

## Relationship of Nutritional Status with Oral Health Status in Visual Impairment

Patcharaphol Samnieng

Department of Preventive Dentistry, Faculty of Dentistry, Naresuan University, Phitsanuloke 10330, Thailand

E-mail: patcharaphols@yahoo.com

---

### Abstract

To analyze the relationship of nutritional status with oral health status among visual impairment. The subjects were 146 elderly people (70 males and 76 females) aged 20-72 years (mean 48.8±6.2 years), Phitsanulok, Thailand. Mini Nutritional Assessment (MNA) questionnaires were administered. Oral examinations investigated the number of present teeth, DMFT and Functional Tooth Units (FTUs). According to the MNA score, 44.5% of subjects were categorized as normal nutrition, 47.3% as questionable, and 8.2% as malnutrition. The mean numbers of present teeth and FTUs were 17.8±6.9 and 6.9±3.2, respectively. Subjects with malnutrition had lower numbers of present teeth (10.7±1.4) and FTUs (4.3±1.7) than those with normal nutrition (20.2±0.7 and 12.3±0.5) ( $p \leq 0.05$ ). Nutritional status of visual impaired Thai was associated with mean numbers of present teeth and FTUs. Keeping many natural teeth or having appropriate numbers of FTUs by replacing missing teeth with dentures would prevention malnutrition.

### Abstrak

**Hubungan antara Status Gizi dan Status Kesehatan Mulut Penderita Kebutaan.** Penelitian ini bertujuan untuk menganalisis hubungan antara status gizi dan status kesehatan mulut penderita kebutaan. Subjek penelitiannya adalah 146 orang lansia (70 orang pria dan 76 orang wanita) berumur 20-72 tahun (rata-rata 48,8±6,2 tahun) di Phitsanulok, Thailand. Kuesioner *Mini Nutritional Assessment* (MNA) digunakan dalam penelitian ini. Pengecekan rongga mulut dilakukan untuk mengetahui jumlah gigi, DMFT dan *Functional Tooth Units* (FTU). Berdasarkan hasil MNA, 44,5% subjek penelitian masuk dalam kategori gizi baik, 47,3% masuk dalam kategori gizi kurang, dan 8,2% masuk dalam kategori gizi buruk. Nilai rata-rata jumlah gigi adalah 17,8±6,9 sedangkan nilai rata-rata FTU adalah 6,9±3,2. Subjek penelitian yang menderita gizi buruk memiliki jumlah gigi yang lebih sedikit (10,7±1,4) dan FTU (4,3±1,7) dibandingkan dengan mereka yang bergizi baik (20,2±0,7 dan 12,3±0,5) ( $p \leq 0,05$ ). Status gizi penderita kebutaan di Thailand dihubungkan dengan nilai rata-rata jumlah gigi dan FTU. Gizi buruk dapat dicegah dengan cara mempertahankan jumlah gigi asli sebanyak mungkin atau dengan mempertahankan jumlah FTU yang mencukupi. Hal ini dilakukan dengan cara mengganti gigi yang hilang dengan gigi palsu.

*Keywords: functional tooth unit, MNA, nutritional status, oral health, visual impairment*

---

### Introduction

The incidence of visual impairment is globally increasing. The main causes were local and systemic disease, medical advances and the increasing age population. Despite there being a large number, there is little information available regarding the dental health care and needs. Visual impairment may have a negative effect upon oral hygiene.<sup>1</sup> Physical access may be the first barrier to accessing dental care for individuals with a visual impairment.<sup>2</sup> The oral health of disabled people may be neglected because of focus on their disabling condition, other major diseases.<sup>3</sup> Socio-economic status,

practical difficulties during treatment sessions, poor patient cooperation, pain, communication problems and inadequate recall system were the problems of oral health care for disabled.<sup>4</sup>

