ORIGINAL ARTICLE

Nutritional and hematological factors associated with the progression of Alzheimer's disease: a cohort study

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http://dx.doi.org/10.1590/1806-9282.65.2.222

SUMMARY

OBJECTIVE: *We studied the users of the Specialized Drug Distribution Program of the public health network.*

METHODS: *A prospective cohort examined the elderly at two intervals of three years and included 30 patients in phase I and 16 in phase II. The methodology was composed of home visits, anthropometric, nutritional and hematological evaluation. For the progression of AD, the Clinical Dementia Rating (CDR) scale was used.*

RESULTS: *According to the CDR, the disease evolved, since in 2014 most of the patients were in CDR 3. In the analysis of the micronutrients, only the B vitamins (B1, B2, B3, B5, B6) presented a significant reduction in 2014. The consumption of carbohydrates and lipids increased in the 2014 evaluation, and protein consumption decreased. As for the average weight of the elderly, there was an increase in 2014, 65.9 (± 15.6) Kg, with a BMI of 26.75 (± 4, 5), in 2011 the average weight was 62.44 kg (± 14, 36), BMI 24.64 (± 4.97).*

CONCLUSION: *The hypothesis that patients are likely to be overweight or obese before the development of AD and that this may be associated with an increased risk of dementia is suggested.*

KEYWORDS: *Alzheimer disease. Obesity. Macronutrients. Dementia.*

INTRODUCTION

Alzheimer disease (AD) is a degenerative neurological disease, progressive and irreversible that affects about 35.5 million people around the world, being characterized as the most common dementia. It manifests itself insidiously as a result of neuronal lesions and consequent degeneration of nervous tissue [1].

Patients with AD present deterioration of the superior cortical functions that lead to loss of memo-

DATE OF SUBMISSION: 03-Apr-2018
DATE OF ACCEPTANCE: 05-Aug-2018
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ry, disorientation, difficulty of comprehension, calculation, learning ability, language, and judgment, making it difficult to perform activities of daily living [2,3]. The first symptom of the perceived disease is often the decline of memory, especially of recent events (episodic memory), and spatial disorientation, cognitive aspects most often subordinate to hippocampal formation [1].

One of the main factors associated with the disease progression is malnutrition due to agnosia (difficulty in distinguishing an object even with tactile stimulus), and apraxia (loss of ability to perform characteristic movements and gestures), symptoms of AD which decrease energy intake by accelerating the process of weight loss, making the patient more and more dependent on their caregivers [4]. Changes in swallowing, such as dysphagia, also affect individuals with AD, impairing food intake, along with anorexia caused by atrophy of the mesial temporal cortex (MTC), the area of the brain responsible for eating behavior. The difficulty in self-feeding is a determining factor for the diagnosis of dementia according to the National Institute of Neurological and Communicative Disorders and Stroke and the Alzheimer's Disease and Related Disorders Association (NINCDS-ADRDA) [5].

Although weight loss is frequently observed in elderlies with AD, weight gain due to hyperphagia has also been documented in these individuals [4,6]. Thus, during the progression of dementia, it is possible to observe a functional loss of the body weight regulation process [4], since the deferred elderly can present weight gain, periods of acute weight loss and, thus, great body mass instability.

Epidemiological and observational studies suggest that nutritional status, lifestyle factors, and some associated pathology (e.g., hypertension, cardiovascular disease, diabetes mellitus, and metabolic syndrome) are directly related to cognitive impairment and dementia [7,8].

Studies have reported that patients with AD present nutritional deficiencies of many vitamins and minerals [7-9]. Micronutrient deficiencies may result not only in loss of lean mass, decline in immune functions and increased risk of fractures but also in oxidative damage in the brain and deficiencies in neurotransmitters, impairing cognitive function [10].

Therefore, the knowledge of the nutritional and cognitive reality of patients with AD is important to establish a means of possible improvement of the general health of patients and even avoid the progression of AD.

In this context, our study aimed to follow and monitor the nutritional, biochemical and cognitive status of a cohort of patients with Alzheimer's disease, users of the Specialized Medicines Distribution Program of the public health network in the city of Guarapuava-Paraná, Brazil, from 2011 to 2014.

