

A Cross-Sectional Study to Evaluate the Association of Body Mass Index with Oral Health Status

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Abstract

Purpose of the study: To evaluate the association between BMI and oral health status, along with the frequency of tooth brushing and frequency of food intake.

Methods: This study was conducted at outpatient clinic, for adults who had visited to the dental clinic. The decayed, missing, and filled teeth (DMFT) index and Periodontal Disease Index (PDI) were used to determine the prevalence of dental caries and periodontitis respectively. Multiple linear regression analysis was used to determine the association between age, BMI, frequency of tooth brushing and food intake with DMFT and PDI.

Results: A total of 100 subjects were enrolled with a mean age of 33 years. Of the 100 subjects, 10% were underweight, 56% were normal, 25% were overweight and 9% were obese upon BMI calculation. There was a positive correlation between age versus PDI and age versus DMFT and this correlation was found to be statistically significant ($p=0.00$). There is a negative correlation of BMI, frequency of food intake and tooth brushing with PDI and positive correlation with DMFT was noticed. The multiple linear regression analysis showed that age and frequency of tooth brushing was influencing PDI and DMFT significantly.

Conclusions: A negative correlation between the PDI and BMI but positive correlation with DMFT and BMI was observed. Longitudinal studies with a larger sample size are required to confirm the association of body mass index and periodontal disease and dental caries.

Keywords: *Body mass index, DMFT, frequency of food intake, PDI, tooth brushing.*

Introduction

Obesity is defined as a condition of abnormal and excessive fat accumulation in adipose tissue to the extent that health may be adversely affected.¹ According to the World Health Organization (WHO), it is the fifth leading cause of mortality worldwide and risk factor for many diseases such as type 2 diabetes, hypertension

and certain types of cancers. However, it is generally acknowledged that most of the patients diagnosed with non-communicable diseases are obese.² Body Mass Index is the most common way of measuring obesity and it represents the weight levels; associated with the lowest overall risk to health and is an indicator of overall adipose tissue. There are other ways as well, to measure the obesity which includes waist circumference, waist to hip ratio and total body fat.³ A low BMI is easily explainable on the basis of being real functional difficulties there that can prevent normal eating in some cases. On the other hand, the association of poor oral health with obesity is likely to be associated with the quality of the diet.⁴ There are studies which have pointed out an association

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between oral conditions and BMI and concluded that increased BMI had slightly worse dental health.^{3,5,6} The present study is aimed to assess the relationship between oral health status represented DMFT and PDI, and BMI among healthy adults. Literature search reveals only few studies comparing the relation of BMI and oral health status has been carried out in the Malaysian population to our knowledge. So, the aim of the present study is to assess the association between BMI and oral health status (dental caries and periodontal status), along with the frequency of tooth brushing and frequency of food intake.

Materials and Methods

The present study was conducted in AIMST Dental Institute, AIMST University, Kedah, Malaysia. A total sample size of 100 subjects with equal number of males and females were chosen with the mean age of 33 years. Patients with any systemic disease(s) with under medication or undergoing any therapy and pregnant patients were excluded from the study. Informed written consent was obtained from all respondents and they were asked to respond to all statements completely and voluntarily. Patient's age, gender, height (*in cm*), weight (*in kg*), frequency of food intake and frequency of tooth brushing were recorded by the examiner.

Oral examination was performed by a single examiner for the assessment of dental status (dental caries, missing teeth and restored teeth) and periodontal status. The periodontal status and dental status were assessed using Periodontal Disease Index (PDI) and DMFT Index respectively.

After recording the required data from the patients, BMI was calculated using formula weight in (kg) divided by square of height in (m).

Based on the BMI values, all patients were categorized as underweight, normal weight, overweight and obese patients as Group A, B, C and D, as <18.5 kg/m², 18.5 to 24.9 kg/m², 25 to 29.9 kg/m² and <30 kg/m² respectively.

All the data were tabulated and analysed using the Statistical Package for Social Science Software, version 22.0 (SPSS, Chicago, IL, USA). Frequency analysis was

done for categorical variables and descriptive statistical measures were calculated for continuous variables. One way analysis of variance (ANOVA) was used to compare the different groups of BMI, frequency of food intake and tooth brushing with PDI and DMFT followed by Duncan's Multiple Post Hoc Test. The parametric Pearson correlation was used to analyse the continuous variables and non parametric Spearman's (rho) correlation was performed for ordinal and continuous variables. Multiple linear regression analysis was performed to determine the degree of prediction of PDI and DMFT with age, BMI, frequency of food intake and tooth brushing.

Results

Of the 100 subjects, 10% were underweight, 56% were normal, 25% were overweight and 9% were obese upon BMI calculation. Frequency of tooth brushing of once, twice or more than twice a day were reported as 23 %, 55% and 21% respectively as well as for frequency of food intake 45% reported thrice daily followed by 26% and 18% for four to five times respectively.

