Relation between oral health and nutritional condition in the elderly

Humberto Lauro RODRIGUES JUNIOR[1], Miriam F. Zaccaro SCELZA[2], Gilson Teles BOAVENTURA[3], Silvia Maria CUSTÓDIO[3], Emília Addison Machado MOREIRA[4], Diane de Lima OLIVEIRA[5]

1- DDS, Graduate student, Master's degree Program in Dentistry, Fluminense Federal University, Niterói, RJ, Brazil.
2- DDS, MSD, PhD, Associate Professor, Department of Endodontics and Geriatric Dentistry, Fluminense Federal University, Niterói, RJ, Brazil.
3- PhD, Associate Professor, Department of Nutrition and Dietary, Fluminense Federal University, Niterói, RJ, Brazil.
4- PhD, Full Professor, Department of Nutrition and Postgraduate Program in Nutrition, Federal University of Santa Catarina, Florianópolis, SC, Brazil
5- Graduate student of Program in Nutrition, Federal University of Santa Catarina, Florianópolis, SC, Brazil.

Corresponding address: Miriam F. Zaccaro Scelza - Av. 28 de Setembro nº 44 - sala 704 - Vila Isabel - 20551-031 - Rio de Janeiro - Brazil - Phone: 55 21 22340901 - e-mail: scelza@terra.com.br

Received: November 02, 2009 - Modification: February 21, 2010 - Accepted: May 30, 2010

ABSTRACT

Oral health is a prerequisite for a good chewing function, which may have an impact on food choices and nutritional well-being. Objective: This study was designed to evaluate the relationship between oral health status and nutritional status in the elderly. Material and Methods: In this cross-sectional study, 33 elderly people from the Group for the Elderly Interdisciplinary Geriatrics and Gerontology Program, at Fluminense Federal University, Niteroi, RJ, Brazil, completed a questionnaire to collect information on socioeconomic status, eating habits, physical activity and health habits, undertook a clinical oral examination, blood test, and anthropometric measurements, and were allocated into groups according to age. The oral health status was assessed using the index for decayed, missing and filled teeth (DMFT). The nutritional status was assessed using hemoglobin, hematocrit and albumin concentrations in blood, anthropometric values and the body mass index. Results: Tooth loss was the biggest nuisance to the elderly subjects (57.6%), followed by the use of dentures (30.3%) and ill-fitting dentures (33.3%). 66.6% of patients had difficulty in chewing, and 54.5% reported this to be due to prostheses and 13.6% to the absence of teeth. A significant correlation was found between DMFT and the value of suprailiac skinfold thickness (rho=0.380, p=0.029). Conclusion: The results support the temporal association between tooth loss and detrimental changes in anthropometry, which could contribute to increased risk of developing chronic diseases.

Key words: Oral health. Elderly. Aging health. Nutritional status. Geriatric dentistry.

INTRODUCTION

Oral health is a prerequisite for a good chewing function, which may have an impact on food choice and nutritional well-being[16,22]. A variety of oral conditions can lead to an inadequate nutritional status, including tooth loss, pain and discomfort associated with caries, periodontal disease and ill-fitted dentures[22]. The absence of teeth in particular can affect the digestive capacity and nutritional status of the individual. Furthermore, the selection of food can be impaired due to the reduced masticatory capacity of the individual, leading to a restricted intake of fiber- and protein-containing foods[21]. The presence of natural teeth and well-fit dentures has been linked to an increased variety of foods and nutrient intake, which will contribute to the consumption of a diet rich in fiber[11].

Maintaining an adequate nutritional status is important because an inadequate health status can lead to either underweight, which increases the risk of infections and mortality[27], or possible overweight, which increases the risk of chronic diseases such as hypertension and diabetes[12,25].

The relationship between oral health and nutritional health in the elderly is complex and controversial, and current understanding of it is limited[21]. The aim of this study was to evaluate the relationship between oral health status and

nutritional status of non-institutionalized elderly individuals.

