Original Article

Dietary Intake of Antioxidants in the Elderly People under Nursing Care: A Case–Control Study

Abstract

Background: Nutrient deficiency such as antioxidants is a common problem in the elderly; it can result in different diseases such as cancer. Accordingly, assessment of the dietary intake of antioxidants is necessary to design a specific plan for solving this problem. **Methods:** This case–control study was conducted on 152 old people (≥60 years) with and without nursing care in nursing care centers in Isfahan, Iran, in 2017. Nutritional assessment was performed by an expert nutritionist using semi-quantitative validated Food Frequency Questionnaire. Nutrition IV software was used as food analyzer. Analysis of covariance and independent *t*-test were used for data analysis. **Results:** The mean age of the participants was 68.6 ± 4.9 and 68.9 ± 6.1 years in case and control groups, respectively, and the percentage of male/females in these groups was 46.3%/53.7% and 51.4%/48.6%, respectively. Dietary intake of energy, vitamin E, and selenium was significantly higher (P = 0.041; 0.007; 0.017) while beta-carotene intake was significantly lower in the elderly under nursing care than in the control (P = 0.002). **Conclusions:** The findings indicated that nursing care leads to improved intake of energy, vitamin E, and selenium, while diminished beta-carotene intake in the elderly. Intake of vitamin E, A, C, zinc, and selenium was high among elderly people with and without care, compared with the dietary reference intake. It seems that further studies are required to confirm these findings.

Keywords: *Antioxidants, diet, elderly, energy intake, Iran*

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Introduction

Population aging is widespread in developed countries and has also been expanding in developing countries, including Iran. The elderly population has doubled in Iran over the past 20 years.[1,2] According to previous studies, the most important complications of aging include increased level of oxidative stress and reduced intakes of energy, protein, and other nutrients.[3-5]

Although oxidants are the normal products of aerobic metabolism, they increase under pathophysiological conditions of the body. Oxidation is a type of chemical reaction which can generate free radicals and result in chain reactions ultimately damaging cells.[6]

Antioxidants are components of the diet which can delay, eliminate, or prevent oxidation processes. Antioxidant compounds such as vitamin A, ascorbic acid, phenolic compounds, tocopherols, carotenoids, zinc, selenium, and glutathione can also be found in various animal and plant sources.[7,8] Selenium and vitamin E, as important antioxidant micronutrients, play an important role in neutralizing free radicals in the body's antioxidant system. Additionally, selenium plays an important role in thyroid function, immune system, and cardiovascular function[9] and acts as a cofactor of the glutathione reductase enzyme.[10] Also, vitamin E can also reduce oxidative stress by taking electrons and directly neutralizing oxidants.[11]

These effective dietary components contribute to reducing the incidence of various cancers, autoimmune diseases, cardiovascular disease, cataracts, and brain disorders.[12]

During aging, antioxidant levels are reduced due to physiological problems such as absorption disorders and reduced nutrient intakes. Since nutritional care can increase the intake of nutrients in the elderly, these care measures are helpful in achieving the desired level of health in this vulnerable group.[4,13]

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Generally, antioxidants play an important role in age-related diseases, and nutritional care may play an important role in improving the levels of these components of the diet. Accordingly, our purpose in this study was to compare the levels of antioxidants' intake between the elderly with and without nursing care.

Methods

This case–control study was performed on 152 participants including 82 elderly (38 males and 44 females) as the case group and 70 elderly (38 males and 32 females) as the control group in nursing care centers, Isfahan, Iran, in 2017. The case group was selected from the elderly people living in nursing care centers, while the control group was chosen from the elderly who referred to nursing care center at the beginning of the entry to the center (without care).

Due to the group matching in this study, after dividing the case group into different subgroup characteristics, the control group was matched with these characteristics and determined.

Inclusion criteria were being older than 60 years old, nonsmoker, not taking antioxidant compound supplements, living in nursing care center for at least 6 months, and willingness to participate in the study. The study was approved by the ethics committee of the institution (Ir.mui.rec. 1395.1.200). After selecting the study groups, the consent form was completed by each participant in the study.

