

Number of Teeth and Its Association with Body Mass Index Among Older Adults

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Keywords:

Body Mass Index, Elderly,
Oral Health

ABSTRACT

Tooth loss can have impact to nutrients intake and nutritional well-being among the aged population. Reduction in number of functioning teeth may lead to difficulties in chewing and less intake of specific nutrients. This study aimed to assess the association between number of remaining natural teeth with body mass index (BMI) in community-dwelling older adults. This cross-sectional study involved 115 members of an elderly association in Selangor, Malaysia. Clinical oral examination was carried out to assess the number of remaining natural teeth. Nutritional status was determined through anthropometry assessment to measure the BMI of respondents. A Pearson correlation coefficient was calculated to assess the correlation between total number of remaining teeth and BMI. Oral health conditions showed that more than half (68.7%) of the older adults had less than 20 teeth with mean number of remaining teeth of 11.9 (SD 10.4). About 26.1% of the older adults were edentulous. In relation to nutritional status, 46.1% of respondents had normal BMI, 36.5% and 10.4% were overweight and obese respectively. Only 7.0% were underweight. Total number of remaining natural teeth was positively correlated with BMI (Pearson correlation coefficient: 0.22, 95% confidence interval [CI]: 0.01 – 0.18; $p < 0.05$), indicating that higher number of teeth was correlated with higher BMI. Number of remaining natural teeth of the older adults were associated with their nutritional status, namely BMI. Thus suggesting the importance to maintain an optimum number of teeth into old age for healthier nutritional status.



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1. INTRODUCTION

The number of older people is increasing rapidly worldwide [1]. Due to the demographic transition, increased percentage of older people is surviving into old age and at greater risk of age-related chronic diseases, including cardiovascular disease, diabetes, cancer and stroke, thus dominating the burden of disease in the population [2], [3]. They are also more likely to experience functional limitations associated to chronic diseases and ageing. These conditions put elderly to be socially disadvantaged and more dependent to others, resulting in lower quality of life [4]. One of the contributing factors that lead to morbidity and mortality risks among the elderly is poor nutritional status [5], [6]. With the current changes of trend in dietary behaviours and lifestyles e.g. towards higher fat and more refined foods, it puts elderly at

greater risk of obesity and other chronic diseases. At the same time, lower energy intakes and higher requirements of important micronutrients among this group may increase the risk of nutrients deficiencies and malnourished.

Several factors have contributed to nutritional inadequacy among older individuals, including biological and physiological changes, pathological conditions and social determinants [7]. Oral health condition, as one of the factors, plays an important role in nutritional intake of older people. In view to oral health, it was observed that there was a deteriorating oral health status as age increased. Dental caries, periodontal disease and tooth loss are prevalent in this group. Tooth loss is one of the main factors to changes in nourishment among older individuals. Reduction in number of functioning teeth may lead to food avoidance and difficulties in chewing [8], poor diet quality [9], less intake of specific nutrients [10] and inadequate calorie intake [11]. These unfavourable chewing-related problems may increase the possibility of nutritional problems especially in a vulnerable group like the elderly [12]. Thus changes in number of teeth can have impact on the physical functioning (eating, swallowing and speaking) of their daily life.

Although oral conditions can have impact to nutrients intake and nutritional well-being among the aged population, some controversial findings from previous literatures stressed that it was still unclear whether oral conditions like tooth loss could lead to nutritional disorders [13]. As for developing countries like Malaysia which is still experiencing high prevalence of tooth loss among its older populations, such data on the associations are still limited. Thus, study among local older adults on the possible association between number of teeth and nutritional status need to be further explored.

2. Material and Methods

This was a cross-sectional study conducted among a group of older adults aged 50 years and above from an elderly association in Selangor, Malaysia. Members were Malaysian, aged 50 years and above and could communicate in Malay or English language. Those who were with conditions that could affect the history taking and anthropometric measurement were excluded. All the older adults that met the inclusion criteria and agreed to provide consent were included in the study. Ethical approval to conduct the study was obtained from the Research Ethics Committee, Universiti Kebangsaan Malaysia, Malaysia.