MATERIAL AND METHODS

This investigation was conducted from May to August 2009 by the Group for the Elderly Interdisciplinary Geriatrics and Gerontology Program of the Fluminense Federal University, RJ, Brazil. The study plan had been approved by the Ethics Committee of the University, in accordance with the World Medical Association's Declaration of Helsinki[28] (2000). Thirty-three independent elderly subjects of both genders were studied from a total of 100 individuals, aged 60 years old or over, the cut-off point for the definition of "elderly" recommended by the World Health Organization (WHO)[24] (1989). The subjects were previously informed of the aims of the study, and consent forms were explained, read and signed by all the participants. For illiterate or low-reading level subjects, consent was obtained through their legal representatives. Excluded from the study were those individuals that were not in good enough physical and/or mental condition to participate in the collection of data, for example: those confined to wheelchairs, amputees, or those with problems of understanding that would prevent the measurements used in the study from being taken. The sample was divided into two groups, the Young Senior Group (YSG), with age not exceeding 70 years, and the Elderly Senior Group (ESG), aged over 70 years.

The evaluation of oral health status included the identification of decayed, missing, and filled teeth, and the presence of prostheses. The oral examination was conducted in daylight according to biosecurity standards and the findings reported in an odontogram as recommended by the WHO[26] (1997). The index of decayed, missing and filled teeth (DMFT) was used due to its recommendation by the WHO[26] (1997) to measure and compare the experience of dental caries in populations. For comparison and analysis of results the cut-off values used were those obtained from the Oral Health Survey of 2003 for the elderly age group (65 to 74 years) carried out in the Southeast region of Brazil[3]. The mean DMFT for this region was 28.61±6.44 which meant that dental health was satisfactory, this being defined when DMFT ≤22.17, with dental health status considered poor when DMFT >22.17[3]. By transforming the DMFT index in Decayed (D), Missing (M) and Filled (F) the cut-off point was the average found in the Southeast where oral health status had satisfactory values of D>0.60, M>27.05 and F=0.91, and oral health status was poor with D>0.60, M>27.05 and F>0.91[3]. The Kappa test was used to lend a greater reliability to the data collected, and the value of k was =0.9129, with a p-value below 0.01%. The importance of this test is that it shows that the value of K was significantly different from zero and this association is classified as "excellent". Other data on the oral health status were obtained with direct questions about intake of types of food and perception of the quality of dental prostheses[3].

To assess nutritional status anthropometric measurements such as weight, height, arm circumference (AC), triceps skinfold thickness (TST), subscapular skinfold thickness (SST), suprailiac skinfold thickness (SIT), and waist circumference (WC) were measured by a trained professional according to the techniques recommended by the WHO[27] (1995) for adults and the elderly. Weight (kg) was measured with a Filizola® balance (São Paulo, SP, Brazil), with the patient wearing minimal clothing and barefoot. The height, in meters, was measured by a stadiometer attached to the balance. The Body Mass Index (BMI) was determined by the weight (kg) and height squared (m). The diagnosis of nutritional status according to BMI was classified according to criteria established by the WHO[25] (2000), used for adults and elderly individuals, as normal weight (18.5 to 24.9 kg/m^2), overweight (25-29.9 kg/m^2), obesity class I (30-34.9 kg/m^2), obesity class II (35-39.9 kg/m^2) and obesity class III (>40 kg/m^2). The AC was measured with the arm extended horizontally to the average level of the arm. The examiner was positioned to the side and passed the graduated, flexible and inelastic tape, with an accuracy of 0.1 cm, around the arm. The cut-off indicates as high values >29.9 mm for women and >30.7 mm for men[6]. All skinfolds were measured using the Lange skinfold caliper (Lange, Beta Technology Incorporated®, Santa Cruz, CA, USA), with constant pressure of 10 g/mm and an accuracy of 1 mm. The triceps skinfold thickness (TST) was measured in the upper arm 1 cm above the midpoint of a line joining the acromion to the olecranon. The cut-off values indicate as high those values >24.0 mm for women and >11.0 mm for males[6]. The SST was measured on the left side with the arm in front of the body. The fold is measured at the inferior angle of the scapula, separating the muscle tissue. The cut-off point indicates as high values >19.8 mm for females and >17.4 mm for males[23]. The suprailiac skinfold thickness (SIT) was obtained with the right arm slightly away from the body, moving a fold of skin and fat away from the mid-axillary line and the iliac crest, in the oblique direction[10]. The cut-off point indicates as high values >19.8 mm for females and >17.9 mm for males[23]. The bicipital skinfold thickness (BST) was measured by moving a fold of skin and fat over the biceps muscle in a vertical direction (midline)[10]. Values >11.8 mm for women and >6.4 mm for men are considered as high[23]. The