Oral health is linked to happiness and good general health. Good oral health is important for proper mastication, digestion, appearance, speech and health.<sup>5</sup> Poor oral health and oral function have been implicated as risk indicators for poor diet and nutrition. Aged/handicaps people with fewer teeth are known to be less likely to eat nutrient-rich food such as vegetables, fruits, meat, and whole grains.<sup>6-8</sup> An evident

suggesting that edentulous persons lack specific nutrients and these nutritional deficiencies could ultimately result in an increase in the incidence of various health disorders.<sup>9-10</sup>

Masticatory function is an important factor in the quality of life (QOL) in older people because masticatory impairment has a negative impact both on dental health and general health.<sup>11-14</sup> Another important determinant of masticatory performance is the number of functional tooth units (FTUs).<sup>15-16</sup> Chewing difficulties are often associated with a small number of FTUs.<sup>17-18</sup>

Visual impairment can have many effects on food choices, social aspects of eating behavior, variation within the diet and ability to access dietary information.<sup>19</sup> Few studies have assessed the relationship between oral health and nutritional status of visual impaired persons using standard measurements such as the Mini Nutritional Assessment (MNA) questionnaire. The previous studies show that a poor oral health status predicts “underweight” of older people.<sup>14</sup> Thus, the early detection of “risk of malnutrition” or “malnutrition” would be an important step towards the provision of necessary health care for visual impairment.

Many studies report that nutritional status is associated with oral health status and keeping a healthy and functional dentition until old age is important in maintaining appropriate nutritional intake.<sup>20-21</sup> However, there are no studies in Thailand examining the relationship between oral health status, oral function and nutrition. Thus the aim of this paper was to analyze relationships among these variables in a population of visual impaired Thai.

## Methods

The subjects for this cross-sectional study were drawn from visual impaired people aged 20 years or older with a simple sampling from Phitsanulok, Thailand. A total of 146 people (70 males and 76 females; mean age=48.8 years; SD=6.9) agreed to join the study and finger printed the informed consent form. A questionnaire survey administered by interview and oral examination were conducted

The questionnaire asked about sociodemographic and health behavioral information regarding age, gender, marital status, smoking status and alcohol consumption. Medical history and intake of medications were also asked during the interview.

The MNA was originally developed for the assessment of nutritional status of older patients in clinics, nursing homes and hospitals, or those who were otherwise

frail.<sup>22</sup> The MNA comprises 18 items, whose score is calculated using an assigned weighted number of each item, and the total score ranges from 0 to 30. Older persons with scores 23.5 and over are classified as having a “normal” nutritional status, those with scores from 17 to 23 are classified as “questionable”, and those with scores 16 or less are classified as “malnutrition”.

One dentist assessed dental status for all subjects. Information was collected on the number of present teeth and dental caries experience such as decayed and filled teeth according to the World Health Organization (WHO) criteria.<sup>23</sup> The presence and type of dental prostheses for upper and lower arches were also registered in accordance with the WHO criteria.

The FTUs was defined as pairs of upper and lower opposing natural teeth (i.e., sound, restored and functional carious teeth) and artificial teeth on fixed and removable prostheses. Progressed carious teeth with extensive coronal destruction and missing teeth were regarded as non-functional.<sup>24</sup> FTUs which involved two opposing anterior or premolar teeth were defined as one FTU, and two opposing molars were defined as two FTUs. Therefore, a person with a completely occluding dentition had 20 FTUs (third molars excluded).

**Statistical analyses.** The Chi-square test was used to compare categorical or nominal scale data Analysis of covariance (ANCOVA) was used to compare the differences of mean scores by control confounding covariates such as age. Statistical analyses were performed with the SPSS 20 software program and  $p < 0.05$  was used as the level for statistical significance.

