

Masticatory function and nutritional status in institutionalized elderly: influence of denture use

Rayssa Lucena Wanderley

Universidade Federal da Paraiba

Francisco Naldo Gomes Filho

Universidade Federal da Paraiba

Maryana Fernanda Rocha Bonifácio

Universidade Federal da Paraiba

Aldelany Ramalho Freire

Universidade Federal da Paraiba

Luiz Fabrício Santos de Oliveira

Universidade Federal da Paraiba

Mariana Marinho Davino de Medeiros

Universidade Estadual de Campinas Faculdade de Odontologia de Piracicaba

Renata Cunha Matheus Rodrigues Garcia

Universidade Estadual de Campinas Faculdade de Odontologia de Piracicaba

Yuri Wanderley Cavalcanti (✉ yuri@ccs.ufpb.br)

Universidade Federal da Paraiba <https://orcid.org/0000-0002-3570-9904>

Research article

Keywords: Elderly, Mastication, Nutritional status, Nursing homes

Posted Date: January 29th, 2020

DOI: <https://doi.org/10.21203/rs.2.22125/v1>

License:   This work is licensed under a Creative Commons Attribution 4.0 International License. [Read Full License](#)

Abstract

Background: Institutionalized elderly has been reported to poorer oral health status and this could compromise the general health of those individuals.

Objective: To evaluate the influence of tooth loss and the use of removable dentures on chewing function and nutritional status of institutionalized elderly.

Methodology: Cross-sectional study with 155 elderly from seven long-stay institutions in João Pessoa - PB, from December 2018 to August 2019. The elderly were classified according to the presence of remnescent teeth and use of dentures in four levels: toothless, without denture (1); toothless with complete denture (2); partial toothless without denture (3) and partial toothless with 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 assessment of masticatory function, using a portion of roasted peanuts (3,7g). 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 lower swallowing threshold ($p < 0.001$), whilst partial toothless with dentures had better masticatory function ($p > 0.05$).

Conclusion: The presence of reminescent teeth and the use of dentures do not influence the nutritional status of the elderly, but interfere with the masticatory function. Prosthetic rehabilitation is desirable for complete toothless individuals.

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 being able to look after the elderly members and this has increased institutionalization; the process in which elderly 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 elderly 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 health teeth and functional dentures, as they are related to adequate nutrient consumption, may favor a good general health and quality of life of the elderly [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 elderly, 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 elderly 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 elderly residing in nursing homes.

Methods

This is a cross-sectional study conducted with elderly people living in seven long-term care facilities in the metropolitan region of João Pessoa - PB, from December 2018 to August 2019. Only elderly without mental impairment were included,

after agreeing and signing the free and informed consent form. Subjects were examined in long-term care units by previously calibrated examiners ($Kappa > 0.87$).

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

Sample calculation was based on a pilot study conducted with elderly from long-term care facilities in the city of João Pessoa-PB. From a universe of 193 elderly people 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 elderly from long-term care institutions in João Pessoa was obtained.

Instruments were used to assess the oral condition (presence of reminescent teeth and use of dentures), as well as the nutritional status and masticatory function, through the swallowing threshold.

The oral health status was evaluated according to the presence of teeth, and use of dentures. We used the criteria of the World Health Organization (WHO) and the latest Brazilian oral health epidemiological surveys [9]. The study participants were classified as partial or total toothless, according to the number of sound reminescent teeth. The use of dentures considered the fact 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. For these analyzes, researchers were trained to obtain an intra-examiner and inter-examiner Kappa index of 0.87 or greater.

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

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 the elderly. 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 elderly.

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, 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]. The researcher counted the number of chewing cycles performed by the volunteer until the moment of swallowing.

Data were tabulated and statistically analyzed using the IBM Statistical Package for Social Sciences software (IBM SPSS, v. 20, Chicago, IL). 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 $p < 0.05$.

Results

We included in the study a total of 155 elderly 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 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).