WC was measured at the edge of the iliac crest, in centimeters, using a tape measure belt. The cut-off points established by the WHO[25] (2000) both for adults and for the elderly were employed: men with WC between 94 and 101.9 cm and women with WC between 80.0 and 87.9 cm are classified as being overweight and at increased risk for complications associated with obesity, while men with WC>102.0 cm and women with WC>88.0 cm are classified as obese and presenting a much greater risk for metabolic complications associated with obesity. The percentage of body fat (%BF) was determined using the sum of skinfolds: TST, BST, SST, SIT[13], with a cut-off percentage for women of greater than 33% and for men a percentage above 22%[9].

The nutritional status was also evaluated through the analysis of albumin, hematocrit and hemoglobin. The level of albumin in blood was verified by a bromocresol green colorimetric method using the kit Bioclin® (Bioclin, Quibasa Química Básica Ltda, Belo Horizonte, MG, Brazil), with reference values from 3.5 to 5.5 g/dL (BIOSPECTRO®, SP 220). The hematocrit was measured by the capillary tube method, with reference values of 37% to 47% for women and 40% to 54% for men (MICROSPIN, Mod Spin 1000). A colorimetric method was employed to measure hemoglobin (BIOSPECTRO®, SP 220), with reference values of 11.5 g/ dL to 15.5 g/ dL for women and 12.5 g/dL to 17.5 g/dL for men (Bioclin®).

The data obtained were presented in descriptive form as mean, standard deviation and percentage. For comparison of continuous variables between the two groups, we used Student's *t* test for independent samples or the Mann-Whitney test. To examine the correlations between continuous variables we used Pearson's correlation test or Spearman's. For the correlations between variables, we used Fischer's exact test.

RESULTS

The elderly patients evaluated had an mean age of 71.7±5.35 years, and were divided into 2 groups: Young Senior Group (YSG), with 13 individuals (39.4%), and the Elderly Senior Group (ESG) with 20 (60.6%); 97% of subjects were female and 3% were male.

The average DMFT was calculated for both groups: YSG=20.60±6.17 and ESG=21.44±7.26. On closer examination of this index it was found that the means for decayed (0.75±1.84, p=0.274) and missing teeth (20.06±9.27, p=0.808) were higher in the ESG. The mean value for filled teeth found in the ESG (0.62±1.54, p=0.464) was lower than that found in the YSG. The average number of teeth in the mouth was higher in the YSG, although there were no statistically significant differences between the groups (Table 1).

The mean body mass index (BMI) of 30.17±5.38 kg/m^2 for the YSG classified them as overweight, while the ESG was of normal weight, with an average BMI of 27.21±4.11 kg/m^2. The AC and BST values were elevated in both groups, with average values of 31.64±4.66 cm and 14.55±7.96 mm, respectively. Of the indicators SST (19.26±6.15 mm) and SIT (19.62±9.85 mm) among individuals classified as overweight in the YSG, a significant difference was noted in the values of SST compared to the ESG (p=0.022). According to the WC of the YSG, calculated to be 97.93±14.08 cm, this group is classified as overweight and at increased risk for complications associated with obesity. Similarly, the percentage of body fat (% BF) was elevated in the YSG, with a mean of 37.70±5.95%. On this indicator the ESG also showed a raised value (34.64±6.15%). The biochemical indicators blood albumin, hematocrit and hemoglobin were within normal limits, with no differences between groups (Table 2).

