Perceived general health in relation to oral health status in a rural Kenyan elderly population

Hideki Fukuda (fukuda.h.aa@niph.go.jp)
National Institute of Public Health

Yoshihiko Hayashi
Nagasaki University

Kazuo Toda
Nagasaki University

Satoshi Kaneko
Nagasaki University

Evelyn Wagaiyu
University of Nairobi

Research Article

Keywords: perceived general health, satisfactory mastication, tooth loss, periodontitis,

DOI: https://doi.org/10.21203/rs.3.rs-117066/v1

License: © This work is licensed under a Creative Commons Attribution 4.0 International License. Read Full License
Abstract

Background: This study aimed to determine the present oral health status of the rural Kenyan elderly population and to investigate whether oral health status is associated with the perceived general health.

Methods: A total of 131 individuals aged 65 years and over in Mbita District, Nyanza Province, Kenya, were randomly selected and visited at home. The home visit study, which was conducted from 2014 to 2016, included oral examination by a dentist and administration of a self-reporting questionnaire. The number of teeth present and functional tooth unit (FTU) points were calculated using the dental chart. Perceived general health, subjective masticatory ability, and periodontal symptoms were collected using a self-recorded questionnaire sheet.

Fisher’s exact test and nonparametric test were used to determine the difference in percentage and means. The odds ratio of good general health based on the participants’ masticatory satisfaction was calculated by logistic analysis.

Results: Satisfactory mastication was dependent on the number of teeth present, FTU points, and periodontal symptoms. Furthermore, satisfactory mastication was associated with perceived general health status independent of sex and age. The adjusted odds ratio of good perceived general health was 2.29 (95% confidence interval, 1.05–4.99) for participants who had the subjective masticatory ability.

Conclusion: Among the Kenyan elderly population, satisfactory mastication was dependent on the number of teeth present, FTU points, and periodontal symptoms. Furthermore, satisfactory mastication was associated with perceived general health status independent of sex and age.

Introduction

Good oral health status in the elderly should be one of the priority health issues in the aging society because of its impact on general health. Impaired dentitions due to extensive tooth loss without prosthodontic care have been shown to affect the dietary selection and also lead to difficulty in chewing hard foods[1-7]. These conditions could lead to an increase in the risk of low protein[8, 9], energy intake[10, 11], and frailty[12]. According to the prospective studies for the elderly, keeping more number of teeth and wearing dentures showed lower mortality rate[13-15]. In Kenya, the percentage of 65 years or over is only 2.4% in 2019. It is gradually increasing and it will reach 3.4% in 2030[16]. The elderly rate will be still smaller than other industrial countries, however, it will be imperative for the Kenyan health system to take measures to address dental health issues for the coming elderly society.

To promote a healthy lifestyle in the elderly, their oral health status should be in good condition so that chewing is not a problem. Inadequacy in mastication, specifically in elderly individuals, naturally lead a poorly perceived oral health. Some studies[17, 18] showed that perceived oral health-related with the general health of the elderly significantly. The perceived general health is known as a simple and good indicator to measure the risk of mortality in the elderly[19].

Most of the published field research in oral health in Kenya has mainly focused on children and adults. There is hardly any published information on the association between oral health status and perceived general health status in the Kenyan elderly with a systematic field research design. Hence, this study aimed to determine the present dental health status in a rural Kenyan elderly population with limited dental services and to investigate whether dental health status is associated with the perceived general health among them.
Methods

Design and participants

The Institute of Tropical Medicine at Nagasaki University established the Health and Demographic Surveillance System (HDSS) in 2006 in Mbita Constituency, Homa Bay County in Kenya, which is located approximately 300 km west of Nairobi, Kenya. The HDSS program recruited 11,182 households and 55,929 inhabitants on July 1, 2011. From the list of names of recruited individuals in the HDSS, 150 individuals aged 65 years and over were randomly selected from four sub-locations in Mbita Constituency. The sampling rate of this study was 35% (150/434). The home visit study was conducted from 2014 to 2016 in the following sub-locations: Mbita center and south sub-location in 2014, east sub-location in 2015, and middle-south sub-location in 2016. Before commencing the home visit study, community health workers engaged in the HDSS program, visited the participants’ houses, and explained the purpose of the research, and made an appointment for the home visit. Informed consent was obtained at the time of the home visit by the authors after the purpose of the study was comprehensively explained to the participants.

