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Research Article

Antioxidant Nutrient Intake in Elderly Patients with Alzheimer's disease: A Case-Control Study

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Abstract

Introduction: Alzheimer's disease is the leading cause of cognitive decline in the elderly. It is caused by oxidative stress of biomolecules that appears to be related to the increased occurrence of lesions in brain regions responsible for cognition and may lead to enzymatic inactivation, mutation, rupture, increase in the atherogenicity of low-density plasma lipoproteins, and cell death. It is believed that a diet rich in antioxidant nutrients can help reduce the cell damage caused by free radicals and minimize the deleterious effects of oxidative stress.

Objective: To identify patterns of antioxidant nutrient intake in the diet of elderly people with and without Alzheimer's disease.

Methods: A case-control study was conducted on elderly patients managed at a public hospital in Maceió. Socio-demographic and anthropometric variables as well as the 3-day food registry were collected.

Results: The study was composed of 92 elderly patients with and without Alzheimer's disease. No differences were observed between groups in the frequencies of the variables: gender, marital status, schooling, and income. Elderly patients with Alzheimer's disease had a higher average age. Regular physical activity was reported only in the control group. It was also observed that malnutrition was associated with the diagnosis of Alzheimer's, where the frequency of individuals with low body weight was higher in the affected group (n = 7; 20.6%) than in the control group (n = 4; 6.9%). A high frequency of subjects with intake below the recommendation was noted in both groups for all the antioxidant nutrients, except vitamin C. Intake of antioxidant nutrients showed correlations with energy and macronutrient intake in both groups.

Conclusion: The antioxidant nutrient intake in the majority of the studied elderly was below the nutritional recommendations for age, and the inadequacy of intake is even more frequent among elderly patients with Alzheimer's disease.

Introduction

The change in the world age pyramid has mandated the study of aging, provoking involvement of social and governmental agents, as well as health professionals. Among the various disorders affecting the elderly, mental health deserves special attention. Depression and dementia have caused disability among elderly people throughout the world by leading to the loss of independence and almost inevitably, autonomy [1].

Alzheimer's disease (AD), the leading cause of cognitive decline in the elderly, accounts for more than half of the cases of dementia, and is characterized by progressive memory disturbance and other cognitive functions, affecting occupational and social functioning. Age is the main risk factor its prevalence increases from 0.7% from 60 to 64 years of age to about 40% in the age groups of 90 to 95 years [2].

Other factors may favor damage to the central nervous system of the elderly, including the oxidative stress of biomolecules, which seems to be related to the greater occurrence of lesions in brain regions responsible for cognition, and may lead to enzymatic inactivation, mutation, membrane rupture, and to cell death [3,4].

Oxidative stress arises from an imbalance of oxidative and antioxidant compounds. Such a process leads to the oxidation of biomolecules with consequent loss of their biological functions and/or homeostatic imbalance, which is manifested as oxidative damage [5]. Oxidation is indispensable to aerobic life, and thus, free radicals are produced naturally. They react with DNA, RNA, proteins, and other oxidizable substances, generating potentially toxic reactions to the human body [6].

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These effects have been associated with the aging and development of chronic, inflammatory, and degenerative diseases. It is also suggested that people who already have some mild cognitive decline may eventually develop Alzheimer's disease as a consequence of oxidative stress [3,4].

Cellular components are not fully protected by endogenous antioxidants, and antioxidant intake is indispensable for proper defense against oxidation and thus plays an important role in maintaining health [4].

Current evidence suggests that the deficiency of antioxidant vitamins such as vitamin -A, -C, and -E as well as some minerals such as copper, selenium, and zinc in addition to the presence of risk factors for cardiovascular and cerebrovascular diseases could play an important role in the decline of cognition. It is probable that there is a common oxidative mechanism between these diseases, and therefore, antioxidants from the diet, similar to protective factors against such diseases, would also act in the prevention of cognitive decline and dementia [7].