The DMFT index was not significantly associated with the BMI (χ^2=0.636, p=0.364), blood albumin (χ^2=0.185, p=0.508), hematocrit (χ^2=1.102; p=0.182) and hemoglobin (χ^2=0.016, p=0.714). However, 81.8% of patients were overweight or obese; of these, 36.4% (n=12) had an unsatisfactory DMFT value (Table 3).

In the evaluation of the oral health status,

Table 1- Distribution of the sample in the Young Senior Group (YSG), with age equal to or less than 70 years, and the Elderly Senior Group (ESG), aged more than 70 years, by the DMFT index. (Results are mean±standard deviation. DMFT=decayed, missing and filled teeth. Mann-Whitney test)

	ALL (n=33)	YSG ≤70 years (n=13)	ESG >70 years (n=20)	P
DMFT	20.19±7.97	20.60±6.17	21.44±7.26	0.955
Decayed	0.53±1.50	0.20±0.63	0.75±1.84	0.274
Missing	19.65±8.75	19.00±8.28	20.06±9.27	0.808
Filled	0.92±1.95	1.40±2.50	0.62±1.54	0.464
Nº of teeth	8.00±8.63	8.90±8.15	7.43±9.14	0.957

considering the use of ill-fitting dentures (IFP), it was found that 54.5% of the subjects had an altered BMI (overweight or obesity), therefore without any statistical significance (Table 4).

In relation to prostheses that make it difficult to chew (PDC), 17 patients (51.5%) proved to be

Table 2- Distribution of the sample in the Young Senior Group (YSG), aged less than 70 years, and the Elderly Senior Group (ESG), aged more than 70 years, by anthropometric indicators and clinical evaluation. (Student's Unpaired t test; Significant with * p<0.05). Results are expressed as means ± standard deviations

Variables	ALL (n=33)	YSG ≤70 years (n=13)	ESG >70 years (n=20)	p
Weight (kg)	65.8±12.80	70.7±14.5	62.60±10.8	0.176
Body Mass Index (kg/m^2)	28.8±4.80	30.17±5.38	27.21±4.11	0.142
Arm circumference (cm)	31.64±4.66	33.23±5.43	30.93±3.72	0.200
Triceps skinfold thickness (mm)	20.19±6.26	21.23±6.52	19.70±6.26	0.567
Bicipital skinfold thickness (mm)	14.55±7.96	16.58±8.45	13.88±7.18	0.287
Subscapular skinfold thickness (mm)	16.29±6.88	19.26±6.15	15.06±6.17	0.022*
Suprailiac skinfold thickness (mm)	16.05±8.68	19.62±9.85	15.21±6.82	0.121
Waist circumference (cm)	94.50±11.38	97.93±14.08	93.28±7.91	0.228
% Body Fat	35.87±6.17	37.70±5.95	34.64±6.15	0.125
Albumin	3.80±0.26	3.83±0.29	3.78±0.25	0.943
Hematocrit (%)	40.06±3.15	39.61±3.64	40.36±2.83	0.516
Hemoglobin (g/dL)	12.18±1.12	12.20±0.98	12.17±1.24	0.960

Table 3- Association between Body Mass Index (BMI), albumin, hematocrit, hemoglobin and decayed (D), missing (M) and filled (F) teeth (DMFT). Fischer's exact test