A total of 131 participants provided informed consent, received a dental examination, and completed a questionnaire (collecting rate is 87.3%). One of the authors, a dentist (H.F.), examined the dental status of the participants by assessing the participants’ teeth using a disposable dental mirror and a portable light. The examination was performed outside the homes with the participants seated on an ordinary chair under direct sunlight. Dental status was assessed using the World Health Organization standards. The number of teeth present was counted, including the number of sound teeth, decayed teeth, and roots of the teeth. The present teeth ranged from 0 to 32. Functional tooth units (FTUs) are points derived from adding the number of pairs of molar and premolar. One pair of molars and one pair of premolars are equivalent to 2 points and 1 point, respectively, based on FTUs. FTUs range from 0 to 12 points per participant. If retained dental roots of the molars and/or premolars were observed, they were not counted as a pair.

Perceived general health was measured by answering “good,” “average,” and “bad” to the question “How is your general health?” Perceived general health was divided into the following two categories: “good/average” and “poor.” Data on subjective masticatory ability and periodontal symptoms “gum bleeding” and “tooth mobility” were also collected using self-recorded questionnaires.

Any participant having severe tooth pain and oral lesions were treated by prescribing medication and referring the participant to the nearest dental facilities by one of the authors, a Kenyan dentist (E.W.). None of the participants experienced severe tooth pain requiring medication or referral. A visual oral examination was performed without periodontal probing. Therefore, measuring the periodontal pocket depth was not possible. Traditional extraction of lower anterior incisor and canine teeth (33 to 43), which is common in the elderly population, was verbally confirmed by the participants.

Data analysis

A difference in percentages was tested using the chi-squared test and Fisher’s exact test. The mean number of teeth present was not a normal distribution. Therefore, the difference in the number of teeth present and FTU points based on the participants’ characteristics and perceived general health was verified using the Mann-Whitney U test and the Kruskal-Wallis test. The odds ratio of good general health based on the participants’ masticatory
satisfaction was calculated by logistic analysis. All statistical analyses were performed using the IBM SPSS version 20.0. The level of significance was set at 5%.

**Ethics approval**

This study was conducted in full accordance with the World Medical Association Declaration of Helsinki. The study was approved by the ethics and research committee of the Kenyatta National Hospital/University of Nairobi (P328) on August 7, 2013.

**Results**

The mean age of the participants was 75.0 years in men and 75.6 years in women. There was no significant difference in age and sex among the participants (Table 1).

|            |            | Age (SD) | P value | 65–69 | 70–74 | 75–79 | 80+ | P value |
|------------|------------|----------|---------|-------|-------|-------|-----|---------|
| Male       | 46         | 75.0     | 0.65    | 28.3  | 21.7  | 23.9  | 26.1| 0.81    |
| Female     | 85         | 75.6     |         | 22.4  | 20.0  | 30.6  | 27.1|         |
| Total      | 131        | 75.4     |         | 24.4  | 20.6  | 28.2  | 26.7|         |

Table 1. Characteristics of the participants

a Standard deviation  
b T-test  
c Chi-square test

A total of 86.3% of participants had the lower anterior incisor and canine teeth (33 to 43) extracted traditionally. The percentage of traditional extraction increased significantly with increasing age (59.4% and 94.3% in elderly participants aged 65–69 years and 80 years and over, respectively). The percentage of participants with insufficient mastication was significantly higher in those who underwent traditional extractions than those who did not undergo traditional extractions (Table 2). The number of present teeth and FTU points significantly decreased with increasing age. The number of teeth present and FTU points were also significantly associated with the participants' satisfaction in mastication. The number of present teeth and FTU points with good subjective masticatory ability were 24.1 teeth and 8.5 points, respectively. On contrary, the number of present teeth and FTU points with poor subjective masticatory ability were 18.7 teeth and 5.8 points, respectively (Table 2). The percentage of periodontal symptoms “tooth mobility” and “gum bleeding” was insignificantly different in terms of sex and age. However, the percentage of periodontal symptoms was significantly different in terms of subjective masticatory satisfaction. Participants with insufficient mastication significantly experienced the periodontal symptoms “tooth mobility” or “gum bleeding” (Table 2).
Table 3 demonstrates the association between subjective masticatory ability and perceived general health. The percentage of participants who had good general health among those who had good subjective masticatory ability was significantly higher than those who had poor general health. The odds ratio of good perceived general health was 2.63 (95% confidence interval [CI], 1.27–5.44) for good subjective masticatory ability. Although the odds ratio regarding crude age and sex decreased to 2.29 (95% CI, 1.05–4.99), it was still significant.