METHOD

Study type

The methodological approach used was a descriptive quantitative research, with a longitudinal and prospective design. The elderly were examined on two occasions, with three years interval: evaluation I (August to October 2011) and evaluation II (January 2014).

Study population

The AD elderly cohort was performed in Guarapuava city, on the Middle East region of Paraná state, Brazil. The identified participants were citizens of the community registered on the public health system (SUS), provided by the Health Ministry, which received specific AD medicines at no charge. These patients confirmed the AD diagnosis according to the National Institute of Neurological and Communicative Disorders and Stroke and the Alzheimer's disease and Related Disorders Association (NINCDS-ADRDA) [5].

From 66 patients registered in SUS, 30 (45%) received anthropometric measurements and hematological examinations. The remaining 36 patients were excluded for the following reasons: 07 had died, 11 moved from Guarapuava, 02 were not found, and the caregivers of the remaining 16 did not agree to participate in the study because of their weakness. Thus, the 2011 cohort was completed with data from 30 patients.

In January 2014, after a 27-month interval, a new cohort data collection was performed. From the 30 elderly individuals in stage I (2011), 09 died, and there were 05 follow-up losses (3 change of municipality and 2 refusals in participating in the study), so in the evaluation 2 (2014) the sample was composed of 16 patients. Only the participants with the initial and segmental evaluations participated in the analysis, totaling 16 patients for this study in 2014.

Data collection

Considering the studied population, it was idealized a set of applied instruments on the following order: Interview (personal data, socioeconomic condition, clinical history, used medication); anthropometrical evaluations; dietary evaluation using Mini nutritional evaluation (MNA) [11], and 24 hours reminder (R24H). Besides, a hematological evaluation (hemogram) was performed [12]. For the disease staging, a Clinical Dementia Rating (CDR) was used [13,14].

Data collection proceed

The interview for data collection was conducted in the patients' residences using a semi-structured questionnaire. The elderly's medications were analyzed, separated and counted, according to the pre-established pathologies: systemic hypertension, diabetes mellitus, hypercholesterolemia, and AD. The weight was determined using a portable digital scale (Plenna®, Brazil) with 150 kg capacity and 100 g precision. Anthropometrical measurements of weight, height, arm, wrist, waist, hip, circumferences, triceps, skin folds, and demi-span were also performed using standard equipment (CMS Pesando Equipment Ltd., London, UK). When the weight and height measurements were not possible, the estimative was done through theoretical formulas, using arm, calf circumferences, knee height, and subscapular skinfold thickness, according to Chumlea et al. [15]. All the anthropometrical measurements were performed by a direct method.

Based on the parameters of base and height, the body mass index (BMI) of each patient was calculated, which corresponds to the ratio of body weight (kg) to height (m) squared. The cut-off points recommended by the Pan American Health Organization for body mass index (PAHO, 2002) were used as reference, and the PAHO classification recommends the following cut-off points (kg / m2) [16]: appropriate BMI (> 23 and <28), BMI indicative of low weight (≤ 23), BMI of overweight (≥ 28 and <30) and BMI indicative of obesity (≥ 30).

The patients nutritional status were evaluated through MNA, composed of anthropometrical measurements of CB, CP, BMI and weight loss percent, general evaluation associated to life quality, subjective evaluation and dietary survey, which was developed with the intention of elderly malnutrition detection [17].

The patient's food consumption was evaluated through the 24 hours reminder, which consists on questions to the respondent (or responsible) to describe the ingestion of food and beverages consumed on the past day [17]. The caregiver provided information about the time, food, type of preparations and quantities of each food consumed during the 24 hours before the interview. All the food and beverages reported were submitted to a dietary analysis composed of energy values (kcal), macronutrients (carbohydrates, lipids, and proteins) and micronutrients. The data were analyzed with computer program Avanutri® 4.0 version [18].

Blood analysis

For the blood composition verification, a blood sample was collected. The blood analysis for the hematological parameters evaluation was carried on the hematology cell counter Hema-Screen 18. The following rates of blood cell were evaluated: mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), hemoglobin, total leukocytes, and platelets, using reference values advocated by Matos et al. [12]. All the exams were carried on in the Midwest State University (UNICENTRO), in Guarapuava.