	Variable	BMI (kg/m^2)			Albumin (g/dL)			Hematocrit (%)			Hemoglobin (g/dL)		
		Normal	Altered	c^2	Normal	Altered	c^2	Normal	Altered	c^2	Normal	Altered	c^2
		n (%)	n (%)	p	n (%)	n (%)	p	n (%)	n (%)	p	n (%)	n (%)	p
DMFT	Satisfactory <22.17	5 (15.2)	15 (45.5)	0.636	18 (54.5)	2 (6.1)	0.185	18 (54.5)	2 (6.1)	1.102	14 (42.4)	6 (18.2)	0.016
	Not Satisfactory ≥22.17	1 (3.0)	12 (36.4)	0.364	13 (39.4)	-	0.508	9 (27.3)	4 (12.1)	0.182	8 (24.2)	5 (15.2)	0.714
D	Satisfactory <0.6	2 (8.7)	16 (69.6)	0.707	18 (78.3)	-	-	14 (60.9)	4 (17.4)	-	9 (39.1)	9 (39.1)	0.472
	Not Satisfactory ≥0.6	2 (8.7)	3 -13	0.194	5 (21.7)	-	-	4 (17.4)	1 (4.3)	-	4 (17.4)	1 (4.3)	0.339
M	Satisfactory <27.05	3 (11.5)	12 (46.2)	0.045	15 (57.5)	-	-	12 (46.2)	3 (11.5)	-	8 (30.8)	7 (26.9)	0.015
	Not Satisfactory ≥27.05	1 (3.8)	10 (38.5)	0.614	11 (42.3)	-	-	8 (30.8)	3 (11.5)	-	7 (26.9)	4 (15.4)	0.701
F	Satisfactory <0.91	1 (3.8)	17 (65.4)	2.234	18 (69.2)	-	-	13 (50.0)	5 (19.2)	0.122	10 (38.5)	8 (30.8)	-
	Not Satisfactory ≥0.91	3 (11.5)	5 (19.2)	0.072	8 (30.8)	-	-	7 (26.9)	1 (3.8)	0.628	5 (19.2)	3 (11.5)	-

Table 4- Association between Body Mass Index (BMI), albumin, hematocrit, hemoglobin and ill-fitting dentures (IFD) (no/yes), prosthesis making chewing difficult (PDC) (yes/no) and avoidance of foods (AF) (yes/no). Fischer's exact test

Variable		BMI (kg/m²)			Albumin (g/dL)			Hematocrit (%)			Hemoglobin (g/dL)		
		Normal	Altered	c²	Normal	Altered	c²	Normal	Altered	c²	Normal	Altered	c²
		n (%)	n (%)	p	n (%)	n (%)	p	n (%)	n (%)	p	n (%)	n (%)	p
IFD	No	04 (12.1)	18 (54.5)	-	20 (60.6)	02 (6.1)	0.067	18 (54.5)	04 (12.1)	-	12 (36.4)	10 (30.3)	2.881
	Yes	06 (18.2)	09 (27.3)	-	11 (33.3)	-	0.542	09 (27.3)	02 (6.1)	-	10 (30.3)	01 (3.0)	0.054
PDC	No	02 (6.1)	14 (42.4)	0.136	15 (45.5)	01 (3.0)	-	13 (39.4)	03 (9.1)	-	10 (30.3)	06 (18.2)	0.015
	Yes	04 (12.1)	13 (39.4)	0.656	16 (48.5)	01 (3.0)	-	14 (42.4)	03 (9.1)	-	12 (36.4)	05 (15.2)	0.721
AF	No	02 (6.1)	14 (42.4)	0.136	15 (45.5)	01 (3.0)	-	12 (36.4)	04 (12.5)	0.285	10 (30.3)	06 (18.2)	-
	Yes	04 (12.1)	13 (39.4)	0.656	16 (48.5)	01 (3.0)	-	15 (45.5)	02 (6.1)	0.398	12 (36.4)	05 (15.2)	-

Table 5- Correlation between Body Mass Index (BMI) and decayed, missing and filled teeth (DMFT) with anthropometric and clinical data. (§Pearson and £Spearman correlation. Significant with * p<0.05)