| Age class | No. | Yes. | Total | Can you masticate sufficiently now? |
|-----------|-----|------|-------|-----------------------------------|
| 65–74     | 26  | 26   | 52    | 0.01                              |
| 75–84     | 25  | 23   | 48    | 0.03                              |
| 85+       | 13  | 15   | 28    | 0.24                              |
| Total     | 64  | 54   | 118   |                                    |

Discussion

Oral health examination including the assessment of traditional tooth extraction was performed by visiting individual homes. The prevalence of traditional tooth extraction was 86.3%, and it increased with increasing age. Satisfactory mastication was dependent on traditional extraction, number of teeth present, FTU points, and periodontal symptoms. Furthermore, satisfactory mastication was associated with perceived general health status independent of sex and age.

Home visit survey was conducted at Mbita Constituency in Homa Bay County, Kenya. Almost all participants were from the Luo ethnic group. The Kenyan Luo ethnic group practice traditional tooth extraction in the six lower anterior permanent teeth as a rite of passage into adulthood[20]. Almost 90% of the participants underwent the extraction of their six lower teeth in this study. Our study showed that traditional extraction was inversely associated with the participants’ masticatory satisfaction. Regarding the subjective masticatory ability, traditional extraction may have an adverse effect on the elderly in this area.

Satisfactory mastication was dependent on the number of teeth present, FTU points, and periodontal symptoms. The association between better masticatory satisfaction and more teeth present, specifically more FTU points in molar occlusion, has been suggested by the previous studies[21, 22].
performance, biting force and periodontal diseases have also been reported[23-25]. These results suggest that dental treatments such as appropriate prosthesis on edentate segments and treatment of periodontal diseases; common causes for missing teeth in Kenyan adults[26, 27] are required to achieve masticatory satisfaction. When the present study was conducted, there were no dental clinics within the study area. The “Kenya national oral health survey report 2015” reported that there was 1 dentist per 42,000 population in Kenya and 80% of the dentist were concentrated in large urban areas[28]. Hence, dental services including prostheses and periodontal treatment in rural areas are insufficient. Countermeasures to expand dental healthcare services in rural areas and to prevent tooth loss and periodontal diseases will be considered important for the aging society in Kenya.

In our study, the good perceived health status was associated with satisfactory mastication independent of participants’ sex and age. Perceived health status in the elderly has been reported as a simple and good predictor for mortality[19, 29-31]. Maintaining satisfactory mastication may prevent early death through their good perceived health status. As mentioned earlier, older adults with satisfactory mastication maintained more teeth and better periodontal health. The establishment of the dental healthcare system in rural Kenya is considered to be one of the priority healthcare systems to maintain a healthy life and prevent early death in the Kenyan elderly.

This study has limitations. First, diet survey was not conducted in this study. Therefore, the validity of masticatory satisfaction based on the participants’ daily meals was not measured. Second, perceived oral and general health status was evaluated using a questionnaire only. Hence, crude health condition was not assessed because health checkups including blood test were not conducted. Finally, oral health study comprising 29 elderly individuals could not be conducted in advance. These individuals may have transferred to other places and/or died. However, difference regarding age between the participants and dropouts was not observed. Therefore, sampling bias occurring in our study was considered to be small.

Conclusions

Oral health examination was performed by visiting individual homes in a rural community in Kenya. Satisfactory mastication was dependent on traditional extraction, number of teeth present, FTU points, and periodontal symptoms. Furthermore, satisfactory mastication was associated with perceived general health status independent of sex and age.

