

## Sociodemographic, Oral Health Behaviour, and Physical Activity: Factors in Caries Experience among 19-59 Years Old Adults in a Malaysian Population

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### Abstract

Dental caries is one of the common diseases which are attributed by many factors. Many from the adult population are afflicted with dental caries. This study aimed to determine the predictors of developing dental caries among adults. Three hundred and thirty four adults participated in this study. Information gathered were their socio-demographic backgrounds, oral health behaviour, physical activity level, body mass index, body fat percentages, visceral fat level, and dental missing filled extracted teeth (DMFX) index. All standard protocols were observed and DMFX was examined using the World Health Organization (WHO) criteria. Prevalence of dental caries was 87.4%, inclusive of 61.3% of female respondents with caries experience. Most of the study participants were overweight. Only consumption of high sugar food ( $p=0.03$ ) were found between dental caries and oral health behaviours. Regression analysis ( $p<0.001$ ) showed that older age ( $p<0.001$ ), regular visits to dental clinic per year ( $p=0.012$ ), lower education level ( $p=0.025$ ), and lower physical activity ( $p=0.008$ ) were significant factors in developing dental caries among in this study population. Older aged adults, frequent appointment with the dentist, lower education in oral health and lower physical activity were possible factors for dental caries presence.

### Abstrak

#### Sosiodemografi, Perilaku Kesehatan Gigi dan Mulut, dan Aktivitas Fisik: Berbagai Faktor Penyebab Karies.

Karies gigi adalah salah satu penyakit umum disebabkan oleh banyak faktor. Banyak orang dewasa menderita karies gigi. Penelitian ini bertujuan untuk menentukan prediktor karies gigi pada orang dewasa. Tiga ratus tiga puluh empat orang dewasa ikut berpartisipasi dalam penelitian ini. Informasi yang dikumpulkan adalah latar belakang sosio-demografis, perilaku kesehatan gigi dan mulut, tingkat aktivitas fisik, indeks massa tubuh, persentase lemak tubuh, tingkat lemak *visceral*, dan indeks gigi yang hilang, ditambal, dan diekstraksi (DMFX). Semua protokol standar diamati dan DMFX diperiksa mengikuti kriteria Organisasi Kesehatan Dunia (WHO). Prevalensi karies gigi adalah 87,4%, termasuk 61,3% responden perempuan dengan pengalaman karies. Sebagian besar peserta penelitian kelebihan berat badan. Hanya konsumsi makanan tinggi gula ( $p=0,03$ ) yang dapat dikaitkan dengan karies gigi dan perilaku kesehatan mulut dan gigi. Analisis regresi ( $p<0,001$ ) menunjukkan bahwa usia yang lebih tua ( $p<0,001$ ), kunjungan rutin ke klinik gigi per tahun ( $p=0,012$ ), tingkat pendidikan yang lebih rendah ( $p=0,025$ ), dan aktivitas fisik yang lebih rendah ( $p=0,008$ ) merupakan faktor signifikan yang menyebabkan karies gigi pada populasi penelitian ini. Orang dewasa berusia lanjut, rendahnya frekuensi kunjungan ke dokter gigi, kurangnya pendidikan mengenai kesehatan mulut dan gigi, dan aktivitas fisik yang lebih rendah merupakan faktor yang memungkinkan kehadiran karies gigi.

*Keywords: adults, BMI, dental caries, oral health behaviour, physical activity*

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### Introduction

Worldwide, most people from the adult population are suffering from dental caries.<sup>1</sup> In Malaysia, the prevalence of dental caries has remained high apart from the fact that it declined over the years. From 1994, 95% of dental caries occurrence reduced to 94.6% in the year of 2004. It is undeniable that the adult populations are suffering

the most from this disease compared to other populations. This was indicated in a national survey in Malaysia in 1990.<sup>2</sup>

Dental caries is known as a multi factorial disease.<sup>3</sup> The factors can be divided into 3 types which are personal factors, oral environmental factors and also factors that directly contribute to caries development. Personal

factors are tertiary factors that support the growth of caries indirectly. For example, socio-demographic status, oral health behavior, oral health knowledge, attitude, education and monthly household income.