**Ethics.** This study protocol was approved by the Naresuan University Ethical Committee on Human Rights, Thailand.

## Results and Discussion

**Sociodemographic and health behavioral characteristics.** The number of subjects aged 20-69 years was 120 (82.19%) and those aged 60 years and older were 26 (17.81%). Among all subjects, 39.8% of those lived with only husband or wife, 56.1% lived with their family members, and 4.1% lived alone. Most subjects were non smokers (97.3%). Systemic diseases were observed in 77.2% of subjects: hypertension 47.3%, diabetes mellitus 26.3%, heart disease 7.5% and other disease 11.7%, and 74.9% of subjects routinely used medicines.

**Nutritional status.** The result from MNA shows that 44.5% of subjects had “normal”, 47.3% had “questionable” and 8.2% had “malnutrition” status. In the 60 years and older age group, 13.6% of subjects were classified in the “malnutrition” status, which

percentage was significantly higher than that of the 20-59 years old age group (5.2%).

**Oral examination.** The numbers of present teeth, decayed teeth and filled teeth by age and gender were showed in Table 1. Subjects in the 60 years and older age group had significantly lower number of present teeth than those in the 20-59 years old age group. The mean number of filled teeth was low and less than 2 tooth among all subjects.

**Functional tooth units.** The number of FTUs was show in Table 1. The overall mean number of FTUs was  $6.9 \pm 4.2$ . Females tended to have higher mean numbers of FTUs than males in both age groups ( $p < 0.05$ ).

Table 2 shows the relationship of nutritional status with oral health status and chewing ability adjusted by age. The mean number of present teeth in the malnutrition group was 10.7, which was lower than 20.2 in the normal group and 18.1 in the questionable group ( $p < 0.05$ ). Subjects who were classified in the malnutrition group had a significantly higher mean number of decayed teeth (5.9) than those in the questionable (4.3) and normal nutrition groups (3.1). Further, subjects with malnutrition had significantly lower mean numbers of FTUs (4.3) than those with normal nutrition (12.3) ( $p < 0.05$ ).

This study was the first study to use MNA for assessment of nutritional status among visual impaired Thai. More than eight percent (8.2%) of the elderly were classified as "malnutrition" and 47.3% as "questionable", which meant half of visual impaired

Thai had some nutrition problems. However, the medical or laboratory measurements needed for accurate malnutrition diagnosis.

The ratio of the risk at malnutrition of visual impairment is higher than their sight peers. Due to the permanent lack of necessary physical activity overweight is common in blind. Blind and visually impaired people have many difficulties in shopping food and prepare it. These difficulties affect they choice what to eat and also affect their BMI and body composition. Dietitians have an important role with disable people, so the blinds; dietitians may need special skills in the diet of blind people.<sup>25</sup>

In this study sample, decayed teeth, filled teeth and number of present teeth were lower than those reported in the national oral health survey in 2012.<sup>26</sup> Other study reported that DMFT scores were higher in blind population when compare to sighted peers.<sup>27</sup> Visual impairment can have a negative effect upon oral hygiene, some individuals having poorer oral hygiene than sight peers.<sup>28-29</sup> Many tooth loss as well as very few filled teeth in current results indicate that all stages of prevention are needed in this population.

FTUs index was used for the first time in visual impaired Thai. FTUs were calculated including both anterior and posterior teeth because visual impaired Thai had many tooth loss and few denture replacements in all parts of dentition. The number of FTUs in current subjects was very low with 6.9 FTUs out of 20 total FTUs compared to those studied in elderly Thai.<sup>24</sup>

**Table 1. Oral Health Status and Functional Tooth Units by Age and Gender**

Age	Gender	N	Number of present teeth	Number of decayed teeth	Number of filled teeth	Number of FTUs
20-59	Male	59	18.8±6.2	5.6±2.3	1.4±1.6	8.1±4.0
	Female	61	20.4±5.5	4.6±2.5	1.6±1.8	9.5±4.8
	Total	120	19.2±5.7	4.8±2.4	1.5±1.8	8.8±4.8
60+	Male	9	13.7±4.4	3.6±3.2	0.2±0.9	4.1±2.6
	Female	15	14.6±5.4	2.8±2.2	0.3±2.2	5.4±2.8
	Total	26	13.9±5.2	3.0±2.5	0.3±1.9	5.0±2.8
All subjects	Male	70	16.9±7.2	4.6±2.7	1.3±1.3	6.1±3.2
	Female	76	18.4±6.8	4.3±2.4	1.5±2.0	7.1±3.2
	Total	146	17.8±6.9	4.4±2.5	1.4±1.9	6.9±3.2