Declarations

Ethics approval and consent to participate

The study was approved by the ethics and research committee of the Kenyatta National Hospital/University of Nairobi (P328) on August 7, 2013. The informed consent forms were obtained from all participants in this study. All participants who responded to receive the oral examination and the questionnaire survey agreed with the purpose of this study and the use of the data.

Consent for publication

Not applicable.

Availability of data and materials
All data analyzed during the current study are not publicly available because the ethics and research committee did not permit to be widely disclosed.

**Competing interests**

All authors declare not to have competing interests.

**Funding**

This work was supported by JSPS KAKENHI Grant Number 17H04674.

**Authors’ contributions**

HF, YH, KT, SK, and EW designed the study and wrote the manuscript. HF, YH, KT, and EW performed the oral examination in the field. All authors read and approved the final manuscript.

**Acknowledgements**

We would like to thank the staff of Nagasaki University Kenya Research Station for supporting the field research.

**Authors’ information**

1 National institute of public health. 2-3-6 Minami, Wako city, Saitama prefecture 351-0197 JAPAN. 2 Graduated school of biomedical sciences, Nagasaki university, 1-7-1 Sakamoto, Nagasaki city, Nagasaki prefecture 852-8588 JAPAN. 3 Department of Ecoepidemiology, Institute of Tropical Medicine, Nagasaki University, 1-12-4 Sakamoto, Nagasaki city, Nagasaki prefecture 852-8523 Japan. 4 School of Dental Sciences, University of Nairobi, P.O.Box 30197-00100, Nairobi, Kenya.

**References**

1. Sheiham A, Steele JG, Marcenes W, Finch S, Walls AW. The impact of oral health on stated ability to eat certain foods; findings from the National Diet and Nutrition Survey of Older People in Great Britain. Gerodontology. 1999;16(1):11-20.
2. Lamy M, Mojon P, Kalykakis G, Legrand R, Butz-Jorgensen E. Oral status and nutrition in the institutionalized elderly. J Dent. 1999;27(6):443-8.
3. Akpata E, Otoh E, Enwonwu C, Adeleke O, Joshipura K. Tooth loss, chewing habits, and food choices among older Nigerians in Plateau State: a preliminary study. Community Dent Oral Epidemiol. 2011;39(5):409-15.
4. Gaewkhiew P, Sabbah W, Bernabe E. Does tooth loss affect dietary intake and nutritional status? A systematic review of longitudinal studies. J Dent. 2017;67:1-8.
5. Kossioni AE. The Association of Poor Oral Health Parameters with Malnutrition in Older Adults: A Review Considering the Potential Implications for Cognitive Impairment. Nutrients. 2018;10(11).
6. Iwasaki M, Taylor GW, Manz MC, Yoshihara A, Sato M, Muramatsu K, et al. Oral health status: relationship to nutrient and food intake among 80-year-old Japanese adults. Community Dent Oral Epidemiol. 2014;42(5):441-50.
7. Sheiham A, Steele J. Does the condition of the mouth and teeth affect the ability to eat certain foods, nutrient and dietary intake and nutritional status amongst older people? Public Health Nutr. 2001;4(3):797-803.
8. 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(1):51-8.

9. Nordenram G, Ljunggren G, Cederholm T. Nutritional status and chewing capacity in nursing home residents. Aging (Milano). 2001;13(5):370-7.

10. Ioannidou E, Swede H, Fares G, Himmelfarb J. Tooth loss strongly associates with malnutrition in chronic kidney disease. J Periodontol. 2014;85(7):899-907.

11. Mendonca DD, Furtado MV, Sarmento RA, Nicoletto BB, Souza GC, Wagner TP, et al. 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):1096-105.

12. Hakeem FF, Bemabe E, Sabbah W. Association Between Oral Health and Frailty Among American Older Adults. J Am Med Dir Assoc. 2020.

13. Shimazaki Y, Soh I, Saito T, Yamashita Y, Koga T, Miyazaki H, et al. Influence of dentition status on physical disability, mental impairment, and mortality in institutionalized elderly people. J Dent Res. 2001;80(1):340-5.