Cognitive evaluation

For the evaluation of dementia in Alzheimer's disease, as well as classification of patients in stages of the disease, the clinical dementia rating scale (CDR) was used, as proposed by Montaño et al. [14].

This evaluation classifies patients concerning memory, orientation, judgment and problem solving, community affairs, home and hobbies, and personal care, with score: healthy (CDR 0), questionable dementia (CDR 0.5), mild dementia (CDR 1), moderate dementia (CDR 2) or severe dementia (CDR 3) [13,14].

Ethical aspects

This study was submitted to the Research Ethics Committee (CEP) of the Midwest State University (UNICENTRO) and approved by the decision No. 611.316/2011.

Statistical analysis

The statistical analysis was performed using package SPSS 20.0 version. The non-parametrical analysis was chosen due to the high number of variables that have not acceded presumption of normal distribution evaluated by the Shapiro-Wilk test. It

consisted of the evaluation of the subjects during 3 years, using the Wilcoxon test. Additionally, possible correlations and associations among the variation (Δ %) on the segment were evaluated.

RESULTS

General characterization of the elderly in 2011 and 2014

In the initial sample, 30 elderly patients with AD were evaluated in 2011, 33% (n = 10) were evaluated in early-stage dementia (CDR-1), 26% (n = 8) 2) and 40% (n = 12) in the advanced stage of dementia (CDRconti3). Among the 30 elderly evaluated, in 2011, 60% (n = 18) were women, and 40% (n = 12) were men. The age of the sample ranged from 54 to 91 years in 2011, with the mean age of all the elderly being 77 (± 9.3 years). After the three years, 8 patients died, and another 6 patients chose not to be part of the study. The mean number of years of AD diagnosis was 3.5 (± 2.51). In the 2014 sample, mean years of diagnosis of AD were 5.6 (± 2.91).

Among the 16 elderly patients with AD, who were followed up in 2011, 25% (n = 4) were diagnosed with dementia at the early stage of the disease (CDR-1), 31% (n = 5) 2) and 44% (n = 7) in the advanced stage of dementia (CDR-3).

In 2014 the sample was reassessed and from the 16 elderly with AD, 25% (n = 4) were evaluated with early-stage dementia (CDR-1), 25% (n = 4) and 50% (n = 8) in the advanced stage (CDR-3). The sample of 2014 had 8 males and 8 females, ranging in age from 57 to 94 years, and the mean age of all the elderly was 79 (± 10.5) year

Comorbidities of the elderly in 2011 and 2014

Among comorbidities present in AD, systemic arterial hypertension (SH) was the most prevalent among the elderly 66%, regardless of cognitive function, followed by the diagnosis of Diabetes mellitus (DM) 33%, hypercholesterolemia 33%.

In 2014, the most prevalent comorbidities among the elderly continued to be hypertension, with 56% of the elderly affected, followed by the diagnosis of Diabetes mellitus 43%, hypercholesterolemia 18.7%.

Anthropometry of the elderly in 2011 and 2014

Regarding the average weight of the elderly in 2011, 62.44 kg (± 14.36), with a mean BMI of 24.64 (± 4.97) for the 2011 sample. Following the classification, for the elderly of PAHO, the (n = 1) were underweight, (n = 0) of the elderly were eutrophic, 31.25% (n = 5) were overweight, and 62.50 % (n = 10) were obese.

In 2014, the mean weight of the elderly was 65.9 (± 15.6) kg, with a mean BMI of 26.75 (± 4.5). The BMI of the 2014 sample, according to the classification, for PAHO the elderly showed that 6.25% (n = 1) were underweight, (n = 0) elderly were eutrophic, 18.75% (n = 3) were overweight, and 75% (n = 12) were obese.

Comparing the two samples in relation to CP and CB data, it indicates a trend in both circumferences in the 2014 cohort. BMI and weight also tended to increase in the 2014 sample.

