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ORIGINAL ARTICLE

Masticatory Function and Nutritional Status in Brazilian Institutionalized Elders: Influence of Denture Use

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ABSTRACT

Objective: To evaluate the influence of tooth loss and the use of removable dentures on chewing function and nutritional status of institutionalized elders. **Material and Methods:** Cross-sectional study with 155 elders from seven long-stay institutions in João Pessoa, Brazil. The participants were classified according to the presence of reminiscent teeth and use of dentures in four levels: toothless, without denture (1); toothless with a complete denture (2); partial toothless without denture (3) and partial toothless with a partial denture (4). Nutritional status was assessed using the Mini-Nutritional Assessment (MNA) instrument and the Body Mass Index (BMI). Swallowing threshold was used for the assessment of masticatory function, using a portion of roasted peanuts (3.7 g). Comparisons among groups were performed using Kruskal-Wallis test with Bonferroni adjustment, considering $p<0.05$. **Results:** MNA ($p=0.702$) and BMI ($p=0.884$) were not modified in relation to the presence of teeth and denture use. Toothless individuals without dentures had a lower swallowing threshold ($p<0.001$), whilst partial toothless with dentures had better masticatory function ($p>0.05$). **Conclusion:** The presence of reminiscent teeth and the use of dentures do not influence the nutritional status of the elders but interfere with the masticatory function. Prosthetic rehabilitation is desirable for complete toothless individuals.

Keywords: Aged; Mouth, Edentulous; Nursing Homes; Dentures.

Introduction

The increase in life expectancy in both developed and developing countries has led to a greater number of aged people worldwide [1]. In addition to the aging process, many families are not able to look after their elderly members and this has increased institutionalization, the process in which elders move to nursing care homes [2]. Nevertheless, residing in a nursing home may affect the oral health of the aged people [3]. A recent meta-analysis showed that elders living in nursing homes are more likely to have worse oral conditions (number of decayed and missing teeth and periodontal disease) than the community-dwelling ones [4].

The presence of healthy teeth and functional dentures, as they are related to adequate nutrient consumption, may favor a good general health and quality of life of the elders [5,6]. However, it is suggested that the absence of functional occluding tooth pairs worsens the chewing ability, which may lead to modifications in eating habits, food and nutritional intake, causing malnutrition [7,8]. In this context, considering the high prevalence of tooth loss, the reduced number of functional occluding tooth pairs, the low use of dental dentures and the poor condition of removable dentures among institutionalized elders, these individuals would have compromised chewing capacity, which may affect their nutritional status [7,8].

Thus, the relationship between masticatory function and nutritional status of the elders in nursing homes needs to be elucidated. Therefore, the present study aimed to evaluate the influence of tooth loss and use of dentures on chewing ability (swallowing threshold) and nutritional status of elders residing in nursing homes.

Material and Methods

Study Design

This is a cross-sectional study conducted with elders living in seven long-term care facilities in the metropolitan region of João Pessoa, Brazil, from December 2018 to August 2019.

Sample

Only elders without mental impairment were included after agreeing and signing the free and informed consent form. Sample calculation was based on a pilot study conducted with elders from long-term care facilities in the city of João Pessoa, Brazil. From a universe of 193 elders who did not have moderate or severe impairment of mental status, a frequency of prosthesis use was estimated at 50% and the design effect of 1.2. Based on the sample calculation, a sample of 155 elders from long-term care institutions in João Pessoa was obtained.

Instruments were used to assess the oral condition (presence of reminiscent teeth and use of dentures), as well as the nutritional status and masticatory function, through the swallowing threshold. Subjects were examined in long-term care units by previously calibrated examiners (Kappa>0.87). In addition, the variables dental caries experience and the assessment of denture status were used to assess concordance.

The oral health status was evaluated according to the presence of teeth and the use of dentures. We used the World Health Organization (WHO) criteria and the latest Brazilian oral health epidemiological surveys [9]. According to the number of sound reminiscent teeth, the study participants were classified as partial or total toothless. The use of dentures considered that the individual uses the denture at the time of the interview. The need for dentures was indicated when the individual was toothless and did not use dentures or needed to replace the old dentures. The assessment of the state of the prosthesis that the elderly person already had was carried out in two moments: inside and outside the mouth.