The weight, height, history of drug uses, and the number of chronic disease of all the individuals were extracted from their files. The dietary intake of case and control groups was also evaluated by an expert nutritionist using the semi-quantitative Food Frequency Questionnaire. Previous studies have approved the validity and reliability of the questionnaire in the elderly people.[14] The amount of consumption of each common food in this questionnaire was determined. The level of consumption of each item was converted to grams per day by N4 software to measure the daily intake of each nutrient. Also, it is noteworthy that the intake of each antioxidants was compared with dietary reference intake (DRI) in elderly population.

Statistical analysis

Comparison of the dietary intake of antioxidants and other quantitative variables was performed by independent *t*-test between the case and control groups. Also, Chi-square test was used for comparison of drug uses as the qualitative variable between study groups [Table 1].

Analysis of covariance was used for comparing the means of antioxidant compounds' adjusted energy intake and number of chronic disease by gender between the two groups [Tables 2 and 3]. Normality of data was checked and conformed using Kolmogrov–Smirnov test. SPSS software (version 22; Chicago, IL, USA) was used for data analysis and P value <0.05 was considered as the significance level of the statistical test.

Results

The demographic characteristics of the participants are presented in Table 1. The mean age of the participants was 68.6 ± 4.9 and 68.9 ± 6.1 years in case and control groups, respectively. Also, the percentage of male/females in case and control groups was 46.3%/53.7% and 51.4%/48.6%, respectively.

Table 2 indicates the results of the comparison of antioxidants' intake between case and control groups after adjusting the number of chronic diseases and energy intake by gender. The dietary intakes of vitamins C and E were higher (P = 0.041; P = 0.031), while the intakes of vitamin A and beta-carotene were lower among the women compared with the control (P = 0.001). None of the antioxidants' consumption was significantly different among the men of the case group when compared with the control (P > 0.05) [Table 2].

The intakes of energy, vitamin E, and selenium were significantly higher in the case group than in the control (P = 0.041; P = 0.007; P = 0.017). The dietary intake of beta-carotene was lower among the elderly under care compared with the control group (P = 0.002) [Table 3]. The results obtained in Table 3 are after adjusting the energy intake and the number of chronic diseases.

From another perspective, compared to the DRIs [estimated average requirements (EARs)] in the elderly population, the

Table 1: Demographical characteristics of elderly with and without nursing care

Variables†	Elderly people under nursing care	Elderly people without nursing care	*P**
Age (years)	68.6±4.9	68.9±6.1	0.783
Weight (kg)	63.6±8.2	63.4±7.6	0.882
Height (cm)	163.4±6.8	161.6±7.4	0.122
BMI (kg/m^2)	23.9±3.5	24.4±3.3	0.373
No. of chronic diseases	1.7±0.76	1.8±0.78	0.564
Drug uses (%)¥			
Yes	46.3%	53.7%	0.965
No	45.9%	54.1%	

BMI: Body mass index, †The values are expressed as means±standard deviation and percent (%), *P<0.05 considered as significant level, ¥Chi-square test

Table 2: Analysis of covariance results for variables based on Food Frequency Questionnaire by gender

Variables†	Elderly people under nursing care	Elderly people without nursing care	*P**
Men			
Vit C (mg/d)	116.6±11.8	133.45±12.17	0.326
Vit A (µg/d)	906.4±62.0	751.7±63.7	0.087
Beta-carotene (µg/d)	1131.8±70.8	1210.2±72.8	0.443
Vit E (mg/d)	24.0±1.8	19.4±1.9	0.088
Zinc (mg/d)	11.7±0.5	11.8±0.5	0.856
Selenium (µg/d)	51.8±3.9	41.6±4.0	0.075
Women			
Vit C (mg/d)	156.45±12.01	117.03±14.05	0.041*
Vit A (µg/d)	572.4±30.7	747.7±35.9	0.001*
Beta-carotene (µg/d)	1010.9±60.0	1352.6±70.2	0.001*
Vit E (mg/d)	25.2±1.6	19.6±1.9	0.031*
Zinc (mg/d)	12.1±0.6	11.5±0.7	0.509
Selenium (µg/d)	71.3±4.6	61.7±5.4	0.193