Profile of the sample according to BMI, calf circumference, arm circumference and total weight in 2011 and 2014. Nonparametric analysis was used because of the high number of variables that did not meet the standard distribution assumption assessed by the Shapiro- Wilk. The analysis consisted of the evaluation of the variation of subjects over 3 years. For this purpose, the Wilcoxon test was used. Comparing the two samples in relation to CP and CB data indicates a trend in both circumferences in the 2014 cohort. BMI and weight also tended to increase in the 2014 sample.

Diet of the elderly in 2011 and 2014

Regarding the consumption of carbohydrates, there was an increase in the evaluation of 2014, as well as in the consumption of lipids. In relation to proteins, its consumption decreased in 2014.

Comparison of the consumption of carbohydrates, proteins, and lipids in the sample in 2011 and 2014. Nonparametric analysis was used because of the high number of variables that did not meet the standard distribution assumption evaluated by the Shapiro-Wilk test. The analysis consisted of the evaluation of the variation of subjects over 3 years. Wilcoxon's test was used for this purpose. Concerning the consumption of carbohydrates, there was an increase in the evaluation of 2014, as well as in the consumption of lipids. In relation to proteins, the consumption of proteins decreased in 2014 (figure 1).

In figure 2 it can be seen that in the analysis of micronutrients, only the B vitamins (B1, B2, B3, B5, B6) showed a significant reduction between 2011 and 2014.

The complex B vitamin intake of the sample in 2011 and 2014 was evaluated using the non-paramet-

ric analysis due to the high number of variables that did not meet the standard distribution assumption assessed by the Shapiro-Wilk test. The analysis consisted of the evaluation of the variation of subjects over 3 years. The Wilcoxon test was used in the analysis of micronutrients, only the B vitamins (B1, B2, B3, B5, B6) presented a significant reduction between 2011 and 2014, P <0.05.

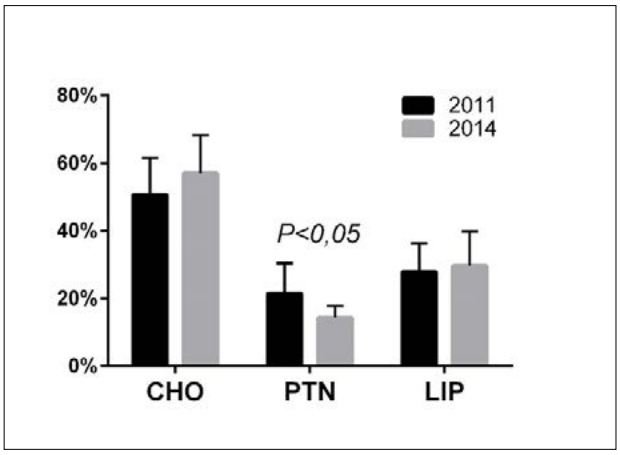
Blood count

According to Table 1, in relation to the blood picture data and hemoglobin in the samples, there was a decrease in erythrocytes, MCHC, and RDW in the 2014 review, but no significant change amounts occurred in the hemoglobin, confirming that none of the samples had anemic patients according to standardized values.

Regarding the medicines used, the average was the same in the two evaluations 3.7 medications per patient. The change occurred in the number of patients in this average, which in 2011 was 80% and in 2014 increased to 87%. The drugs evaluated were those used in the most prevalent pathologies, hypertension, diabetes mellitus, cholesterol, and AD (table 1).

Hematological evaluation of the sample in 2011 and 2014 was expressed as mean ± SD - Student T-test for paired samples; Median and interquartile range (25 - 75%) - Wilcoxon; percent - chi-square. p significant <0.05. Being significant for erythrocytes, RDW and CHCM.