The second factor would be oral environmental factor. Oral environmental factors cover the saliva composition, fluoride, plaque pH, sugars, and antibacterial agents. These supporting factors are manipulative and influence the prevalence of dental caries. The main factors that act as the foundation for caries consists of tooth, time for the caries formation, bacteria in biofilm and the amount or frequency of diet.

In Malaysia, studies have related dietary patterns with dental caries among children but few relatively done on adults.<sup>4</sup> Besides that, fewer studies were published on the association between oral health behavior and dental caries among adults as more studies were found to focus more on the knowledge and practices of oral health.

## Methods

A cross sectional study was conducted among 334 subjects aged from 19-59 years in attending government dental clinic in Klang Valley, Malaysia. Approval to conduct the study was obtained from the Ministry of Health, Oral Health Department (KKM-60(13/9)), NMRR (National Medical Research Registrar), Faculty of Applied Science (FOAS) Research Ethics Committee of UCSI University (Proj-FAS-EC-12-009) and head of the 11 government dental clinics.

**Questionnaire.** A designed questionnaire was used to collect information on socio demographic, lifestyle habits, oral health behavior and physical activity level. International Physical Activity Questionnaire (IPAQ) was used to measure the physical activity level by calculating MET week score. Questionnaire which consist of oral health behaviours, smoking habits, and alcohol consumption were adapted from studies done by Vasileious in 2012, Sajith in 2008, and Jasmin in 2011.<sup>5-7</sup> In this section, questions were asked on the frequency of oral health behavior, sweet food and beverage consumption.

**Anthropometric measurement.** Anthropometric measurements were measured after the completion of questionnaire. Height was measured by using stadiometer to the nearest 0.1 cm, and weight (to the nearest 0.1 kg), body fat percentage, and visceral fat level were measured on a portable OMRON body analyzer model HBF-356 (Japan).

**Dental caries index.** All the selected respondents were clinically examined by qualified dental personnel. DMFX index was calculated by total number of decayed, missing, filled and extracted teeth and it was

classified into categories according to the WHO classification (1997).

**Statistical Analysis.** The data collected was analyzed using SPSS version 19. Mann Whitney U-test was used to differentiate the difference between genders. Kruskal-Wallis. Multiple linear regression analysis was executed to determine predictors of dental caries among adults. The level of significance for the data analysis will be set at  $p < 0.05$ .

## Results and Discussion

**Socio-demographic backgrounds of adult respondents aged 19-59 years old.** A total of 334 respondents participated in this survey study. About 198 (59.3%) of Malay respondents participated in this study, followed by 81 (24.3%) of Chinese respondents, 44 (13.2%) of Indian respondents. Around 11 respondents were from the minority ethnic groups such as Sikh, Iban, Kadazan. From the respondents, most of them were found from the 19-29 years old group and 17.7% from the age group of 40-49. It is observed that the respondents from the age group of 19-29 were the highest among the other age group to visit the dental clinic. Most of the respondents completed their secondary school education which is 154 (46.1%), 72 (21.6%) of them have completed their diploma, and 4 (1.2%) respondents who have no formal education. Total of 193 (57.8%) respondents neither work from any of the specific categories. Majority respondents have monthly household income between RM1500 to RM5000 which is around 187 (56.0%) of them. About 128 (38.3%) of them have total household monthly income which is less than RM 1500 and only 19 out of 343 respondents with 5.7% has RM 5000 and above (Table 1).

**BMI, visceral fat level, and body fat percentages according to gender.** Table 2 shows that mean BMI among the participants was  $24.88 \pm 5.27 \text{ kg/m}^2$ , categorized under overweight category. Overall, mean BMI of the female respondents ( $24.94 \pm 5.52 \text{ kg/m}^2$ ) was higher compared to the male respondents ( $24.68 \pm 4.86 \text{ kg/m}^2$ ). Male respondents ( $10.77 \pm 11.73$ ) scored a higher mean visceral fat score compared to the female respondents. ( $7.36 \pm 5.64$ ). As for body fat percentage, female respondents were indicated to have a higher mean body fat percentage  $32.35 \pm 7.09\%$  compare to the male respondents  $23.40 \pm 7.58\%$ .