On the other hand, cognitive and behavioral disorders can compromise nutrition, such as chewing and/or swallowing difficulty, and behavioral disorders that make the elderly distracted and slow during meals, compromising adequate eating habits and leading to weight loss, nutritional deficits; this reduced intake of macro- and micronutrients compromises the antioxidant defense system depending on the ingestion of these exogenous components [8].

Thus, knowing the antioxidant intake of the elderly with AD is necessary to gain a better understanding of possible associations between the activity of these nutrients in the process of disease development or protection of the health in the elderly population. Thus, the objective of the study was to identify patterns of antioxidant nutrient intake in the elderly with and without clinically diagnosed Alzheimer's disease.

Methods

Study design and sampling

This is a case-control study, whose sample consisted of elderly patients who visited the Geriatrics and Gerontology Outpatient Clinic of Professor Alberto Antunes University Hospital/HUPAA and Nutrition Outpatient Clinic for the Elderly of the Nutrition Faculty of the Federal University of Alagoas/UFAL between August 2014 and May 2015. The non-probabilistic sampling plan of convenience was used for patient selection. All the enrolled elderly patients attended in both outpatient clinics that met the inclusion criteria were included in the sample.

Participants of this study were divided into two groups: group-I (Case) comprised patients with Alzheimer's disease and group-II (control) composed of healthy individuals, paired by gender and monthly income.

Criteria for Inclusion and Exclusion

The Free and Informed Consent Term (TCLE) were obtained from all participants, who were chosen in both sexes, were aged 60 years or above, were referred by a geriatrician, and did or did not have Alzheimer's Disease that was previously established on the basis of DSM-IV criteria.

Elderly with physical disability and/or with decompensated chronic diseases (uncontrolled tumor diseases, cardiopathies, chronic gastrointestinal disease, or renal disease or hepatic insufficiency) were excluded.

Data Collection

As instruments of research, we used medical records and the research protocol applied during the nutritional consultation. Data on the following variables were collected: gender, date of birth, marital status, physical activity, smoking, alcohol, education, and income. In addition, chronic diseases such as dyslipidemia, diabetes mellitus, and hypertension, were recorded. The information on food consumption was collected through the application of the daily three-day food record method completed by the elderly (in case of absence of clinical signs of dementia) or by their caregiver, where all foods and beverages consumed on alternate days of the week were counted, including a weekend day [9].

To obtain the weight, a digital scale with capacity for 200 kg and accuracy of 50 g. The height was obtained by means of the portable stadio-meter, graduated in tenths of centimeters, and affixed to a flat surface. Weight and height measurements were made in duplicates by different evaluators. In case of a variation between the recorded values, a third measurement was made, and the average of the three measures was used. The height recorded corresponded to the average of the two measurements. The body mass index (BMI) was obtained by the relationship between weight (kg) and height squared (m) WHO (1995) [10]. The cut-off points of Lipschitz (1994) [11] for eutrophy (22.0-27.0 kg/m²) and overweight (> 27 kg/m) were considered.

To assess the intake of antioxidants nutrients, dietary record in three days for assessing food intake were used. The average of the obtained results in dietary surveys collected was calculated using the following equation: Average intake = (Σ diet registry)/3.

As a parameter of the ideal intake of antioxidant nutrients, the Recommended Dietary Intake (RDI) (Institute Of Medicine, 2006) [12] was used, and AVANUTRI® software version 3.09 (2008) was used to calculate the micronutrient intake. For the evaluation of intake of vitamin -A, -C, -E, zinc, selenium and copper, values calculated in the food surveys were adjusted and corrected for the variability of consumption among the individuals in the same group, by using the methodology described in Dietary Reference Intakes (DRI) having the estimated average need (Estimated Average Requirement - EAR) as a cutoff point for estimating the nutrient requirements.