FIGURE 1: COMPARISON OF THE CONSUMPTION OF CARBOHYDRATES, PROTEINS, AND LIPIDS OF THE SAMPLE, IN 2011 AND 2014

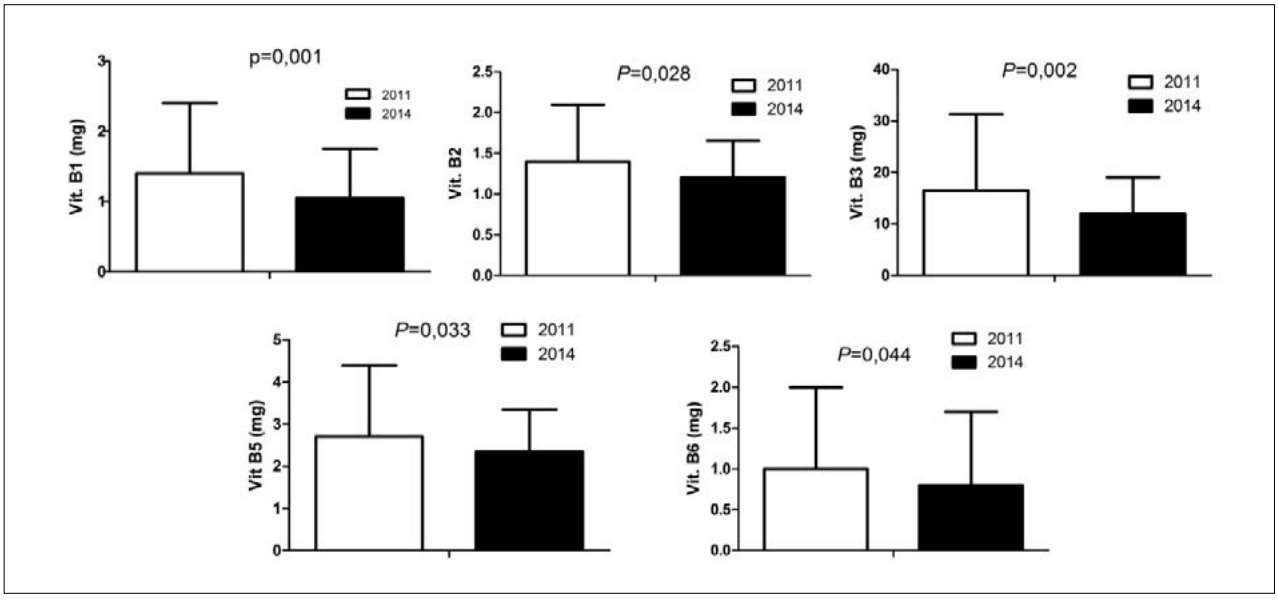


**CHO Carbohydrate, PTN, protein, LIP, lipid

DISCUSSION

Different epidemiological studies have attempted to find associations to explain the progression of disease in Alzheimer patients [6,8,19]. The genetic and biochemical conditions are the main topics discussed [2,3]. The present study aimed to identify the pattern of food consumption, its alteration over 2.7 years, and if these modifications would correspond to cognitive changes the and progression of AD since the alterations in food behavior, especially micronutrient reduction seem to show association with cognitive loss.

FIGURE 2: COMPLEX B VITAMIN CONSUMPTION OF THE SAMPLE IN 2011 AND 2014



The Clinical Dementia Rating Scale (CDR) is a measure to detail the nature and severity of cognitive and functional impairment of Alzheimer's disease (AD) and other dementias. Before this study, it was observed that the majority of patients in 2011 were between the mild and severe stage (CDR 1 and 3). In 2014, it was observed a predominance in the severe stage of AD in (CDR 3). In another study in southern Brazil with patients with diverse types of dementias, differences were also observed between the stage where most, 80% of the patients, were mild to moderate stages (CDRs 1 and 2) [4]. This fact may be associated with the late diagnosis of AD in the analyzed community. In 2011, the mean time of diagnosis of the patients was 3.5 ± 2.51 and in 2014, 5.6 ± 2.91.

Regarding the types of conditions associated with both evaluation years, hypertension was the most prevalent comorbidity among the elderly independently of cognitive function, then the diagnosis of Type 2 diabetes mellitus and hypercholesterolemia. These findings corroborate the studies of the United States Alzheimer's Association [20], where patients with AD older than 65 years had comorbidities associated with systemic hypertension prevalence in (60%) and coronary heart disease (26%).

An epidemiological study demonstrated the relationship between high blood cholesterol levels with increased risk of developing a cognitive disease, vascular alterations and Alzheimer's disease [21], mainly because of the strong relationship between the deterioration of cerebral lipid homeostasis associated with a carrier of cholesterol, the apoE4.