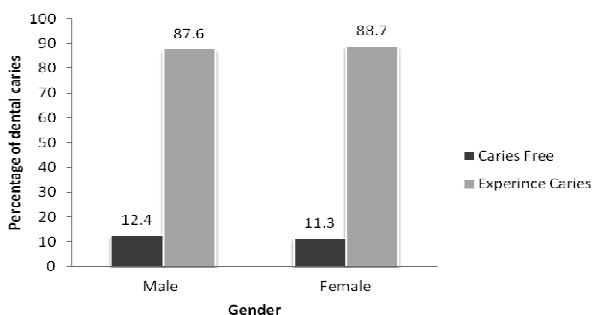
**Prevalence of dental caries according to gender (n=334).** The prevalence of dental caries found in this study is 87.4%. Among the male respondents, 12.4% of them were free from dental caries whereas 87.6% of them experienced dental caries. As for the female respondents, 11.3% of them were caries free while 88.7% overall had been suffering from dental caries (Figure 1).

**Table 1. Socio-demographic Backgrounds of Adult Respondents Aged 19-59 Years Old (n=334)**

Socio-demographic Information	Male n (%)	Female n (%)	n (%)
<b>Age</b>			
19-29	56 (40.8)	82 (41.6)	138 (41.3)
30-39	25 (18.2)	43 (21.8)	67 (20.1)
40-49	26 (19.0)	33 (16.8)	59 (17.7)
50-59	30 (21.9)	39 (19.8)	70 (21.0)
<b>Gender</b>	137 (41.0)	197 (59.0)	334 (100)
<b>Race</b>			
Malays	80 (58.4)	118 (59.9)	198 (59.3)
Indian	17 (12.4)	27 (13.7)	44 (13.2)
Chinese	36 (26.2)	45 (22.8)	81 (24.3)
Others	4 (2.9)	7 (3.5)	11 (3.3)
<b>Education level</b>			
No formal education	0 (0.0)	4 (2.03)	4 (1.2)
Primary Education	16 (11.7)	19 (9.6)	35 (10.5)
Secondary Education	63 (46.0)	91 (46.2)	154 (46.1)
Tertiary Education	58 (42.3)	83 (42.1)	141 (42.2)
<b>Occupation</b>			
Government	16 (11.6)	26 (13.2)	42 (12.6)
Retired	17 (12.4)	10 (5.1)	27 (8.1)
Private	104 (31.1)	161 (81.7)	265 (79.3)
<b>Marital Status</b>			
Married	82 (59.9)	119 (59.9)	201 (60.2)
Single	53 (38.7)	71 (35.5)	124 (37.1)
Widowed	1 (0.3)	6 (3.0)	7 (2.1)
Divorced	1 (0.3)	1 (0.5)	2 (0.6)
<b>Monthly Household Income (RM)</b>			
Less than RM 1500	50 (36.5)	78 (39.6)	128 (38.3)
RM1500-RM5000	77 (56.2)	110 (55.8)	187 (56.0)
RM5000 and above	10 (7.3)	9 (4.5)	19 (5.7)

**Table 2. Mean of BMI, Visceral Fat Level and Body Fat Percentages and Dental Caries Index of the Study Population According to Gender (n=334)**

Variables	Gender (Mean±SD)		Total n (%)
	Male (n=137)	Female(n=197)	
BMI	24.68 ± 4.86	24.94 ± 5.52	24.84 ± 5.27
Visceral Fat	10.77 ± 11.73	7.36 ± 5.64	8.67 ± 8.66
Body Fat Percentage	23.40 ± 7.58	32.35 ± 7.09	28.67 ± 8.51
Dental Caries Index	8.23 ± 7.01	7.42 ± 6.90	7.73 ± 6.94

**Figure 1. Prevalence of Dental Caries according to Gender (n=334)**

**Differences of DMFX scores between oral health behavior and dental caries.** Table 3 illustrates the prevalence of dental caries based on respondent's oral health behavior. Most of the respondents (n=243) who brushes their teeth more than twice a day were observed to have no caries experience. Hundred and sixty nine respondents with dental caries were found to not practice flossing and 23 respondents who practice flossing were detected to have no dental caries. There was significant difference (p=0.03) found between one oral health behavior variable which is Consumption of High Sugar Food and DMFX of adult respondents. Majority of respondents, 76.03% consume soft drinks

less than once a day, suffers from dental caries and 66.66% of them have no dental caries. Among respondents with caries experience, 65.07% of them consume citrus fruits/juices less than once a day along with respondents with no caries experience 64.29% consume citrus fruits/juices with the same frequency. About 35.27% of respondents without dental caries visited the dental clinic less than once a year where as 14.29% of respondents with dental caries visited the dental clinic more than twice a year.