Nutritional status of the respondents, namely the BMI [weight (kg) / height (m²)] was derived from the anthropometry measurements. For measurement of height, a measuring tape was used whereby respondents were requested to stand with their backs lean against the wall, with both heels touching the wall and feet side by side. Measurements were made twice and an average value was recorded. As for the weight, Tanita BC-581 (Tanita Cooperation, Tokyo, Japan) body composition monitor was utilized. The respondents were bare footed and required to remove any heavy items like coins and keys from their clothing. Weight was then measured to the nearest 0.1kg. The BMI was calculated and based on World Health Organization (WHO), individuals with BMI of less than 18.5 kg/m² were considered underweight, more than or equal to 25.0 kg/m² as overweight while more than or equal to 30.0 kg/m² were considered obese. Normal BMI was between 18.5 to 24.9 kg/m² [14].

Oral examination was conducted to assess the oral health conditions of the respondents, namely the number of remaining teeth, dental caries experience and presence of denture. The assessment was based on the WHO criteria for Oral Health Surveys, 2013 [15]. One examiner was involved in the clinical examination and showed good intra-examiner reliability (Kappa value of 0.96). Data were analysed using IBM SPSS software version 24.0. Descriptive statistics analysis was performed to determine frequency and proportions for categorical variables, and mean and standard deviation for continuous variables. Chi-square test of

independence was used to determine associations between categorical variables of oral health and nutritional status. Spearman's correlation was utilized to assess the correlation between number of teeth and body mass index. The significance level was set at $p < 0.05$.

3. Results

3.1 Socio-demographic characteristics

A total of 115 older adults aged 50 years and above from an elderly association participated in the study. Table 1 demonstrates the socio-demographic characteristics of the study population in relation to sex, age group, occupation and presence of systemic disease.

Table 1. Socio-demographic characteristics of the study population

Items	n (%)	Mean (SD)
Sex		
Male	62 (53.9)	
Female	53 (46.1)	
Age Group		64.5 (9.73)
50 – 59	39 (33.9)	
60 – 69	43 (37.4)	
70 – 79	22 (19.1)	
80 & above	11 (9.6)	
Occupation		
Still working	31 (27.0)	
Retired / housewife	84 (73.0)	
Systemic disease		
Yes	73 (63.5)	
No	42 (36.5)	

3.2 Dental condition

Most of the older adults (73.9%; $n=85$) were dentate, while only 26.1% ($n=30$) had total tooth loss (edentulous). In view to number of teeth present, majority of them (42.6%; $n=49$) had less than 20 teeth in their oral cavity. For dentate respondents, the mean number of teeth present was 11.9 teeth (SD 10.4). As for denture-wearing status, about 37.4% ($n=43$) older adults wore dentures. Among those who were edentulous or with total tooth loss, only 60.0% of them had dentures. (Table 2)

Table 2. Oral health conditions and body mass index of the study population

Items	n (%)	Mean (SD)
Dental status		
Dentate	85 (73.9)	
Edentate	30 (26.1)	
Total number of teeth		11.9 (10.4)
0 teeth	30 (26.1)	
1 – 19 teeth	49 (42.6)	
20 and more	36 (31.3)	
Denture presence		
Yes	43 (37.4)	
No	72 (62.6)	
Body mass index (BMI)		24.7 (4.9)
Normal	53 (46.1)	
Underweight	8 (7.0)	

Overweight	42 (36.5)
Obese	12 (10.4)

3.3 Body mass index

Mean BMI score for the respondents was 24.7 (SD 4.9) indicating a normal body mass index. About half (46.1%) of the older adults had normal BMI, 36.5% were overweight and 10.4% obese. Only 7.0% of the respondents were underweight. (Table 2)

3.4 Association between number of teeth and body mass index

Table 3 presents the association between dental conditions with BMI among the older adults. Bivariate analysis using Chi-square test showed that higher percentage of dentate respondents (50.6%) and with more than 20 teeth (58.3%) were overweight and obese. A slightly higher percentage of denture-wearers were also noted to be overweight and obese (48.8%) compared to respondents with normal BMI (44.2%). However, no statistically significant were observed ($p>0.05$).