Diabetes mellitus is a disease that has common risk factors for Alzheimer's disease [21]. There are some hypotheses, such as central insulin resistance, along with reduced levels of insulin in the brain, which may be due to DM 2, lead to accumulation of β-amyloid and, consequently, AD.

Concomitant with AD, other comorbidities may affect the elderly, making the practice of polypharmacy common at this stage of life [22].

It is considered light polypharmacy, the use of two to three drugs, moderate from four to five and severe, more than five [23]. This polymerization can influence both the nutrition of the elderly and the pharmacokinetic processes, compromising nutrition and therapy (22). All of these pathologies associated with AD cause the elderly in the sample to be polymedicated. Studies reported that elderly patients who used a high number of drugs were 60% more likely to be at nutritional risk (22). This polymerization can influence both the nutrition of the elderly and the pharmacokinetic processes, compromising nutrition and therapeutics.[23] These interactions are facilitated since most drugs are administered orally [24]. All the patients of the study in 2011 and in 2014 were using at least one cholinergic drug, donepezil, galantamine or rivastigmine acetylcholinesterase inhibitors that are recommended in the treatment of mild to moderate AD.

Concerning body weight, the sample showed an increase. In 2011, the average body weight was 62.44 kg changing to 65.9 kg in 2014. This effect was observed similarly in a study that aimed to identify the relationship between weight loss and temporal

TABLE 1: HEMATOLOGICAL EVALUATION OF THE SAMPLE IN 2011 AND 2014

	2011		2014		
	Medium	P75-P25	Medium	P75-P25	P
Leukocytes	7310.0	2720.00	6100.0	1400.0	0.155
Lymphocytes	2152.5	783.60	1800.0	852.0	0.799
Eosinophils	222.6	352.5	264.5	336.0	0.262
Erythrocytes	4.6	0.50	4.50	0.70	0.022
Hemoglobin	13.7	2.00	13.95	2.30	0.906
Neutrophils	4190.4	1762.10	3472.0	2570.0	0.328
Monocytes	585.0	286.60	601.0	310.0	0.168
RDW*	13.1	0.60	15.45	2.00	0.003
CHCM**	32.9	1.60	31.00	1.20	0.003

* RDW Distribution Range of Red Blood Cells ** CHCM mean corpuscular hemoglobin concentration). Reference values 13.0 to 18.0 g/dL for men and 12.0 to 16.0 g/dL for women, values of (RDW) 11.6 to 14.6% for both sexes.

lobe atrophy in AD patients. This hypothesis, however, has not been confirmed given the weight gain occurred in most study patients [25].

Confirming the hypothesis of the weight gain in the sample, we see that the BMI also increased, in 2011 it was 24.64 kg / m² and in 2014 it was 26.45 kg / m²; the majority of the patients studied presented obese nutritional status. These BMI and total weight data are complemented with the CP and CB measurements of the elderly who also had weight gain in 2014.

There are two possible explanations for these episodes, one involving the patient, the other the caregiver. According to some authors, the finding of weight gain in some people suggests that body weight regulation is dysfunctional in AD [25,26]. This dysfunction may be a consequence of the pathophysiology of AD because the complex regulation of energy intake involves eating disorders, including hyperphagia (overfeeding) [25].

In AD, there is usually a reduction in the levels of 5-hydroxytryptophan (5-HT), which is related to feelings of delayed satiety, a preference for sweet foods, and a reduction in protein intake. Hyperphagia has been reported in scientific studies in 10 to 36% of patients with Alzheimer's disease [27].

Without the intervention of the caregivers, Alzheimer's patients who develop hyperphagia will continue to eat erroneously and may even evolve into clinical disorders resulting from weight gain, which may contribute to a considerable increase in disease morbidity [28].

In another study, with a group of 85 individuals, 35% had hyperphagia at some stage during the disease, and 54% of individuals were in the habit of eating more sweet foods when compared to ingestion before acquiring the disease [28]. Similar results were found in other studies in which researchers studied dietary behavior in a group of 33 individuals with Alzheimer's and found a food preference for sweet foods in 24% of individuals [29]. Another hypothesis for weight gain or the mean eutrophic of the sample is that patients were probably already overweight or obese before the development of AD.