**Multiple linear regression analysis of dental caries predictors.** Table 4 describes the multiple linear

regression analysis of the dental caries experience to several independent variables such as age, education level, visits to dental clinics per year, physical activity. The variables in the model explained 35.9% of variance according to the experience of dental caries for the adults aged 19-59 years old. Older adults, frequent visitation to dental clinic, lower education level and low physical activity were significantly associated with the occurrence of dental caries among adults.

The prevalence of dental caries found in this study was 87.4% which include 38.7% of male respondents and 61.3% of female respondents. The mean DMFX score

**Table 3. Prevalence of Dental Caries Based on Respondent’s Oral Health Behavior**

Variables	Dental caries experience		P
	With caries experience n(%)	No caries experience n(%)	
<b>Brushing frequency</b>			
Less than once a day	2 (5.26)	3 (1.22)	0.11
More than twice a day	36 (94.74)	243 (98.78)	
<b>Flossing</b>			
No	169 (57.88)	19 (45.24)	0.14
Yes	123 (42.12)	23 (54.76)	
<b>Consumption of High Sugar Food</b>			
Less than once a day	128 (43.84)	11 (26.19)	<b>0.03*</b>
Once a day	91 (31.16)	13 (30.95)	
More than twice a day	73 (25.00)	18 (42.86)	
<b>Consumption of Soft Drinks</b>			
Less than once a day	222 (76.03)	28 (66.66)	0.42
Once a day	49 (16.78)	10 (23.81)	
More than twice a day	21 (7.19)	4 (9.52)	
<b>Consumption of citrus fruits /juices</b>			
Less than once a day	190 (65.07)	27 (64.29)	0.93
Once a day	70 (23.97)	11 (26.19)	
More than twice a day	32 (10.96)	4 (9.52)	
<b>Visits to dental clinic</b>			
Less than a year	17 (40.48)	103 (35.27)	0.09
Once a year	19 (45.24)	101 (34.59)	
More than twice a year	6 (14.29)	88 (30.14)	

\* $\chi^2$  test significant difference at  $p < 0.05$

**Table 4. Multiple Linear Regression Analysis of Education Level, Age, Visits to Dental Clinics per year, Physical Activity and Body Fat Percentage between Dental Caries Index and Selected Variables**

Variables	Unstandardized Coefficients	Standardize Coefficients	Sig.
	Beta	Std.Error	Beta
(Constant)	2.488	0.466	<0.001
Education Level	-0.265	0.118	0.025*
Age	0.657	0.059	<0.001*
Visits to dental clinics per year	0.203	0.080	0.012*
Physical Activity	-0.286	0.106	0.008*

Dependent variable: DMFX (Dental, Filled, Extracted teeth) index

\*Significance difference <0.05

R<sup>2</sup>=0.359

Model ANOVA F=34.952

from the present study was  $7.73 \pm 6.94$ . The reported mean DMFX score was slightly low compared to the mean DMFX score ( $17.6 \pm 8.08$ ) determined among 369 elderly people in one of the rural area in Malaysia.<sup>8</sup> As a comparison, the mean caries score in the rural area was higher due to the inadequate dental facilities and lack of attention provided in the rural area which could cause a higher prevalence of dental caries compared to the urban area. Apart from that, strategies such as dental facilities and health programs that have been created by Ministry of Oral Health, Malaysia have contributed to the reduction of dental caries prevalence over the years.<sup>2</sup> The mean BMI of female respondents ( $24.94 \pm 5.52$  kg/m<sup>2</sup>) was higher than male respondents ( $24.68 \pm 4.86$  kg/m<sup>2</sup>) in this present study. The finding from our study was similar to a previous study done in Malaysia in 2009, the mean BMI of female respondents ( $24.61$  kg/m<sup>2</sup>) was also higher compared to the male respondents ( $24.15$  kg/m<sup>2</sup>).<sup>9</sup> In the meantime, mean visceral fat level of male respondents ( $10.77 \pm 11.73$ ) was found to be higher than the female respondents ( $7.36 \pm 5.64$ ). This finding was comparable to a study done in Malaysia previously, as the male respondents ( $11.19 \pm 4.69$ ) also scored a higher visceral fat level compared to the female respondents ( $7.57 \pm 2.67$ ).<sup>10</sup> Higher mean of body fat percentage was established among female respondents ( $32.35 \pm 7.09$ ) compared to the male respondents ( $23.40 \pm 7.58$ ). As parallel, previous study also showed a similar pattern of body fat percentage as female respondents ( $36.53 \pm 7.53\%$ ) scored a higher mean of body fat percentage than the male respondents ( $20.79 \pm 5.92\%$ ).<sup>10</sup>