The frequency, mean and standard error for BMI, frequency of food intake and tooth brushing in relation with PDI and DMFT are depicted in **Table 1**. Pearson correlation (r) analysis of the continuous variables such as age versus PDI and age versus DMFT is shown in **Table 2**. It is observed that there is a positive correlation between the age versus PDI and age versus DMFT, with p value 0.00. It means that as the age increases, there is an increase in PDI and DMFT. Spearman's rho correlation analysis of the ordinal and continuous variables such as age, BMI, frequency of food intake and tooth brush with PDI and DMFT is shown in **Table 3**. The linear regression analysis results for age versus PDI and DMFT are presented in **Table 4** and **Graph A**. The coefficient of determination R² was found to be (0.175) and the slope was 0.051 with PDI. The coefficient of determination R² was found to be (0.268) and the slope was 0.253 with DMFT. The multiple linear regression analysis results for the independent variables (BMI, Frequency of food intake and frequency of tooth brushing and dependent variable (PDI and DMFT) are presented in **Table 5**.

		n	PDI		DMFT	
			Mean ± SE	p value*	Mean ± SE	p value*
BMI	Underweight (Group A)	10	0.73±0.20	0.102	7.90 ±1.78	0.696
	Normal (Group B)	56	1.26±0.15		8.28 ±0.74	
	Over weight (Group C)	25	1.83±0.34		9.12±0.75	
	Obese (Group D)	9	1.40±0.31		10.11±1.58	
Frequency of food intake	2 times a day	8	1.46±0.46	0.890	8.0±2.15	0.569
	3 times a day	45	1.49±0.20		9.5±0.78	
	4 times a day	26	1.18±0.17		7.5±0.85	
	5 times a day	18	1.26±0.34		8.16±1.21	
	6 times a day	3	1.46±0.74		9.33±3.48	
Frequency of tooth brushing	once a day	24	1.96±0.27	0.005	7.8± 0.61	0.428
	twice a day	55	1.34±0.16		8.54± 0.70	
	> twice a day	21	0.73±0.21		9.76± 1.41	

*One way ANOVA test; p<0.05 considered significant

Table 1: Frequency, mean and standard error for BMI, frequency of food intake and tooth brushing in relation with PDI and DMFT

	Age versus PDI	Age versus DMFT
<i>r</i>	.419**	.518**
p value	.000	.000

Pearson correlation (r); p <0.05 considered significant.

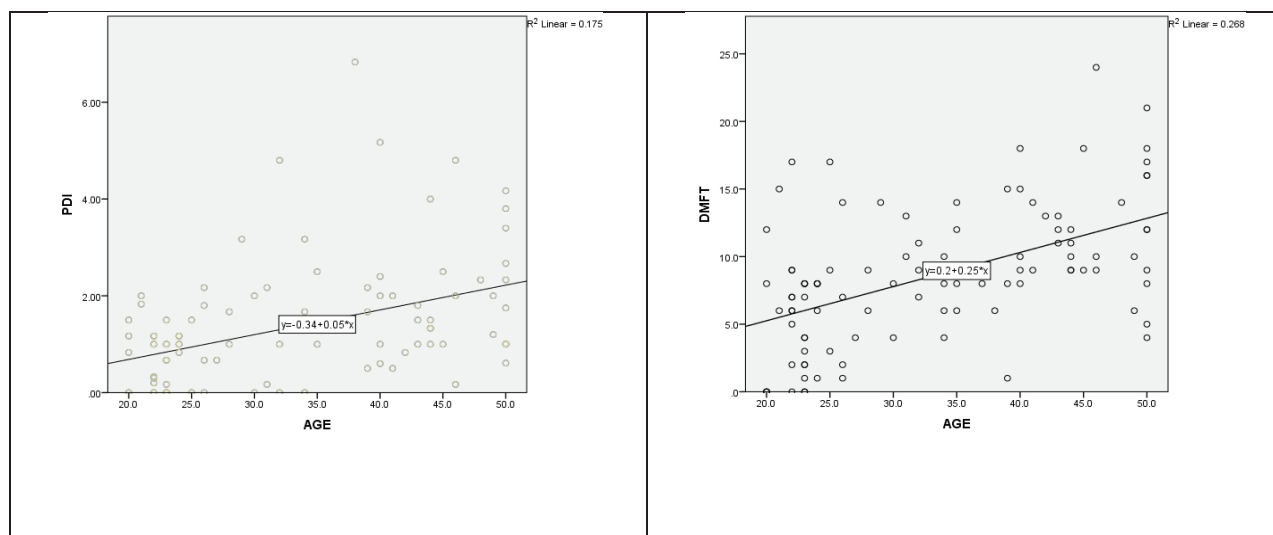
Table 2: Pearson correlation (r) analysis of the continuous variables such as age versus PDI and age versus DMFT

Variables	Periodontal Disease Index (PDI)		Decayed, Missing, Filled Teeth Index (DMFT)	
	Spearman's rho "r"	p value	Spearman's rho "r"	p value
Age	0.445	0.000	0.523	0.000
BMI	-0.144	0.154	0.137	0.173
Frequency of food intake	-0.078	0.440	-0.074	0.463
Frequency of tooth brushing	-0.383	0.000	0.113	0.264

Table 3: The relationship between age, BMI, frequency of food intake and tooth brush with PDI and DMFT.