Some studies show that a high BMI in adulthood may be associated with dementia increased risk [29,30]. In the study by Pasinetti and Eberstein [30], obese participants had a 35% higher risk of dementia compared to healthy weight. The study concluded that obesity in adulthood increases the risk of dementia mainly by factors that bind to fat AD as hyperinsulinemia, derived hormones of adipocytes (adipokines and cytokines), and the influence of adiposity on risk vascular and cerebrovascular disease [30].

It is possible that the caregivers are burdened by the disease process, so they invest adequate resources to enable patients with AD to feed appropriately. This explanation can be defended by the results observed in the present study. It was observed an increase in body mass, CP and CB, outcomes, possibly stabilization of macronutrient consumption and a decrease in micronutrient consumption. These combined conditions indicate low nutritional quality in the patients' diet, that is, empty calories. Conversely to this study, other studies have documented a reduction in body weight, and in some cases, this reduction was considered a predictive factor of cognitive changes [6,9,31]. It is known that the decline in total body mass and muscle mass are related to functional loss [6,31]. The reduction in macronutrient intake, especially of protein order, is associated with a reduction of muscle mass and weight loss, which in high degrees characterize sarcopenia [32].

Swallowing disorders such as dysphagia, chewing problems associated with loss of teeth also affect individuals with AD, affecting food intake by limiting the consumption of solid food such as fruits, vegetables, and meats [9].

Compared to 2011, the consumption of protein decreased in the evaluation of 2014. Kalmijn et al. [33] in his study reported that a high intake of total fats increases by 2.4 times the chance of developing dementia. The consumption of lipids increased in the 2014 sample, and the consumption of fat food above 35% is directly related to cognitive decline [31,32] . Other research also found an association between high fat intake and cognitive impairment [33].

Different from what was seen in this study, Kwan et al. [34] in order to identify factors associated with weight changes in patients with Alzheimer's disease, conducted a study with 45 patients and 36 being the control. Among the different tests, the authors found that patients had a higher caloric intake, increased protein consumption compared to the control group.

Individuals with AD tend to prefer carbohydrate-rich foods to protein sources due to a change in neurotransmitters, usually serotonin, which may alter food preference [31].

The diet of the patients should contain higher

levels of protein and lower carbohydrate from the beginning of treatment of disease, particularly to maintain the levels of neurotransmitters such as serotonin, adrenaline, and dopamine, involved in feeding regulation of behavior and some cognitive deficits [35]. Neurotransmitters need some precursors such as tryptophan, choline, and tyrosine, which are present in protein foods.

The study by Forlenza [36] reaffirms that reduced food intake, together with low protein intake, causes a reduction in plasma levels of tryptophan thus altering cortical serotonin levels and contributing to the onset of some disorders such as depression, agitation, and aggressiveness. In the analysis of micronutrients, only B vitamins (B1, B2, B3, B5, B6) showed a significant reduction between the years, decreasing significantly in 2014.

The B complex vitamins in reduction in the study have, as their primary food source, the proteins, which corresponds to the previous data where, in 2014, there was a decrease in protein consumption

The majority of the elderly population present higher rates of nutritional deficiencies than the young population due to physiological changes, such as a decrease in basal metabolism, redistribution of body mass, alterations in digestive functioning. These occur mainly in relation to B vitamins and antioxidant nutrients (vitamin C and E, selenium) [19]. In a study conducted in Greece with 100 elderly patients with AD, 48% were overweight, and the vast majority had inadequate intakes of vitamins A, B6, D, E and K19 [19].

Many thiamine (vitamin B1) dependent processes are decreased in brains of patients with AD. Karuppagounder et al. [37], in their study, demonstrated that thiamine deficiency exacerbated amyloid plaques in transgenic rats, increased the area occupied by plaques in the cortex, hippocampus and thalamus, and induced inflammation in plaque forming areas. The intake of vitamin B3 from the diet is inversely associated with AD, having a protective effect on disease development and cognitive decline [34]. In the present study, there was a decrease in vitamin B3 consumption in 2014, which may increase the risk of cognitive decline, and may be associated with an increase in CDR3 patients when compared to 2011.