Dental caries is known as one of the major problem faced by the industrialized countries, as there are more access to the consumptions of sugar for all populations.<sup>11</sup> Population adopting more westernized food marks an increase in dental caries as those foods are diets high in sugar.<sup>12</sup> Adaptation to the fast food in Malaysia has been observed to be increasing year by year and the diet transition was more of carbohydrates, sugars and fats.<sup>13</sup> This is because diet richen with sugar, fermentable carbohydrates, refined carbohydrate are prone to be metabolized by the bacteria found in the mouth to acids.<sup>12</sup> In contrast, our study portrayed an observation of respondents who consumed high sugar food less in a day have the highest dental caries experience. Although some respondents stated that they had less sugary food intake in a day, the amount of food consumed at a time was not taken into account. A previous study showed that amount of sugar intake plays an important role in the progression of dental caries and the development of caries caused by the amount of sugar intake gets rapid when the oral hygiene is poor.<sup>14</sup> Thus, more studies are encouraged to explore the link between amount of sugar intake and caries development.

Current study as well found that lower education level was a causal factor for the growth of dental caries. Respondents with higher education level were acknowledged to have higher oral health knowledge.<sup>11</sup> People with better oral health knowledge were ought to be more concern on their oral health, giving more importance in practicing a better oral health behavior.<sup>15</sup> At the same time, personnel with higher education level were shown to seek for more dental treatment whenever there are dental issues.<sup>16</sup>

Regular visitation to dental clinics in a year was found to be a contributor to the development of dental caries among adults. Lower prevalence of dental caries was observed among the Mauritians adults who visited dental clinics more than once a year and caries experience was statistically significant among adults who visited the private dental clinics more than once in a year.<sup>19</sup> In our study, frequent visits to the dental clinics could be a predictor as government dental clinics located in Klang Valley operate based on dental appointments. Here, respondents with higher risk of dental issues are given appointment frequently for a routine check-up or for consultation. Hence, this will help respondents to improve their oral condition with proper guidance.

In India, the effect of obesity and lifestyle on the oral health of pre adolescent children was accessed and it was found that participants who have sedentary lifestyle by watching television, playing video games or desk jobs tend to consume more soft drinks and fast foods which lead to poor oral hygiene statuses.<sup>18</sup> In our study, low physical activity contributed significantly to the progression of dental caries. This is because physically active adults are acknowledged to practice healthful diets. Their choice of food consumption were more on fruits and vegetables than high fat foods.<sup>19</sup> Besides that, physically active adults also have healthy lifestyle which was found to be associated with clinically measured oral health and it is observed that the mean dental score was related to the increase of unhealthful standard of living.<sup>20</sup> Meanwhile, a previous study perceived that sedentary lifestyle was escorted with a higher lean body mass proportion which leads to chronic diseases.<sup>21</sup> This implies that the rate of obesity increases in concurrence to the growth of unhealthful nutrition transition. As a result, low physical activity is more likely to be a contributing factor for both incidence of higher dental caries prevalence and higher rate of obesity.

Regression analysis showed a moderately good model that explained 35.9% for improvement to be done, and predictors such age, education level, visits to dental clinics per year, physical activity. More research should be done to examine the relation between oral health, dental caries and other associated factors as this could alarm the public on the various types of cause that can trigger dental caries or other associated dental problems.

## Conclusions

From our study, it can be observed that certain factors from socio-demographic background (age, education level), oral health behavior (consumption of high sugar food, visits to dental clinics) can be a factor to develop dental caries. Hereby, respective health personnel or government organization should educate public on the right practices of maintaining the oral health and its inference in combating dental caries. Physical activity was also found as a possible reason that can influence the increment of dental caries. Therefore, additional research study should be conducted in determining the strength of association between dental caries and physical activity.

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