	BMI§		DMFT£	
	r	p	rho	p
Arm circumference (mm)	0.942	<0.001*	0.201	0.261
Triceps skinfold thickness (mm)	0.740	<0.001*	0.303	0.080
Bicipital skinfold thickness (mm)	0.669	<0.001*	-0.025	0.089
Subscapular skinfold thickness (mm)	0.847	<0.001*	0.177	0.323
Suprailiac skinfold thickness (mm)	0.828	<0.001*	0.380	0.029*
Waist circumference (mm)	0.868	<0.001*	0.193	0.282
% body fat	0.843	0.399	0.248	0.163
Albumin (g/dL)	-0.065	0.719	0.246	0.167
Hematocrit (%)	0.047	0.798	-0.244	0.178
Hemoglobin (g/dL)	0.170	0.351	-0.154	0.400

dissatisfied, and 13 (39.4%) had a change in their nutritional status (χ^2=0.136, p=0.656). As for the patients who avoided foods (AF), 17 (51.5%) were among those who had altered oral health status (Table 4). In evaluating the consistency of the food, it was found that at least one third of the subjects prefer putty (n=12, 36.40%), soups (n=9, 27.30%), chopped (n=11, 33.30%), ground (n=11, 33.30%), crushed (n=12, 36.4%) or boiled (n=10, 30.3%) food. Biochemical indicators such as blood albumin, hematocrit and hemoglobin did not show any association with DMFT and its components decayed, missing and filled teeth (Table 3), IFD, PDC and AF (Table 4).

In the analysis of the BMI and the anthropometric and biochemical markers, a significant correlation was found between BMI and the variables AC (r=0.942, p<0.001), TST (r=0.740, p<0.001), BST (r=0.669, p<0.001), SST (r=0.847, p<0.001), SIT (r=0.828, p<0.001) and WC (r=0.868, p<0.001). The DMFT index was correlated significantly only with the variable suprailiac skinfold thickness (SIT) (rho=0.380, p=0.029) (Table 5).

DISCUSSION

In the present study, we found that changes in oral health can influence the diet, reflecting in the nutritional status of the individual[22]. Review of the literature has shown that patients who have marked loss of teeth may be prone to a decrease in the intake of foods with a heavy consistency, which are a major source of vitamins, minerals, fiber and protein[19,21]. However, it is important to

note that there are several factors other than oral health status that influence food choice, such as personal preferences, available food sources and dietary habits, as well as psychosocial and economic factors[19].

In relation to DMFT, the reference was to the southeast of the country, given that the subjects were residents of the state of Rio de Janeiro. In the sample studied it was found that both the YSG and ESG had DMFT values that were inferior to that observed in the survey SB Brazil for Southeast, which was 28.61±6.44[3]. When stratifying the DMFT, the comparison of these averages with the average value observed in the Southeast showed that only YSG presented a lower value for decayed teeth. Regarding missing teeth, both the ESG and YSG had mean values below that of the region. It was found that in the YSG the number of filled teeth was not satisfactory. Although there was no significant difference in relation to filled teeth between the YSG and ESG, it was found that the number of healthy teeth in the mouth decreased with age. Similar findings were reported from a study involving elderly individuals aged between 65 and 74, the youngest of whom (65 to 69 years) had a greater number of teeth. On the other hand, the DMFT in that study was 26.2 and the missing component accounted for 20.7 teeth[17], both values being higher than those found in the present study, where the DMFT of the sample was 20.19 and the missing component accounted for 19.65.

The reduced number of healthy teeth and the presence of filled teeth in the mouth can also contribute to the choice of foods. Considering complaints of difficulty in chewing from the use of dentures, either partial or complete, and the influence on food choice, our findings are similar to those that mentioned that users of dentures have a reduced ability to chew compared with those patients with at least 20 teeth in the dental arch[15,21].

In agreement with the conclusions of Esfandiari, et al.[5] (2009), the psychological condition of the elderly person should be considered when choosing the diet, which justifies the option of implants for use of the overdenture. Chewing ability is associated with not only oral health status but also the physical constitution of the elderly, since it may contribute to the regulation of the nutritional status in the elderly[14].

In the present study, there was no significant difference between the groups in the values found for DMFT, BMI and albumin. In relation to BMI, Sadamori, Hayashi and Hamada[18] (2008) reported no significant difference between users and nonusers of dentures. However, a difference was observed in the amount of albumin present in the blood of the two groups (94 elderly women, mean age 89.6±5.6), being lower for users of prostheses. According to Collins[4] (2001), the monitoring of albumin levels can provide a measure of the long-term condition of the patient's protein levels.