Ethical Aspects

According to Resolution 466/12, which deals with research involving subjects from Brazil/Ministry of Health, National Health Council, this study was submitted for consideration by the Ethics and Research Committee Plataforma Brasil and approved under n°432.659 / 2013.

Individuals were invited to participate in the survey during the outpatient visit. After all the necessary explanations were obtained, all elderly people with AD signed the TCLE, respecting the principle of the individuals' autonomy in deciding whether or not to participate in this research.

Table 1: Association of variables related to personal data, social and life habits of the elderly with and without Alzheimer's disease. Maceió - AL, 2015.

	Case Group *n (%)*	Control Group *n (%)*	Value p
Sex			
Female	21(61.7)	45 (77.5)	0.104#
Male	13 (38.2)	13 (22.4)	
Marital Status			
Married/living together	9 (26.4)	31 (53.4)	0.012#
Unmarried, widowed or divorced	25 (73.5)	27 (46.5)	
Schooling			
<1 full degree	24 (70.5)	26(44.8)	0.017#
>or= 1 complete	10 (29.4)	32(55.1)	
Physical Activity			
Yes	2 (5.8)	25 (43.1)	<0.001¥
No	32 (94.1)	33 (56.89)	
Smoking			
Yes	0 (0)	1 (1.7)	0.099¥
No	34 (100)	57 (98.3)	
Alcohol			
Yes	1(3.3)	14(24.13)	0.008¥
No	33 (97.05)	44(75.86)	

Pearson's Chi-square; ¥ Fishers Exact Test

Statistical Analysis

The collected data were organized in an electronic database, and Statistical Package for Social Sciences (SPSS®) version 20.0 was used to obtain the results and for statistical analysis.

Statistical analyses were performed considering the results obtained using parametric or non-parametric tests, taking into account the distribution nature of the studied variables. Before proceeding with the analyses, the behavior of the variables was checked for normality using the Shapiro-Wilk test. To evaluate the difference between the means, Student's t-test for parametric variables and Mann-Whitney's tests were used for non-parametric variables. The results were expressed as Mean ± Standard Deviation (SD) or median + Inter Quartile Range (IQR), respectively, and considered significant when $p < 0.05$.

Association analysis was performed using Pearson's chi-square test or Fisher's exact test and Pearson's correlation analysis was performed between continuous variables.

Table 2: Mean difference of the variables related to the nutritional status of the elderly with and without Alzheimer's disease. Maceió - AL, 2015.

	Case Group	Control Group	Value P
	Mean (SD)	**Mean (SD)**	
Weight (kg)	61.5 (12.5)	70.0(14.5)	0. 011
Height (m)	156.3(7.9)	156.9(8.1)	0.773
BMI (Kg/m²)	25.1(3.7)	28.8(4.9)	0.001

Test-T: BMI = Body Mass Index; Height = Estimated height; SD = Standard Deviation

Results

The sample included 34 elderly patients with AD and 58 without the disease, totaling 92 elderly people. In the total sample, most of the elderly were females (n = 66; 71.7%), married (n = 40; 43.4%), and studied for a period equal to or greater than the 5th grade of elementary school. Considering the total sample, it was observed that the majority of the individuals had a family income of two or more minimum wages (n = 54; 58.6%). There were no intergroup differences in the frequencies of these variables. The results of these variables are presented in (Table 1), separately for each group of elderly.

A difference was noted in the age between the groups, and the elderly with the AD had higher average age (76.8 ± 8.6 years vs. 66.3 ± 4.9 years; $p < 0.001$).

With respect to lifestyle, we observed higher frequency of elderly patients in the control group (n = 25; 43.1%) with regular physical activity, as compared to the group of elderly patients with AD (n = 2; 5.8%). Smoking and alcohol consumption were denied by the majority of the elderly, in both groups (Table 1).

On evaluating the nutritional status of the elderly subjects according to the body mass index (BMI), we observed malnutrition was associated with the diagnosis of AD, with the frequency of individuals with low body weight was greater in the disease group (n = 7; 20.6%) than in the control group (n = 4; 6.9%).