The participants were then classified according to the presence of teeth and use of dentures at four levels: total toothless without denture (1); total toothless with a complete denture (2); partial toothless without denture (3); and partial toothless with a partial denture (4). Finally, this criterion was used to compare chewing function and nutritional status of institutionalized elders.

The assessment of nutritional status was performed using the Mini-Nutritional Assessment MNA Short Form® instrument [10]. MNA® is a validated nutritional screening and assessment tool that can identify geriatric patients who are malnourished or at risk of malnutrition (Nestlé Nutrition Institute). MNA® was developed almost 20 years ago and is the best validated nutritional screening tool for elders. The MNA® Short Form consists of six questions, with a final score that can add up to 0 to 14 points. For this study, the final score of points obtained for the MNA was used to assess the nutritional status of the elders.

Nutritional status was also assessed by bio-impedance. Bio-impedance generates body measurements of bone mass, muscle mass, metabolic age, visceral fat, body mass index (BMI) and total water mass. Body measurements were measured using a Tanita BC-601– InnerScan scale (Tanita Corp., Manchester, UK), with 0.1% accuracy. For this study, only BMI measurements were used for analysis.

To assess the swallowing threshold, the volunteer was instructed to chew a portion of roasted peanuts (3.7g) until deemed sufficient to swallow [11]. Then, the researcher counted the number of chewing cycles performed by the volunteer until the moment of swallowing.

Data Analysis

Data were tabulated and statistically analyzed using the IBM Statistical Package for Social Sciences software, v. 20 (IBM SPSS, Chicago, IL, USA). The variables age, BMI, MNA score and swallowing threshold were compared according to the presence of teeth and dentures use. Comparisons between groups were performed by the Kruskal-Wallis test with Bonferroni adjustment, considering $p<0.05$. In addition, comparisons according to sex were performed using Mann-Whitney, considering $p<0.05$.

Ethical Clearance

The Research Ethics Committee of the Federal University of Paraiba approved the study protocol (CAAE: 66122917.6.0000.5188). The elders and guardians were advised about the aims and evaluation procedures. Elders signed an Informed Consent Form by agreeing to participate voluntarily in the research.

Results

We included in the study a total of 155 individuals from 7 long-term care institutions, aged 60 to 99 years old, being 118 females (77.12%) and 37 males (22.88%). Table 1 shows the distribution of the sample according to sex, presence of teeth and denture use. No statistically significant differences (Mann-Whitney test) were identified according to gender for the variables age ($p=0.345$), MNA ($p=0.542$), BMI ($p=0.729$) and swallowing threshold ($p=0.975$). Table 2 presents the median and interquartile range values of the dependent variables (Age, MNA, BMI and swallowing threshold), according to the presence of teeth and use of dentures.

The age of partial toothless group without denture differed statistically from the total toothless group with denture ($p=0.016$) (Table 2). No statistically significant differences were identified among groups with regards to MNA ($p=0.702$) and BMI ($p=0.884$) (Table 2). With regards to the swallowing threshold, statistically significant differences were detected between the total toothless without denture and partial

toothless with denture groups (p<0.001). The total toothless with denture and partial toothless without denture did not differ from each other (p>0.05), but differed from the other groups (p<0.05) (Table 2).

Table 1. Sample distribution according to sex, presence of teeth and use of dentures.

Sex	Total Toothless		Partial Toothless	
	without Denture	with Denture	without Denture	with Denture
	N	N	N	N
Male	7	5	17	8
Female	16	39	37	26

Table 2. Median and interquartile range (Q25-Q75) values of the dependent variables (age, MNA, BMI and swallowing threshold), according to the presence of teeth and use of dentures.