In the analysis of hemoglobin and hematocrit, there was no statistically significant difference between the DMFT and BMI. However, it was observed that 36.4% of subjects did not have an ill-fitting prosthesis and had adequate hemoglobin (χ^2=2.881, p=0.054). In relation to BMI, it was found that the mean indicated overweight in the YSG while in the ESG the value was normal. The difference between the groups on BMI values was similar to that found in a study which reported a lower BMI in older individuals[2]. The reason for the ESG having a mean value for BMI below that found in the YSG is probably the reduction in the number of teeth present and the reporting of dentures that cause discomfort, leading the research subjects to specific choices over foods[19]. Similarly, other authors have reported that edentulousness in the elderly, with an average age of 71 years, while not related to BMI was linked to a lower intake of nutrients, indicating that nutrient intake is associated with oral health status when defined by clinical indicators[1]. On the other hand, another study did find an association between poorer oral health status and obesity in elderly subjects aged between 60 and 90 years[7].

Cutaneous skinfolds, although not the single most accurate form for assessing body fat percentage, are better indicators of the amount of body fat than the body mass index (BMI)[8,27]. When comparing DMFT with anthropometric indices, there was a positive and statistically significant correlation only with the indicator of central adiposity, the suprailiac skinfold thickness[8].

In this study the indicators arm circumference and bicipital skinfold thickness (AC and BST) were altered in the YSG and ESG. Although the BMI value was 27.2 in the ESG, the SST and SIT indicators classified the subjects of YSG and ESG as overweight (19.26±6.15 mm, 19.62±9.85 mm respectively). Significant differences were found in SST values between the YSG and ESG. This difference suggests a trend of nutritional changes that may also be related to tooth loss and the use of removable dentures in the elderly senior. Other indicators such as waist circumference (WC), triceps skinfold thickness (TST), and body fat percentage (%BF) presented values that were not statistically significant compared with DMFT and BMI. Similar to the BMI, waist circumference (WC), with a mean value of 94.5±11.38 cm classified the sample as being overweight and at increased risk for complications associated with obesity, especially in the YSG[27]. However, it should be recalled that values of BMI used to identify overweight in the general adult population may lead to an overestimation in

the number of overweight elderly. Similar problems appear to exist when assessing waist circumference values[20].

Overall, the findings obtained and discussed in this work are relevant to ongoing research linking oral health and nutritional status in order to reach an optimal quality of life for the elderly.

CONCLUSION

According to the number of elderly participants in this pilot study, it may be concluded that the DMFT index was satisfactory in 60.7% of the patients. Tooth loss was the biggest concern of the elderly in accordance with the high percentage of ill-fitting dentures (45.5%) and prostheses that make it difficult to chew (51.5%). There was a significant correlation between DMFT and the thickness of the suprailiac skinfold (rho=0.380, p=0.029).

REFERENCES

1- Andrade FB, França Caldas A Jr, Kitoko PM. Relationship between oral health, nutrient intake and nutritional status in a sample of Brazilian elderly people. Gerodontology. 2009;26:40-5.

2- Barbosa AR, Souza JMP, Lebrão ML, Laurenti R, Marucci MFN. Anthropometry of elderly residents in city of São Paulo, Brazil. Cad Saúde Pública. 2005;21:1929-38.

3- Brasil. Ministério da Saúde. Projeto SB Brasil 2003. Condições de saúde bucal da população brasileira 2002-2003. Resultados principais. Série C, Projetos, Programa e Relatórios. [Internet] Brasilia, DF: Ministério da Saúde. [cited 2008 May 29]. Avalilable from: http://bvsms.saude.gov.br/bvs/publicacoes/projeto_sb2004.pdf.

4- Collins N. The difference between albumin and prealbumin. Adv Skin Wound Care. 2001;14:235-6.

5- Esfandiari S, Lund JP, Penrod JR, Savard A, Thomason JM, Feine JS. Implant overdentures for edentulous elders: study of patient preference. Gerodontology. 2009;26:3-10.