The mean weight and BMI did not differ between the groups, where the AD group had less weight (61.5 ± 12.5 kg vs. 70.0 ± 14.5 kg) and lower body mass index (25.1 ± 3.7 kg/m² vs. 28.8 ± 4.9 kg/m²; p = 0.001) than the control group (Table 2).

A higher frequency of elderly patients with dyslipidemia (n = 37; 40.2%) and diabetic patients (n = 18; 19.5%) was observed in the control group, but the frequency in hypertension showed no intergroup differences.

(Table 3) shows the intake of antioxidant nutrients calculated apart from food record of three days in both groups. According to the DRI, a higher frequency of individuals with intake of vitamin-A, vitamin-E, zinc, copper, and selenium below EAR was noted

Table 3: Assessment of the intake of antioxidant nutrients. Maceió - AL, 2015.

		Case Group n (%)	Control Group n (%)	Value p
Vitamin A	< EAR	19 (55.9%)	31 (53.4%)	0.321
	≥ EAR	15 (44.1%)	27 (46.6%)	
Vitamin C	< EAR	10 (29.4%)	19 (32.8%)	0.739
	≥ EAR	24 (70.5%)	39 (67.2%)	
Vitamin E	< EAR	27 (79.4%)	51 (87.9%)	0.272
	≥ EAR	7 (20.5%)	7 (12.06%)	
Copper	< EAR	25 (73.5%)	40 (69.0%)	0.643
	≥ EAR	9 (26.4%)	18 (31.0%)	
Zinc	< EAR	18 (52.9%)	38 (65.5%)	0.233
	≥ EAR	16 (47.0%)	20 (34.4%)	
Selenium	< EAR	20 (58.8%)	42 (72.4%)	0.180
	≥ EAR	14 (41.1%)	16 (27.5%)	

Pearson chi-square test: EAR= Estimated Average Requirement.

Table 4: Correlations between intake of macro and micronutrients in elderly patients with and without Alzheimer's disease. Maceió - AL, 2015.

	Alzheimer				Control			
	Kcal	Protein	Carbohydrate	Lipids	Kcal	Protein	Carbohydrate	Lipids
Vitamin A	r = 0.135	r = 0.103	r = 0.282	r = 0.194	r = 0.030	r = 0.084	r = 0.069	r = 0.070
	p = 0.445	p = 0.561	p = 0.107	p = 0.271	p = 0.821	p = 0.532	p = 0.608	p = 0.604
Vitamin C	r = 0.129	r = 0.045	r = 0.279	r = 0.241	r = 0.011	r = 0.092	r = 0.160	r = 0.220
	p = 0.467	p = 0.800	p = 0.109	p = 0.170	p = 0.933	p = 0.941	p = 0.231	p = 0.97
Vitamin E	r = 0.371	r = 0.017	r = 0.294	r = 0.358	r = 0.185	r = 0.008	r = 0.113	r = 0.661
	p = 0.031	p = 0.922	p = 0.92	p =0.038	p = 0.164	p = 0.950	p = 0.398	p = 0.000
Copper	r = 0.094	r = 0.097	r =0.064	r = 0.034	r = 0.107	r = 0.204	r = 0.057	r = 0.000
	p = 0.596	p = 0.587	p = 0.719	p = 0.849	p = 0.423	p = 0.125	p = 0.673	p = 0.999
Selenium	r = 0.098	r = 0.477	r = 0.016	r = 0.110	r = 0.258	r = 0.367	r = 0.029	r = 0.240
	p = 0.50	p = 0. 004	p = 0.928	p = 0.537	p = 0.055	p = 0.005	p = 0.830	p = 0.070
Zinc	r = 0.293	r = 0.036	r = 0.301	r = 0.134	r = 0.059	r = 0.051	r = 0.033	r = 0.129
	p = 0.093	p = 0.842	p = 0.083	p = 0.449	p = 0.662	p = 0.703	p = 0.803	p = 0.339

Spearman correlation

Table 5: Average consumption of calorie intake of macronutrients and consumption mid-range of antioxidant nutrients, in the case group and control. Maceió - AL, 2015.