Variables	Total Toothless						Partial Toothless						p-value
	without Denture			with Denture			without Denture			with Denture			
	Median	Q25	Q75	Median	Q25	Q75	Median	Q25	Q75	Median	Q25	Q75	
Age	79.00^{ab}	71.00	88.00	83.00^{a}	75.00	88.00	76.00^{b}	73.00	81.00	82.00^{ab}	73.00	84.00	0.016
MNA	11.00^{a}	9.00	13.00	12.00^{a}	9.00	13.00	11.00^{a}	9.00	13.00	12.00^{a}	10.00	14.00	0.702
BMI	25.90^{a}	23.20	27.30	26.40^{a}	22.75	30.60	27.20^{a}	23.30	29.90	25.30^{a}	23.30	28.50	0.884
Swallowing Threshold	0.00^{a}	0.00	0.00	0.00^{b}	0.00	63.00	0.00^{b}	0.00	56.50	51.00^{c}	0.00	90.00	0.001

*Different superscript letters show statistically significant differences.

Discussion

The present study results indicate that the presence of teeth and the use of dentures interfere with the chewing function of institutionalized elders, but do not influence the nutritional status of these people. Therefore, in the present study, the masticatory function had no association with the nutritional status of institutionalized elders. This aspect is important given the high prevalence of tooth loss and low use of dentures within the Brazilian elderly population, especially those living in long-term care facilities [12].

The literature has extensively addressed the impact of masticatory function and nutritional status on the general health and quality of life of the elderly [6,13,14]. For example, a recent study has shown that patients with tooth loss above 20 teeth have lower consumption of healthy food and lower nutrient intake, which increases the risk of cardiovascular disease [13]. In addition, institutionalized elders who do not have posterior occlusal pairs and use a pasty diet were at higher risk of death after one year of follow-up [14].

Although the present study results did not show a significant difference in the nutritional status of the elders with different teething configurations and denture use, it was found that total edentulous elders without dentures presented a lower swallowing threshold, that is, lower chewing capacity. Therefore, it is possible that these older people make higher consumption of processed foods and pasty consistency, with lower nutritional value [8,15,16].

In general, long-term care facilities for the elders have regular monitoring of diet and health status of residents [17]. However, change in nutritional status is often unavoidable, and it is associated with worsening health status of the elders, such as increased dependence and length of institutionalization [17]. Thus, interventions are needed to reduce the impact of changes in the nutritional status of institutionalized elders. To prevent toothless seniors from becoming malnourished, dietary adjustments are made, so that essential nutrients do not cease to be absorbed. In addition to changing dietary consistency, supplements are often used. These aspects may justify the absence of differences in the nutritional status of partial and total toothless elders, with or without dentures.

Given the findings of this study, it is proposed that regular monitoring of nutritional status be performed with a trained professional, such as nutritionists, adjusting the diet according to the chewing capacity of each person. In addition, it is necessary to implement oral rehabilitation programs in institutions, with the making of new dentures, replacement of old ones and maintenance of the remaining teeth in the oral cavity, aiming at the reestablishment of the masticatory function of institutionalized elders.

The limitations of this study are related to the cross-sectional design of the research, which has a low ability to demonstrate cause-effect relationships. It is possible that elderly people who have long been toothless and prosthetic have developed the ability to ingest food, adapting their chewing, even if inefficiently. Multivariate statistical models that consider the influence of time of institutionalization, time of being toothless and number of occlusal pairs may help in elucidating the masticatory aspects related to the nutritional status of the elders. The analysis of other aspects of chewing function, such as chewing efficiency, is necessary to discuss the food processing capacity of the elderly.

Conclusion

The use of dentures did not influence the nutritional status, but interfered with the masticatory function of institutionalized elders. Although it has not influenced the nutrition of the elders, it is still necessary nutritional monitoring measures, as well as dietary adaptations according to the elderly's needs. It is also necessary to follow the dentist with regular maintenance consultations and oral rehabilitation programs and control consultations.

Authors' Contributions

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All authors declare that they contributed to critical review of intellectual content and approval of the final version to be published.

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Conflict of Interest

The authors declare no conflicts of interest.

Data Availability

The data used to support the findings of this study can be made available upon request to the corresponding author.

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