14. Fukai K, Takiguchi T, Ando Y, Aoyama H, Miyakawa Y, Ito G, et al. Mortality rates of community-residing adults with and without dentures. Geriatr Gerontol Int. 2008;8(3):152-9.

15. Ansai T, Takata Y, Soh I, Awano S, Yoshida A, Sonoki K, et al. Relationship between tooth loss and mortality in 80-year-old Japanese community-dwelling subjects. BMC Public Health. 2010;10:386.

16. United Nations DoEaSA, Population Division. World Population Aging 2019 2019 [Available from: https://www.un.org/en/development/desa/population/publications/pdf/ageing/WorldPopulationAgeing2019-Highlights.pdf.

17. de Andrade FB, Lebrao ML, Santos JL, da Cruz Teixeira DS, de Oliveira Duarte YA. Relationship between oral health-related quality of life, oral health, socioeconomic, and general health factors in elderly Brazilians. J Am Geriatr Soc. 2012;60(9):1755-60.

18. Naito M, Suzukamo Y, Nakayama T, Hamajima N, Fukuhara S. Linguistic adaptation and validation of the General Oral Health Assessment Index (GOHAI) in an elderly Japanese population. J Public Health Dent. 2006;66(4):273-5.

19. DeSalvo KB, Bloser N, Reynolds K, He J, Muntner P. Mortality prediction with a single general self-rated health question. Journal of General Internal Medicine. 2006;21(3):267-75.

20. Pinchi V, Barbieri P, Pradella F, Focardi M, Bartolini V, Norelli GA. Dental Ritual Mutilations and Forensic Odontologist Practice: a Review of the Literature. Acta Stomatol Croat. 2015;49(1):3-13.

21. Hatch JP, Shinkai RSA, Sakai S, Rugh JD, Paunovich ED. Determinants of masticatory performance in dentate adults. Archives of Oral Biology. 2001;46(7):641-8.

22. IKEBE K, MATSUDA K, KAGAWA R, ENOKI K, YOSHIDA M, MAEDA Y, et al. Association of masticatory performance with age, gender, number of teeth, occlusal force and salivary flow in Japanese older adults: is ageing a risk factor for masticatory dysfunction? Arch Oral Biol. 2011;56(10):991-6.

23. Alkan A, Keskiner I, Arici S, Sato S. The effect of periodontitis on biting abilities. J Periodontol. 2006;77(8):1442-5.

24. Takeuchi N, Yamamoto T. Correlation between periodontal status and biting force in patients with chronic periodontitis during the maintenance phase of therapy. J Clin Periodontol. 2008;35(3):215-20.

25. Kosaka T, Ono T, Yoshimuta Y, Kida M, Kikui M, Nokubi T, et al. The effect of periodontal status and occlusal support on masticatory performance: the Suita study. J Clin Periodontol. 2014;41(5):497-503.
26. Manji F, Baelum V, Fejerskov O. Tooth mortality in an adult rural population in Kenya. J Dent Res. 1988;67(2):496-500.

27. Sanya BO, Ng’ang’a PM, Ng’ang’a RN. Causes and pattern of missing permanent teeth among Kenyans. East Afr Med J. 2004;81(6):322-5.

28. Ministry of Health RoK. Kenya national oral health survey report 2015 2015 [Available from: https://profiles.uonbi.ac.ke/gathece/files/kenya_national_oral_health_survey_report_2015.pdf] 2015.

29. Idler EL, Benyamini Y. Self-rated health and mortality: A review of twenty-seven community studies. Journal of Health and Social Behavior. 1997;38(1):21-37.

30. Heistaro S, Jousilahti P, Lahelma E, Vartiainen E, Puska P. Self rated health and mortality: a long term prospective study in eastern Finland. J Epidemiol Community Health. 2001;55(4):227-32.

31. Bamia C, Orfanos P, Juerges H, Schottker B, Brenner H, Lorbeer R, et al. Self-rated health and all-cause and cause-specific mortality of older adults: Individual data meta-analysis of prospective cohort studies in the CHANCES Consortium. Maturitas. 2017;103:37-44.