FTUs= functional tooth units \* $p < 0.05$ , \*\* $p < 0.01$

**Table 2. Relationship of Nutritional Status with Oral Health Status**

Nutritional status	N	Number of present teeth	Number of decayed teeth	Number of filled teeth	Number of FTU
Normal	65	20.2±0.7	3.1±0.2	1.5±0.1	12.3±0.5
Questionable	69	18.1±0.4	4.3±0.1	1.2±0.1	7.4±0.3
Malnutrition	12	10.7±1.4	5.9±0.3	1.3±0.2	4.3±1.1

adjusted for age \*  $p < 0.05$

The number of FTUs and bite force are reported as the key determinants of masticatory performance,<sup>30</sup> which indicates that the maintenance of those elements may be of major importance for promoting a healthy oral functional status. It is also demonstrated that the function and position of remaining natural teeth is a more accurate indicator of chewing ability than merely the total number of present teeth.<sup>31</sup> The low numbers of FTUs suggest that keeping natural teeth by preventing dental caries and periodontal disease is necessary for elderly Thai. In addition, prosthetic replacement of missing posterior teeth would be essential dental services in the present study population.

Sahyoun *et al.* in 2003, reported that dental health was closely associated with nutritional status and that dental condition should be considered in nutritional counseling and assessment of older adults and handicaps.<sup>32</sup> This study also revealed a significant relationship of nutritional status with FTUs. It is reported that poor dental function is associated with impaired chewing and lower fiber intake.<sup>30</sup> Sheiham *et al.* (2001) evaluated nutrient intakes according to the number of present teeth and posterior occluding pairs. Fewer pairs of posterior teeth were significantly related to lower intakes of energy, protein, fat, carbohydrate, fiber, calcium, and vitamin C.<sup>33</sup>

Tooth loss impacts on general health and is a risk factor for malnutrition, disability, loss of self-sufficiency and deterioration in quality of life.<sup>34</sup> Poor oral health among the visual impairment Thai would become a major public health concern, because Thailand is an aging country and the visual impairment tend to have less adequate nutrition due to the lower chewing ability. Therefore, in order to improve the quality of life of the visual impairment, it is essential to disseminate the information about the importance of oral health as well as the necessity of dental treatments.

The given adequate verbal instruction individuals with a visual impairment can have the same levels of oral health as their sighted peers. Adequate oral hygiene instruction can have a positive impact on oral hygiene, periodontal status and maintain or improve self esteem.<sup>35-36</sup> Dental treatment can be invasive and perceivably threatening and a visual impairment may make this more so, hence it may be appropriate to commence treatment with short appointments until the patient is accustomed to the dental staff and a rapport is established.<sup>37-38</sup>

There are a few limitations in this study. Cross-sectional research design cannot analyze the cause and effect relationships of variables. Thus, longitudinal and prospective research should be conducted to confirm the current relationship between oral health variables and

nutritional status of the Visual impairment.

## Conclusions

Oral health status was closely related nutritional status in Visual impaired Thai. People with a low mean numbers of present teeth and FTUs was associated with malnutritional. The study implies the need for an increased consciousness among dental and nutritional professionals about the importance of good oral health for the maintenance of proper nutritional status in visual impairment. Public health policies aimed at keeping natural teeth and having appropriate numbers of FTUs by replacing tooth loss with dental prostheses would improve and nutritional status of the visual impairment.