Regarding RDW and hemoglobin data, there was an increase in RDW in the 2014 sample. High RDW is common, for example, in iron deficiency, in which the lack of this element prevents the formation of normal hemoglobin, leading to the formation of smaller red cells [12]. There were no changes in hemoglobin, confirming that there were no anemic patients, in practice, the hemoglobin turns out to be the most accurate in the evaluation of anemia, the reference values varied from 13.0 to 18.0 g / dL for hemoglobin in men and from 12.0 to 16.0 g / dL for women [37].

The population of our study, despite their intake of protein, iron sources for the body, reduced in 2014 did not present anemia according to the CBC. In our study, hematocrit was not performed in any of the samples because, according to the Nandigam et al. [38] study with 100 elderly patients in the United States, it is recommended not to evaluate the hematocrit in the elderly, due to the physiological decrease of their plasma volume, which could overestimate the values of this indicator. This study had relevant limitations, which were the small sample size and the significant loss of patients throughout the cohort.

CONCLUSION

The initial sample was 66 patients, but only 30 accepted to be part of the research and at the end of the study, in the year 2014, the analysis counted on only 16 patients. However, even given the reduction of the study population, the results were relevant to the final sample population. In both evaluations that followed, it was observed that the most advanced stage of AD (CDR 3) was prevalent and may indicate a lack of proper and specialized care for early diagnosis.

Regarding nutritional status, there is a hypothesis that patients were already overweight or obese even before AD, which may be associated with an increased risk of dementia. It was observed that BMI and body weight of individuals tended to increase in the 2014 evaluation, although the majority of patients in both evaluations were eutrophic.

The consumption of macronutrients, such as carbohydrates and lipids, increased in the sample of 2014, already in relation to the proteins, it is observed that there was a decrease in the intake. The evaluated micronutrients, B vitamins (B1, B2, B3, B5, B6), showed a reduction in both analyzes, decreasing significantly in 2014.

The present study evidences the need to develop other studies in order to evaluate the serum micronutrient dosage of patients with long-term AD. The importance of frequent nutritional monitoring is also emphasized in order to avoid compromising the nutritional status of patients with Alzheimer's disease.

ACKNOWLEDGMENTS

The authors would like to extend their gratitude to the Association of Studies, Research and Assistance to Alzheimer's Disease Patients (AEPAPA), to the Araucária Foundation and the Higher Education Personnel Improvement Coordination (CAPES), CNPQ.

Conflict of interest

The authors declare that there is no conflict of interest.

RESUMO

OBJETIVO: *Foram estudados os usuários do programa de distribuição de medicamentos especializados da rede pública de saúde de Guarapuava, Paraná, Brasil.*

MÉTODOS: *Uma coorte prospectiva, em que os idosos foram examinados em dois momentos, com um intervalo de três anos, com 30 pacientes na fase I e 16 na fase II. A metodologia foi composta por visitas domiciliares, avaliação antropométrica; avaliação nutricional e hematológica. Para a progressão da DA, utilizou-se a escala Clinical Demential Rating (CDR). Os testes de Shapiro-Wilk, teste de Wilcoxon e correlações com associações (Δ%), p < 0,05 para as análises estatísticas.*

RESULTADOS: *A progressão da doença, segundo o CDR, evoluiu, pois, em 2014, a maioria dos pacientes encontrava-se em CDR 3. Na análise dos micronutrientes, somente as vitaminas do complexo B (B1, B2, B3, B5, B6) apresentaram redução significativa em 2014. O consumo de carboidratos e lipídeos aumentou na avaliação de 2014, e o consumo de proteínas diminuiu. Quanto ao peso médio dos idosos, houve um aumento em 2014, 65,9 (± 15,6) kg, com IMC 26,75 (± 4, 5); em 2011, o peso médio foi 62,44 kg (± 14,36), IMC 24,64 (± 4,97).*

CONCLUSÃO: *Não foram encontrados pacientes anêmicos ou desnutridos na amostra. A hipótese de que os pacientes provavelmente já apresentavam sobrepeso ou obesidade antes do desenvolvimento da DA, e que isso pode estar associado com um aumento de risco de demência, pode ser sugerida.*

PALAVRAS-CHAVE: *Doença de Alzheimer. Obesidade. Macronutrientes. Demência.*

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