*P<0.05 considered as significant level. †Adjusted for the number of chronic diseases and energy intake using analysis of covariance; the values are expressed as means±standard error

Table 3: The results of analysis of covariance for variables based on Food Frequency Questionnaire

Variables†	Elderly people under nursing care	Elderly people without nursing care	*P**	DRI€
Energy (kcal)	2165.5±645.2	1965.3±533.5	0.041*	2000
Vit C (mg/d)	138.7±8.5	124.2±9.2	0.252	70
Vit A (µg/d)	718.7±37.4	748.5±40.6	0.592	600
Beta-carotene (µg/d)	1058.9±46.4	1278.4±50.4	0.002*	3000
Vit E (mg/d)	24.5±1.2	19.6±1.3	0.007*	12
Zinc (mg/d)	12.0±0.36	11.6±0.39	0.557	10
Selenium (µg/d)	62.2±3.2	50.7±3.4	0.017*	45

DRI: Dietary reference intake. *P<0.05 considered as significant level. †Antioxidants compounds were adjusted for the number of chronic diseases and energy intake using analysis of covariance; the values are expressed as means±standard error, €DRIs: estimated average requirements in elderly; Food and Nutrition Board, Institute of Medicine, National Academies; 2000

dietary intakes of vitamins C, E, and A, zinc, and selenium were high, but the intake of beta-carotene was low in both the case and control groups [Table 3].

Discussion

The findings of this study suggested that the dietary intakes of energy, vitamin E, and selenium were higher, while beta-carotene was lower in the elderly people under nursing care than the control group.

Aging, as a biological and complex phenomenon, is affected by socioeconomic factors, which play a significant role in the nutritional status in the elderly. The role of oxidative stress and free radicals in the aging process is one of the newest theories. According to this theory, with increasing levels of oxidative stress, the aging process also accelerates.[15-17] Khansari *et al.* showed that oxidative stress and chronic inflammation are the basis of different diseases in the elderly.[18] Overall, the antioxidant mechanism in reducing oxidative stress involves neutralizing and reducing reactive oxygen species.[19] In this regard, vitamin E is a well-known antioxidant factor which has some radical scavenging activity and reducing effect on lipid peroxidation in living systems.[20] Additionally, selenium is another trace element in our body which can reduce reactive oxygen and nitrogen species and improve immune system and body health.[21]

According to the recent evidence, elderly people, as a vulnerable group, are at a high risk of low dietary intake of antioxidant compounds.[22,23] A study by Cesari *et al.* also found that the dietary antioxidants, especially vitamin C, improve the physical functioning of the musculoskeletal system in the elderly.[24] According to Wengreen *et al.*, the dietary antioxidants in the elderly both improve general health and enhance cognitive functions.[25] Therefore, nutritional healthcare coupled with antioxidant compounds may reduce the risk of aging disorders. A study by Jobse *et al.* on nutritional support of the elderly population showed that supplementation in this group is associated with improved level of micronutrients.[26] Also, Woods *et al.* in a study revealed that the intake of nutrients and antioxidant compounds such as zinc is lower than the EARs among older people with a low level of care.[27] However, the results of some studies indicate that the nutritional value of antioxidants does not improve in elderly people living in care centers. Aghdassi *et al.*, in their study on the Toronto-Canadian elderly, showed that 50% of the elderly

under nursing care had vitamin E and zinc intake less than EAR. Also, 15% of subjects in this study received insufficient levels of vitamins A and C compared to the EAR.[28] However, the results of this study indicated higher intake of vitamin E and selenium and lower intake of beta-carotene in elderly people in care centers compared with those not receiving care.

As the strength of this study, the results obtained from the dietary antioxidants in this study are highly valued due to controlling the energy intake as a misleading variable. The limitation of this study was the low number of participants.

Conclusions

The findings suggested that nursing care leads to improved intake of energy, vitamin E, and selenium in the elderly, while beta-carotene intake was lower than control. On the other hand, dietary intakes of vitamins E, A, and C, zinc, and selenium were high among all the elderly (with and without care) compared with DRI. Due to the prevalence of various diseases in elderly population, increasing the awareness of the staff of the nursing care centers can improve nutritional status in this group.

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Conflicts of interest

There are no conflicts of interest.

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