the high cost of living and low income were the two biggest obstacles to following a healthy eating plan, providing food and financial assistance by the government or non-governmental organizations (NGOs) can be a successful strategy for enhancing food security in the population. Many older adults declined to take part in an Omiuchen nutrition education program for the elderly population because they couldn't afford it. Additionally, a lot of senior citizens were unable to participate in the program due to transportation issues. The researchers concluded that financial aid is necessary in addition to education and that obstacles to senior citizens' accessing food should be removed [18]. In our study, 30 participants in the intervention group did not complete the intervention courses and were excluded from the study. Travel expenses, busy work, and lack of motivation were the most important reasons for not completing the course by these people. In a study by Auld *et al.* (2015), the authors evaluated the effectiveness of the EFNEP program. They observed beneficial effects on physical activity ($p < 0.001$), which is consistent with the findings of the present study [19]. In a study to assess the effects of a comprehensive nutrition education program for adolescents on their food safety, the authors have concluded that the posters and educational booklets were greatly helpful in the improvement of participants' food safety [20]. In the present study, no significant difference was observed between the two groups in terms of improving the score of food safety-related behaviors. One possible explanation for this finding was the high food safety scores of both groups before the intervention. Many participants already adhered to food safety recommendations before their enrollment in the study, unlike other areas of dietary behavior that required more improvement. Dickin *et al.* (2014) demonstrated a connection between parenting style and kids' eating patterns and physical activity levels. Parental education can help to encourage family time and healthy eating [21]. According to our study, it appears that choosing female-headed households as the target audience for education was a wise decision because changing mothers' eating or exercise-related behaviors can enhance the lifestyle of the entire family. However, the actions of other family members were not examined in the current study. In general, it can be said that the most successful nutrition education programs in the world, such as EFNEP or SNAP-ed, are the ones which in addition to providing nutrition education, also provide appropriate food assistance for low-income people, and the need for such aid, especially in the current situation of this country, seems to be necessary.

4. Conclusion

The findings of the current study provide evidence supporting the effectiveness of nutrition education programs in improving the dietary quality, food security, and physical activity levels of individuals with limited financial resources. Therefore, the implementation of such programs on a large scale, coupled with the provision of food aid, emerges as a favorable strategy for enhancing people's access to food within a nation.

Authors' Contributions

Jalal Hejazi: Conceptualization (equal); Data curation (equal); Formal analysis (equal); Investigation (equal); Methodology (equal); Project administration (equal); Resources (equal); Supervision (equal); Validation (equal); Visualization (equal); Writing-original draft (equal); Writing-review & editing (equal). Sahar Nazari Darab Khani: Data curation (equal); Formal analysis (equal); Investigation

(equal); Validation (equal); Visualization (equal); Writing-original draft (equal). Mohammad Masoud Vakili: Conceptualization (equal); Data curation (equal); Formal analysis (equal); Investigation (equal); Methodology (equal); Project administration (equal); Resources (equal); Validation (equal); Visualization (equal); Writing-original draft (equal); Writing-review & editing (lead). Majid Aminzare: Conceptualization (equal); Data curation (equal); Formal analysis (equal); Funding acquisition (lead); Investigation (equal); Methodology (equal); Project administration (equal); Resources (equal); Supervision (equal); Validation (equal); Visualization (equal); Writing-original draft (equal); Writing-review & editing (lead).

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Conflicts of Interest

None.

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Ethical considerations

This paper was extracted from the MSc thesis of Sahar Nazari Darab Khani (Code of ethics: IR.ZUMS.REC.1398.259).

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