Variables	Alzheimer		Control		Value P
	Mean/ Median	SD/IQR	Mean/ Median	SD/IQR	
Energy (kcal/day)#	1622.05	451.11	1539.28	322.18	0.352
Protein(g/kg/day)#	1.417	65.1	1.169	28.54	0.147
Carbohydrate (g/ day)#	252.1	1.06	215.55	0.499	0.027
Lipids (g/day) #	36.72	84.36	40.07	13.4	0.298
Vitamin A (re/day)*	663.33	318.5	553.91	203.01	0.048
Vitamin C (mg/day)*	138.45	310.95	92.7	86.95	0.12
Vitamin E (mg/day)*	5.31	2.96	6.71	2.29	0.743
Copper (mg/day)*	0.45	0.108	0.56	0.121	0.063
Selenium (mg/day)*	24.71	20.97	28.96	14.2	0.05
Zinc (mg/day)*	5.21	3.07	6.91	2.59	0.028

SD = Standard deviation; IQR = Inter Quartile Range

#Data presented as Mean + Standard Deviation (SD). T-test used to evaluate differences between groups;

*Data presented in Median + Inter Quartile Range (IQR). The Mann-Whitney test used to evaluate intergroup differences.

among AD patients. Vitamin-C was the nutrient that presented a higher frequency of adequate intake in the population studied. No association was noted between intake of antioxidant nutrients and AD orthe clinical diagnoses of hypertension, diabetes mellitus, and dyslipidemia ($p > 0.05$).

On analyzing possible correlations between dietary intake of antioxidant nutrients with the intake of macronutrients and energy, we observed that the AD group showed a positive correlation between intake of vitamin E and intake of energy ($r = 0.371$; $p = 0.031$) and lipids ($r = 0.358$; $p = 0.038$). Further, in the control group, selenium intake was correlated with protein intake ($r = 0.477$; $p = 0.004$). Similarly, the intake of vitamin E was positively correlated with the intake of lipids ($r = 0.661$; $p <0.001$), as well as the selenium concentration was positively correlated with protein intake ($r = 0.367$; $p = 0.005$) (Table 4).

Table 5 presents the mean energy intake and nutrients, where difference was observed only in the mean intake of carbohydrates between the groups (252.10 ± 1.06 g/day vs. 215.55 ± 0.50 g/day; $p = 0.027$). The intake of vitamin-A was significantly greater (663.33 ± 318.5 g/day vs. 553.91 ± 203.01 g/day; $p = 0.048$) and the intake of selenium and zinc lower in the AD group (24.71 ± 20.97g/day vs. 28.96 ± 14.2 g/day; $p = 0.050$) and (5.21 ± 3.07 g/day vs. 6.91 ± 2.59 g/day; $p = 0.028$) than in the control group.

Discussion

In this study, it was observed that elderly people in the AD group were older than those in the control group. AD is a type of dementia with a higher chance of developing in more advanced ages, since aging is the main risk factor for the development of the disease [13]. The higher frequency of women in the sample reflects the greater frequency of the sex in the demand for ambulatory care. Some factors may explain this finding as the result of reduced exposure of women to certain risk factors and greater concern for women with health care [14].

Another important factor observed in our study was that while the frequency of elderly people with regular physical activity was greater in the control group, only two patients in the AD group. The result is expected because the AD results in considerably decreased autonomy, cognitive ability and professional of the elderly, making them more dependent to carry out these activities. It is known that regular physical activity or even leisure activities is protective against the development of the disease and are associated with a reduction in the rate of progression of the disease [15].