Table 3. Association between dental conditions and body mass index categories

Oral health items	BMI category, n (%)			p value
	Normal	Overweight & obese	Underweight	
Dental status				0.386
Dentate	36 (42.3)	43 (50.6)	6 (7.1)	
Edentate	17 (56.7)	11 (36.7)	2 (6.6)	
Total number of teeth				0.187
0 teeth	17 (56.7)	11 (36.7)	2 (6.6)	
1 – 19 teeth	22 (44.9)	22 (44.9)	5 (10.2)	
20 and more	14 (38.9)	21 (58.3)	1 (2.8)	
Denture presence				0.949
Yes	19 (44.2)	21 (48.8)	3 (7.0)	
No	34 (47.2)	33 (45.8)	5 (7.0)	

* significant at $p<0.05$

Correlation between number of teeth and BMI is shown in Table 4. Findings highlighted that number of remaining teeth in the oral cavity significantly correlated with BMI ($r=0.219$; $p<0.05$).

Table 4. Association between number of teeth and body mass index

	Number of teeth mean (SD)
Body mass index	24.7 (4.9)
	$r = 0.219, p<0.05^*$

* Pearson's correlation coefficient; significant at $p<0.05$

4. Discussion

The aim of this study was to assess the association between number of remaining natural teeth with BMI in a group of older adults aged 50 years and above in the community. Findings showed a significant association between number of teeth and BMI among the respondents. Thus, the older adults with a reduced number of teeth also had a lower BMI score. This finding was consistent with other studies conducted among the Asian elderly communities like India [16] and South Korea [17] that concluded tooth loss was significantly associated with being underweight. A local study in a rural area of Kelantan, Malaysia demonstrated that elderly with compromised functional dentition tend to be underweight compared to those

with non-compromised functional dentition. The odds of being underweight also increased by 5 and 6 times among older adults in age groups 70-74 years and 75 years and above respectively when compared to the younger age group [18]. In other condition, tooth loss among older individuals can lead to nutritional disorders like overweight and obesity. [19] studied 1704 free-living older adults aged 60 and above in southern part of Brazil to clarify the association between dental status and BMI. The results showed elderly with reduced number of teeth were 1.4 times more likely to be centrally obese than individuals with a higher number of teeth [19]. Similarly, studied other elderly community in Brazil and indicated that extensive tooth loss increased the likelihood of having central obesity [20]. These findings indicated the importance of maintaining a natural and functional dentition into old age, defined as having 20 or more teeth, for healthier nutrients intake and nutritional status.

In contrast, some studies have also reported contradicting results whereby they have found inadequate evidence to support the association between the number of teeth and impaired nutritional status among the elderly population [21], [22]. In another study, examined the risk of malnutrition in both institutionalized and non-institutionalized elderly in Spain, and revealed that only age and institutionalizations were predictors to malnutrition but not number of teeth [23]. However again, as the studies used were cross-sectional design, a causal relationship between the variables could not be established. Moreover, inverse causality like whether impaired nutrition might worsen the oral health conditions could not be excluded. It is also important to note that body mass is not determined by tooth loss alone but several other factors like medical problems, polypharmacy, physical activity and socioeconomic status, which later can affect the food choice of older population [22].

This study also reported that majority of the respondents were overweight and obese, 36.5% and 10.4% respectively. Only 7.0% were underweight. With the current changes of trend in dietary behaviours and lifestyles e.g. towards higher fat and more refined foods, it puts elderly at greater risk of obesity and other chronic diseases. At the same time, lower energy intakes and higher requirements of important micronutrients among this group may increase the risk of nutrients deficiencies and malnourished. In relation to underweight, despite of its lower magnitude among respondents, it still remains a public health concern as underweight is more prominent in adults more than 60 years old. Thus, it suggests that a substantial proportion of the respondents had nutritional problems. Several factors play a role in the complex aetiology of malnutrition in older population. Therefore, appropriate strategies need to be formulated to identify the risk factors for both conditions of obesity and undernutrition among the older population, followed by nutrition intervention program to improve their nutritional conditions.

Although findings demonstrated significant association between variables, some limitations of the study were observed. First, its cross-sectional design could not establish causal relationship between number of teeth and BMI. Longitudinal study with larger sample size may be needed to further explore the relationships. In addition, the assessment of nutritional status based only on anthropometric parameters like BMI, may not be able to measure the qualitative aspects of the elderly people, for example perception, presence of comorbidities and dietary pattern [23]. Nevertheless, studies of association between these variables are still limited in the local setting, thus findings from this study can serve as a baseline data for future research.

5. Conclusion

Total number of remaining natural teeth of the older adults were associated with their nutritional status, namely BMI. Findings from this study suggested the importance of maintaining an optimum number of natural and functional dentition into old age for healthier nutritional status as well as maintaining

satisfactory quality of life.

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