Discussion

The results of the present study indicate that presence of teeth and the use of dentures interfere with the chewing function of institutionalized elderly, but do not influence the nutritional status of these people. Therefore, it was shown that the masticatory function has no direct relationship with the nutritional status of institutionalized elderly. 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 impact of masticatory function and nutritional status on the general health and quality of life of the elderly has been extensively addressed in the literature [6,13,14]. 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 elderly people 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 results of the present study did not show a significant difference in the nutritional status of the elderly with different teething configurations and denture use, it was found that total edentulous elderly without dentures presented lower swallowing threshold, that is, lower chewing capacity. It is possible that these older people make higher consumption of processed foods and pasty consistency, with lower nutritional value [15,16].

In general, long-term care facilities for the elderly 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 elderly, 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 elderly. 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 elderly, 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 elderly. 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 elderly.

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 elderly. The analysis of other aspects of chewing function, such as chewing efficiency, is necessary to discuss the food processing capacity of the elderly.

Conclusion

Given the above, we can conclude that the use of dentures did not influence the nutritional status, but interfered with the masticatory function of institutionalized elderly.

Although it has not influenced the nutrition of the elderly, 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, as well as oral rehabilitation programs and control consultations for the elderly, returning the masticatory and phonetic capacity and function.

List Of Abbreviations

BMI—Body Mass Index

MNA—Mini Nutritional Assessment

p—Statistical significance

Q25—Quartile 25%

Q75—Quartile 75%

WHO—World Health Organization

Declarations

Ethics approval and consent to participate

All procedures performed were in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The Ethics Research Committee of the Health Sciences Center from Federal University of Paraiba (CAAE: 66122917.6.1001.5188). Written informed consent was obtained from every person that participated in the survey.

Consent for publication

All participants agreed to participate the study and signed an informed consent, which also gave consent for publication.

Availability of data and material

The datasets used for this study is available from the corresponding author on reasonable request.

Competing interests

MMDM received MSc scholarship from FAPESP and she declare no conflicts of interest. All other authors were not sponsored and they declare no conflict of interest. The authors declare that they have no competing interests.

Funding

MMDM received support (MSc scholarship) from the Fundação de Amparo a Pesquisa do Estado de São Paulo (FAPESP). The authors deny any conflicts of interest related to this study.

Authors' contributions

RLW, LFSO, MMDM, RCMRG and YWC conceptualized and designed the study. RLW, LFSO, FNGF, MFRB, ARF and MMDM participated in data collection and contributed to the construction of dataset. RCMRG and YWC analyzed and interpreted data. RLW, LFSO, FNGF, MFRB, ARF and MMDM drafted the manuscript. RCMRG and YWC revised the manuscript for important intellectual content. All authors read and approved the final version of the manuscript.

Acknowledgements

We would like to thank to all long-term care institutions for giving authorization for data collection. We would like to thank CAPES (Coordenação de Aperfeiçoamento de Pessoal de Nivel Superior) for supporting the graduate programs in Brazil.

References

- [1] Reher DS. Baby booms, busts, and population ageing in the developed world. *Popul Stud (Camb)*. 2015;69 Suppl 1:S57–68. doi: 10.1080/00324728.2014.963421.
- [2] Luppá M, Luck T, Weyerer S, König HH, Brähler E, Riedel-Heller SG. Prediction of institutionalization in the elderly. A systematic review. *Age Ageing*. 2010;39:31–8. doi: 10.1093/ageing/afp202.
- [3] Niesten D, Witter D, Bronkhorst E, Creugers N. Oral health-related quality of life and associated factors in a care-dependent and a care-independent older population. *J Dent*. 2016;55:33–9. doi: 10.1016/j.jdent.2016.09.007.
- [4] Silva e Farias IP, Sousa SA, Almeida LFD, Santiago BM, Pereira AC, Cavalcanti YW. Does non-institutionalized elders have a better oral health status compared to institutionalized ones? A systematic review and meta-analysis. *Cien Saude Colet*. 2018.
- [5] 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.
- [6] Bomfim RA, de Souza LB, Corrente JE. Tooth loss and its relationship with protein intake by elderly Brazilians-A structural equation modelling approach. *Gerodontology*. 2018;35:51–8. doi: 10.1111/ger.12317.