6- Frisancho AR. New norms of upper limb fat and muscle areas for assessment of nutritional status. Am J Clin Nutr.1981;34:2540-5.

7- Hilgert JB, Hugo FN, Sousa MLR, Bozzetti MC. Oral status and its association with obesity in Southern Brazilian older people. Gerodontology. 2009;26:46-52.

8- Kim J, Meade T, Haines A. Skinfold thickness, body mass index, and fatal coronary heart disease: 30 year follow up of the Northwick Park heart study. J Epidemiol Community Health. 2006;60:275-9.

9- Lohman TG. Advances in body composition assessment: current issues in exercise science series. Champaign: Human Kinetics Publishers; 1992.

10- Mahan LK, Escott-Stump S. Krause's food & nutrition therapy. 12th ed. Missouri: Saunders Elsevier; 2008.

11- Marshall T, Warren JJ, Hand JS, Xie XJ, Stumbo PJ. Oral health, nutritient intake and dietary quality in the very old. J Am Dental Assoc. 2002;133:369-79.

12- Moynihan PJ. The relationship between nutrition and systemic and oral well-being in older people. J Am Dent Assoc. 2007;138:493-7.

13- Nelson JK, Moxness KE, Jenson MD, Gastineau CF. Mayo Clinic Diet Manual: a handbook of nutrition practice. 7th ed. Boca Raton: CRC Press; 1994.

14- Okada K, Enoki H, Izawa S, Iguchi A, Kuzuya M. Association between masticatory performance and anthropometric measurements and nutritional status in the elderly. Geriatr Gerontol Int. 2010;10:56-63.

15- Oliveira TRC, Frigerio MLMA. Association between nutrition and the prosthetic condition in edentulous elderly. Gerodontology. 2004;21:205-8.

16- Rauen MS, Moreira EAM, Calvo MCC, Lobo AS. Oral condition and its relationship to nutritional status in the institutionalized elderly population. J Am Diet Assoc. 2006;106:1112-4.

17- Rihs LB, Silva DD, Souza MLR. Dental caries in an elderly population in Brazil. J Appl Oral Sci. 2009;17:8-12.

18- Sadamori S, Hayashi S, Hamada T. The relationships between oral status, physical and mental health, nutritional status and diet type in elderly Japanese women with dementia. Gerodontology. 2008;25:205-9.

19- Sahyoun NR, Lin CL, Krall E. Nutritional status of the older adult is associated with dentition status. J Am Diet Assoc. 2003;103:61-6.

20- Sánchez-García S, García-Peña C, Duque-López MX, Juárez-Cedillo T, Cortés-Núñez AR, Reyes-Beaman S. Anthropometric measures and nutritional status in a healthy elderly population. BMC Public Health. 2007;7:2.

21- Sheiham A, Steele J. Does the condition of the mouth and teeth affect the ability to eat certain foods, nutrient and nutrition status amongst older people? Public Health Nutr. 2001;4:797-803.

22- Touger-Decker R, Mobley CC, American Dietetic Association. Position of the american dietetic association: oral health and nutrition. J Am Diet Assoc. 2007;107:1418-28.

23- Visser M, van den Heuvel E, Deurenberg AP. Prediction equations for the estimation of body composition in the elderly using anthropometric data. Br J Nutr. 1994;71:823-33.

24- World Health Organization. Health of the elderly. WHO Technical Report Series 779. Geneva: WHO; 1989.

25- World Health Organization. Obesity: preventing and managing the global epidemic. Report of a WHO Consultation. WHO Technical Report Series 894. Geneva: WHO; 2000.

26- World Health Organization. Oral health surveys: basic methods. 4th ed. Geneva: WHO; 1997.

27- World Health Organization. Physical status: the use and interpretation of anthtopometry. WHO Technical Report Series 854. Geneva: WHO; 1995.

28- World Medical Association. Declaration of Helsinki: ethical principles for medical research involving human subjects. JAMA. 2000;284:3043-5.