	PDI			p value	DMFT			p value
	Slope 'B'	Correlation coefficient 'r'	Coefficient of determination R2		Slope 'B'	Correlation coefficient 'r'	Coefficient of determination R2	
Age	0.051	0.419	0.175	0.00	0.253	0.518	0.268	0.00

Table 4: Linear regression analysis for age versus PDI and DMFT



Graph A: Scatter plot showing the linear relationship between the age versus PDI and the age versus DMFT

Table 5: Multiple regression analysis of age, BMI, frequency of food intake and tooth brushing with PDI and DMFT.

Independent variables	PDI				DMFT			
	Slope 'B'	p value	Correlation coefficient 'r'	Coefficient of determination R2	Slope 'B'	p value	Correlation coefficient 'r'	Coefficient of determination R2
Age	0.046	0.00	0.506	0.256	0.259	0.00	.550	0.302
BMI	0.086	0.572			0.163	0.781		
Frequency of food intake	0.00	0.998			0.012	0.979		
Frequency of tooth brushing	0.514	0.003			1.419	0.033		

Discussion

Obesity is a growing health-related problem worldwide. Both obesity and oral health are important issues with multifactorial aspects. The prevalence of adult with elevated BMI in Malaysian population was found to be about one in two adults, while one in five were obese.⁷ Prevalence and severity of caries and periodontitis are significantly affected by several factors including age, educational backgrounds, socioeconomic status, genetic susceptibility, fluoride percentage in drinking water, and level of dental awareness.^{8,9} Association between BMI and oral health has been ascribed to unhealthy dietary patterns with insufficient micro-nutrients and excess sugar and fat content¹⁰ and in older adults with poor perception of oral health were more likely to have unsatisfactory BMI.¹¹

The objectives of the present study were to determine the effect of frequency of tooth brushing and frequency of food intake on oral health and its association with BMI and to correlate the findings of periodontal status, dental status, the effect of frequency of tooth brushing and frequency of food intake on oral health status with BMI.

The severity of dental caries ranges greatly from less than 5 to more than 20 (DMFT index).¹² In the present study as depicted in Table 5, statistically significantly and multiple regression model showed positive correlation of DMFT with the age of the population which is in agreement with the study conducted by Abbass MMS et al¹³ in 2019 who stated that DMFT increases significantly with increase in age. It is observed that statistically non-significant with positive correlation was found between BMI and DMFT which is in accordance with findings by Sheiham et al⁴ in 2002, who showed that British people that had less than 20 teeth were more likely to be obese; however, a study performed on Riyadh adults by Idrees M et al¹⁴, in 2017 and Abbass MMS et al¹³ in 2019 on Egyptian population revealed an inverse correlation but, age significantly influenced the DMFT index.

The type and frequency of food habits also play one of the important role in health or disease of a population. Evidence from the previous studies reveals a positive correlation between caries incidence and sugar intake in children and in adults, the present investigation reported statistically non-significant with negative correlation

between frequency of food intake and DMFT. This could be due to the limitation of present study where type of food has not been taken into consideration and with limited sample size. This could explain the lack of significant differences among the different group of BMI and DMFT in association with frequency of food intake. But positive correlation among tooth brushing and DMFT was reported which in agreement with the study by Abbass MMS et al¹² in 2019.

It is well known that being older than 35 years is considered a risk factor for tooth loss as a result of periodontal diseases.¹⁵ Therefore, to exclude any external age-related factors that might influence the oral health status negatively of study subjects, our study subjects were limited to adults aged 35 years and younger.

In the current study, as depicted in Table 5, PDI was found to be statistically significant and multiple regression model showed positive correlation with the age of the population which is in accordance with the study conducted by Lopez R, Smith PC et al⁸ in 2017 and PDI with frequency of tooth brushing which is also in accordance with the systemic review study by Lertpimonchai A et al¹⁶ in 2017. And also Han K et al¹⁷ stated in his study among Korean adults, that tooth brushing post lunch and before bedtime as well as the use of floss and a powered toothbrush may be considered independent risk indicators of periodontal disease. BMI and frequency of food intake was found to be non-significant however, type of food intake has showed a significant reduction in periodontal diseases reported by Woelber JP et al¹⁸ in 2017 but frequency of food intake has not yet reported as per our search and knowledge. The higher prevalence of periodontal disease among the present study population can be attributed to a multitude of reasons like poor oral hygiene practices, poor living conditions and low access to dental health services.

Conclusion

A negative correlation between the PDI and BMI and positive correlation with DMFT and BMI was observed. Their association is still questionable as other factors like age, frequency of food intake and tooth brushing have varied influence may be because of not considering the type of food, social habits and mode of tooth brushing in the present study. Longitudinal studies with a larger sample size are required to confirm the

association of body mass index and oral health status.

Conflict of Interest: Nil

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Ethical Clearance: Ethical clearance is obtained from the AIMST University ethical clearance committee

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