## Acknowledgment

Thank you very much for Mr. Pakinai Seehaumpai, Miss Patcharawan Yoosuk and Miss Supattra Wichachai for subject interviews and personal oral hygiene instruction. We are grateful to all volunteer participants in this study, and all the staff members in the Blind organization centers Phitsanuloke, Thailand.

## References

1. Mahoney EK, Kumar N, Porter SR, Effect of visual impairment upon oral health care: a review. *Britist Dent J.* 2008;204:63-67.
2. Royal National Institute for the Blind. *III Informed. Campaign Report 7.* London: Royal National Institute for the Blind, 1995.
3. Nowak AJ, *Dental care for the handicapped patient past, present, future.* In: Nowal AJ, editor. *Dentistry for the Handicapped Patient.* 1<sup>st</sup> ed. St. Louis, MO: CV Mosby; 1976. p.3-20.
4. Jain M, Bharadwaj SP, Kaira LS, Bharadwaj SP, Chopra D, Prabu D, Kulkarni S. Oral health status and treatment need among institutionalised hearing-impaired and blind children and young adults in Udaipur, India. A comparative Study. *Oral Health Dent Manag.* 2013;12:41-49.
5. Fiske J, Davis DM, Frances C, Gelbier S, The emotional effects of tooth loss in edentulous people. *Britist Dent J.* 1998;184:90-93.
6. Ritchie CS, Joshipura K, Hung HC, Douglass CW. Nutrition as a mediator in the relation between oral and systemic disease: associations between specific measures of adult oral health and nutrition outcomes. *Crit Rev Oral Biol Med.* 2002;13:291-300.
7. N'Gom PI, Woda A. Influence of impaired mastication on nutrition. *J Prosthet Dent.* 2002;87:667-73.
8. Marcenis W, Steele JG, Sheiham A, Walls AW. The relationship between dental status, food selection, nutrient intake, nutritional status, and body mass index in older people. *Cad Saude Publica.* 2003;19:809-816.
9. Abnet CC, Qiao YL, Dawsey SM, Dong ZW, Taylor PR, Mark SD. Tooth loss is associated with increased risk of total death and death from upper gastrointestinal cancer, heart disease, and stroke in a Chinese population-based cohort. *Int J Epidemiol.* 2005;34:467-474.