- [7] Klotz AL, Ehret J, Zajac M, Schwindling FS, Hassel AJ, Rammelsberg P, Zenthöfer A. The effects of prosthetic status and dementia on the chewing efficiency of seniors in nursing homes. *J Oral Rehabil.* 2019. doi: 10.1111/joor.12912.
- [8] Zhang Q, Witter DJ, Bronkhorst EM, Creugers NHJ. The relationship between masticatory ability, age, and dental and prosthodontic status in an institutionalized elderly dentate population in Qingdao, China. *Clin Oral Investig.* 2019;23:633–40. doi: 10.1007/s00784–018–2477-z.
- [9] Bulgareli JV, Faria ET, Cortellazzi KL, Guerra LM, Meneghim MC, Ambrosano GMB, Frias AC, Pereira AC. Factors influencing the impact of oral health on the daily activities of adolescents, adults and older adults. *Rev Saude Publica.* 2018;52:44. doi: 10.11606/s1518–8787.2018052000042.
- [10] Amorim Sena Pereira ML, de Almeida Moreira P, Cunha de Oliveira C, Carneiro Roriz AK, Teresópolis Reis Amaral M, Lima Mello A, Barbosa Ramos L. Nutritional status of institutionalized elderly Brazilians: a study with the Mini Nutritional Assessment. *Nutr Hosp.* 2014;31:1198–204. doi: 10.3305/nh.2015.31.3.8070.
- [11] Campos CH, Gonçalves TM, Rodrigues Garcia RC. Implant retainers for free-end removable partial dentures affect mastication and nutrient intake. *Clin Oral Implants Res.* 2014;25:957–61. doi: 10.1111/clr.12165.
- [12] Ferreira RC, Magalhães CS, Rocha ES, Schwambach CW, Moreira AN. Oral health among institutionalized elderly in Belo Horizonte, Minas Gerais State, Brazil. *Cad Saude Publica.* 2009;25:2375–85.
- [13] Mendonça DD, Furtado MV, Sarmiento RA, Nicoletto BB, Souza GC, Wagner TP, Christofoli BR, Polanczyk CA, Haas AN. Periodontitis and tooth loss have negative impact on dietary intake: A cross-sectional study with stable coronary artery disease patients. *J Periodontol.* 2019;90(10):1096–1105. doi: 10.1002/JPER.19–0036.
- [14] Dewake N, Hashimoto H, Nonoyama T, Nonoyama K, Shimazaki Y. Posterior occluding pairs of teeth or dentures and 1-year mortality in nursing home residents in Japan. *J Oral Rehabil.* 2019. doi: 10.1111/joor.12883.
- [15] Assumpção Dd, Domene SM, Fisberg RM, Barros MB. Diet quality and associated factors among the elderly: a population-based study in Campinas, São Paulo State, Brazil. *Cad Saude Publica.* 2014;30:1680–94.
- [16] Amagai N, Komagamine Y, Kanazawa M, Iwaki M, Jo A, Suzuki H, Minakuchi S. The effect of prosthetic rehabilitation and simple dietary counseling on food intake and oral health related quality of life among the edentulous individuals: A randomized controlled trial. *J Dent.* 2017;65:89–94. doi: 10.1016/j.jdent.2017.07.011.
- [17] Bauer S, Halfens RJG, Lohrmann C. Changes in nutritional status in nursing home residents and associated factors in nutritional status decline: a secondary data analysis. *J Adv Nurs.* 2017;73:2420–9. doi: 10.1111/jan.13297.

Tables

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

	Total toothless without denture	Total toothless with denture	Partial toothless without denture	Partial toothless with denture
Sex 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 without denture			Total toothless with denture			Partial toothless without denture			Partial toothless with denture			p-value
	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	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.