It was observed that the frequency of smoking was low in the elderly in both groups, while the frequency of alcohol consumption was higher in the control group. The excessive consumption of alcohol interferes with nutrition of the elderly via various mechanisms because it competes with the nutrients from your intake until its absorption and utilization [16]. In addition, some complications of alcoholism may cause dementia to have direct toxic effect. These include subdural hematoma due to head trauma and the degeneration of hepatocerebral liver cirrhosis [17]. The AD group had lower frequency of alcohol consumption, which may be attributed to the discontinuation of the habit following diagnosis of AD and treatment.

In the present study, we also observed a higher frequency of low body weight in elderly people with AD, which is often found in surveys that assess the nutritional status of the elderly with dementia [18].This is because weight loss is frequent and occurs in approximately 40% of the cases, at all stages, and is present even before the establishment of AD. One of the explanations for weight loss is the hypothesis of atrophy of the Temporal Lobe Mesial aspect (LTM), which is the area of the brain responsible for the control of feeding behavior. It is also suggested that the AD causes an increase in energy needs associated with low food intake, which would lead to a reduction in body weight. In addition, decrease in the concentration of orexígenos peptides, such as the neuropeptide Y and norepinephrine, observed in patients with the disease, can lead to loss of appetite, with reduction in food intake [19].

The high frequency of chronic diseases in both groups must be considered as a cause for concern, and this finding is the result of the aging process. It may be related to excessive intake of simple carbohydrates, saturated fat, transfat, and sodium and low intake of vitamins and minerals with antioxidant functions, in addition to low fiber intake. Although we believe in this hypothesis, we consider the absence of a qualitative assessment of food intake an important limitation in this study.

A study conducted in the city of São Paulo revealed that chronic diseases have a strong influence on the functional capacity of the elderly. The risk of elderly being dependent for instrumental activities of daily living increases by 39% if hypertension is present, 82% if heart disease is present, 59% if arthropathy is present, and 50% if lung disease is present. In addition, the prevention and control of chronic diseases can improve the activities and hence promote the welfare of the population [20].

In recent years, the effects of antioxidants in relation to sickness have been investigated, mainly in developed countries of the West. Research has attempted to explain the benefits of antioxidants with the aging process, such as the cataract, AD, and other changes in the nervous system [21].

The present study evaluated the intake of vitamins -A, -C, and E and the minerals zinc, copper and selenium. There was a high frequency of individuals with dietary intake below the recommended level in both groups for all antioxidant nutrients, with the exception of vitamin-C. These results are similar to those found by Machado et al. (2009), who evaluated 40 elderly patients with AD and assessed their dietary intake of vitamin-C and low dietary intake of vitamin-E [8]. The adequacy of vitamin C is the result of its presence in an assortment of fruits, vegetables, and plants such as orange, acerola, cauliflower, tomato, cashew, guava, pineapple, mango, lemon, okra, and carrot [22].

Adequate intake of vitamin C was observed in the majority of the elderly in this study; it is believed that the adequate intake of this nutrient can assist in the reduction of damage caused by oxidative stress, since this nutrient is considered the most important and powerful low-molecular-weight antioxidant and is present in greater concentration in the blood as compared to other antioxidant enzymatic [23]. However, we emphasize the importance of adequate intake for all other nutrients in order to potentiate the response antioxidant and organic defense, since the majority of the elderly had intakes below the recommended levels.

The intake of vitamin E showed a high frequency of inadequate intake in elderly patients of both groups and their intake is correlated with the intake of lipids. From the metabolic point of view, vitamin E is an important antioxidant responsible for the scanning of free radicals in the body, and its active form α-tocopherol is found in lipoproteins and membranes, mediating the blocking of the chain reaction of lipid peroxidation, through the kidnapping of the radical peroxila [24]. In addition, owing to its lipo-soluble nature, the main sources of vitamin E are foods rich in lipids, such as vegetable oils, nuts, almonds, Brazil nut, peanuts, hazelnuts among others [25], which justifies the correlation found between the intake of this vitamin and lipids.