10. Semba RD, Blaum CS, Bartali B, Xue QL, Ricks MO, Guralnik JM, Fried LP. Denture use, malnutrition, frailty, and mortality among older women living in the community. *J Nutr Health Aging*. 2006;10:161-167.
11. Nowjack-Raymer RE, Sheiham A. Association of edentulism and diet and nutrition in US adults. *J Dent Res*. 2003;82:123-126.
12. Moynihan P, Bradbury J. Compromised dental function and nutrition. *Nutrition*, 2001;17:177-178.
13. Hutton BJ, Feine, Morais J. Is there an association between edentulism and nutritional state? *J Can Dent Assoc*. 2002;68:182-187.
14. Lee JS, Weyant RJ, Corby P, Kritchevsky SB, Harris TB, Rooks R, Rubin SM, Newman AB. Edentulism and nutritional status in a biracial sample of well-functioning, community-dwelling elderly: the health, aging, and body composition study. *Am J Clin Nutr*. 2004;79:295-302.
15. Hatch JP, Shinkai RSA, Sakai S, Rugh JD, Paunovich ED. Determinants of masticatory performance in dentate adults. *Arch Oral Biol*. 2001;46:641-648.
16. Kwok T, Yu CNF, Hui HW, Kwan M, Chan V. Association between functional dental state and dietary intake of Chinese vegetarian old age home residents. *Gerontol*. 2004;21:161-166.
17. Wayler AH, Chauncey HH. Impact of complete dentures and impaired natural dentition on masticatory performance and food choice in healthy aging men. *J Prosthet Dent*. 1983;49:427-433.
18. van Spronsen PH, Weijts WA, Valk J, Prahl-Andersen B, van Ginkel FC. Comparison of jaw-muscle bite-force cross-sections obtained by means of magnetic resonance imaging and high-resolution CT scanning. *J Dent Res*. 1989;68:1765-1770.
19. Loebel RV, Whitehead KA. An investigation into the impact of visual impairment on food choices. *J Hum Nutr Diet*. 2011;24:394-395.
20. Bartali B, Frongillo EA, Bandinelli S, Lauretani F, Semba RD, Fried LP, Ferrucci L. Low nutrient intake is an essential component of frailty in older persons. *J Gerontol A Biol Sci Med Sci*. 2006;61:589-593.
21. Renato JDM, Hugo FN, Hilgert JB, Padilha DMP. Association between oral health status and nutritional status in south Brazilian independent-living older people. *Nutrition*. 2008;24:546-553.
22. Guigoz Y, Vellas B, Garry PJ. Assessing the nutritional status of the elderly: The Mini Nutritional Assessment as part of the geriatric evaluation. *Nutr Rev*. 1996;54:S59-65.
23. World Health Organization. *Oral health surveys: basic methods*. 4<sup>th</sup> ed. Geneva: WHO;1997.
24. Samnieng P, Ueno M, Shinada K, Zaitsu T, Wright FAC, Kawaguchi Y. Oral health status and chewing ability is related to mini-nutritional assessment results in an older adult population in Thailand. *J Nutr Gerontol Geriatr*. 2011;30:291-304.
25. Vági Z, Deé K, Lelovics Z, Lakatos É. Nutritional status of blind and visually impaired patients. *Z Gastroenterol*. 2012;50:A82.
26. Dental Health Division, Department of Health. *Report of the sixth national oral health survey in Thailand in 2011-2012*. Nonthaburi: Ministry of Public Health; 2012. (In Thai).
27. Dios PD. *Oral care in the blind and visually impaired*. In: Porter SR, Scully C. *Oral Health Care for those with HIV Infection and other Special Needs*. pp.219-221. Northwood Science Reviews, 1995.
28. Anaise JZ. Periodontal disease and oral hygiene in a group of blind and sighted Israeli teenagers 14-17 years of age. *Comm Dent Oral Epidemiol*. 1979;7:353-356.
29. Greeley CB, Goldstein PA, Forrester DJ. Oral manifestations in a group of blind students. *J Dent Child*. 1976;26:39-41.
30. Chai J, Chu FC, Shum NC, Hui WW. Influence of dental status on nutritional status of geriatric patients in a convalescent and rehabilitation hospital. *Int J Prosthodont*. 2006;19:244-249.
31. Hildebrandt GH, Dominguez BL, Schork MA, Loesche WJ. Functional units, chewing, swallowing, and food avoidance among the elderly. *J Prosthet Dent*. 1997;77:588-595.
32. Sahyoun NR, Lin CL, Krall E. Nutritional status of the older adult is associated with dentition status. *J Am Diet Assoc*. 2003;103:61-66.
33. Sheiham A, Steele JG, Marcenes W, Lowe C, Finch S, Bates CJ, Prentice A, Walls AWG. The relationship among dental status, nutrient intake, and nutritional status in older people. *J Dent Res*. 2001;80:408-13.
34. Krall E, Hayes C, Garcia R. How dentition status and masticatory function affect nutrient intake. *J Am Dent Assoc*. 1998;129:1261-1269.
35. Schembri A, Fiske J. The implication of visual impairment in an elderly population in recognizing oral disease and maintaining oral health. *Spec Care Dent*. 2001;21:222-226.
36. Ajwani S, Ainamo A. Periodontal conditions among the elderly: five year longitudinal study. *Spec Care Dent*. 2001;21:45-51.
37. Davis RL. The blind dental patient. III *Dent J*. 1965;34:18-21.
38. Lebowitz EJ. An introduction to dentistry for the blind. *Dent Clin North Am*. 1974;18:651-659.