The results indicate that a large proportion of the elderly in this sample also had low intake of zinc and that the mean intake of this nutrient was lower in elderly patients with AD. A study carried out in Rio Grande do Sul on 51 elderly people over the age of 60 years has found similar results, where the frequency of inadequate intake of zinc per elderly was 55%; however, the study did not involve elderly people with AD [26].

Another study performed in elderly patients with and without cognitive changes indicated an average of inadequate zinc intake of approximately (45% and 68% among those without and with cognitive impairment, respectively) [27] values close to those found in this study. It is possible that the high frequency of inadequate zinc intake as well as the low intake of this nutrient is explained by poor eating habits or by low intake of meat, fish and poultry, which are major food sources of this mineral.

Zinc is an important antioxidant agent involved in inhibiting lipid peroxidation and preventing the progression of cellular injury. A recent study has suggested a possible association of this nutrient with the progression of the AD, where lower serum concentration of this mineral was related to more severe dementia [28] In the present study, we did not evaluate the serum concentrations of these antioxidant agents; however, the correlation between organic concentrations and the intake of this mineral is already known.

According to Bandeira et al., who studied 14 elderly patients (age, over 60 years) with a diagnosis of cognitive decline, the consumption of selenium in these patients and the mean intake was 34.5 18.4 μg/day, and 78.6% of the elderly had consumption levels below the EAR [29].

Selenium is an important antioxidant that provides protection against reactive oxygen species induced by cellular damage and plays a key role in maintaining the proper functioning of the nervous system, functioning as a neuro-protector [28]. In this study, a correlation of selenium with protein intake was observed in both groups, which can be justified by the fact that the sources of selenium include Brazil nuts, seafood, red meat, grains of oats, and brown rice [30].

In the present study, most of the elderly in both groups had low intake of copper; however, the higher frequency of inadequacy was observed in elderly patients with AD. A study [28] conducted in Paraná on 30 elderly patients with AD found that copper was the micronutrient with a lower percentage of adequacy (0.16-0.35). This is unfavorable because this nutrient is associated with the metabolic functions of enzymes that are copper dependent (cuproezimas), including cytochrome coxidase, superoxide dismutase, cytosolic lysyl oxidase, tyrosinase, ceruloplasmin, and dopamine b-hydroxylase. These enzymes catalyze the physiological reactions related to oxidative phosphorylation and inactivation of free radicals, biosynthesis of collagen, blood coagulation, iron metabolism, and synthesis of catecholamines [31].

Another finding in this study was the calorie intake of protein, carbohydrates, and lipids; intergroup differences were observed only in the case of carbohydrate consumption. In the case, group consumption was higher among the AD patients than the control group because the elderly patients with AD often have trouble with the consistency of food and require pasty food prepared by enriching it with milk flour, often without adequate guidance, which may have contributed to this finding. In 2009, Machado et al, assessed the consumption of nutrients in 40 elderly patients with AD and reported results different from those of this study with respect to the dietary intake of protein, lipids and carbohydrates [8].

Among the limitations of this study include the small number of elderly assessed and the difference between the two groups in age because elderly patients with more advanced age have several limitations with food and lifestyle habits than elderly without the disease. Another important limitation was the lack of evaluation of qualitative consumption in the diet of the elderly in this study, which could provide information about the foods and preparations consumed, which may justify some of the results found.

Conclusion

From the results obtained, it is evident that both groups of elderly patients had high frequency of low intake of antioxidant nutrients. However, AD appears to significantly compromise food intake, since the mean intake of most nutrients was lower in this group of elderly, with the differences being significant in the case of carbohydrate, zinc, and selenium.

Additionally, greater impairment of nutritional status was noted among the elderly with AD, which is probably due to decreased appetite, difficulty in swallowing, and little acceptance of foods.

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