



## Association between caries experience and body mass index (BMI) among preschool children in Kuantan

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### Abstract

**Introduction:** Dental caries and obesity are significant and common oral health and general health problems faced by children. Both caries and obesity are reported to share common risk factors. There are conflicting results in the literatures regarding the relationship between dental caries and childhood body mass index particularly among preschool children. Thus, this research aims to measure the prevalence of dental caries and determine the relationship between dental caries and body mass index (BMI) among preschool children in Kuantan.

**Methodology:** A cross sectional study was carried out in kindergartens in Kuantan using the convenience sampling method. A total of 180 participants were enrolled in this study with 60 participants each for every group. The participants were classified into underweight, normal and overweight based on their BMI. Their caries index was recorded using WHO guidelines. For BMI, participant's weight and height were recorded and categorized by using the BMI Calculator for Child and Teen (CDC).

**Result:** Pertaining to dental caries, 73.3% of the participants had dental caries. The overweight group recorded the highest caries index and the highest percentage of visible plaque, but the results were not significant.

**Conclusion:** Our study concluded that there is no association between dental caries and body mass index among preschool children in Kuantan.

**Keywords:** dental caries, body mass index, obesity, preschool children

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### INTRODUCTION

Dental caries and obesity are significant and common oral health and general health problems faced by children. Reported caries prevalence among 5-year old children in Malaysia was found to be 71.3% while for 6-year old children was 74.5% (Che Salleh, et al. 2015). Dental caries is defined as demineralization of tooth that occurs due to the interaction between biofilm and fermented carbohydrate on the tooth surface over time (Heymann, Swift, Ritter, 2014). Recently, there are increasing interest in studying the relationship between obesity and dental caries in children. Dental caries and obesity are thought to share common risk factors. It is also believed that understanding more about the relationship between these two precursors can aid in controlling these two diseases at once. BMI is used to measure weight status based on height and weight of an individual (Scorzetti, et al. 2013). Those with higher BMI will have higher meal intake that will affect oral hygiene

(Nayak, et al. 2015). Visible Plaque Index is used to measure the level of oral hygiene (Ainamo, Bay, 1975). It is known that the presence of dental plaque promotes the occurrence of dental caries. When cariogenic bacteria in the biofilm ingest fermentable carbohydrate, this will result in a drop in the pH of the dental plaque which promotes cavitation. Based on previous studies, there are no conclusive results found (Yen, Hu, 2013). Three studies were found to have positive associations, two studies found that there is an inverse association, two studies found that there is no association between these two factors and another study found a u-shape relationship (Chen, et al. 2018). The prevalence of dental caries among preschool children in Malaysia is increasing for all class of caries except anterior caries.

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There are also no studies conducted regarding the relationship between obesity and dental caries in Malaysia except in the east coast (Ruhaya, et al. 2012). The aim of our research was to determine caries experience among pre-school children and to identify the association between BMI groups and dental caries among pre-school children.

## METHODOLOGY

### Inclusion criteria

Participants aged 4 to 6 years old consented by the child's parent or legal guardian and medically fit and healthy.

### Participants

The present cross-sectional study was conducted on preschool children in Kuantan Pahang from February 2019 until August 2019. Eight kindergartens around Kuantan were selected through convenience sampling to be included in the study. A sample size of 180 was decided upon sample size calculation using G\* Power 3.2.9.2 with power of study of 80% based on medium sized effect and 10% drop out. The participants were classified into 3 subgroups (60 participants in each group) according to their BMI value, which are underweight, normal and overweight and obese.

### Clinical examination

Parents were asked to sign a consent form and fill up questionnaires that had been given. The data was utilized to obtain demographic data for example age, parents' level of education, participant's exposure to fluoride and participant's eating habits. On the day of examination, the body weight of each student was measured while wearing minimal clothing to the nearest 0.1 kg with a digital scale and their height was determined without shoes to the nearest 0.1 cm, using a stadiometer following the method by Azam (Goodarzi, et al. 2019). Then, the data was used to calculate for BMI value and its classification. Dental examination of the participants was held at the corresponding school itself and held on the dental chair under light. Dental Caries experience is measured and recorded using DMFT according to World Health Organization (WHO). The decayed, missing, and filled teeth (DMFT) in the students were assessed by a single, calibrated dentist. Caries was diagnosed on clinical and visual examination without radiographic exposure.

### Ethical approval

This study was approved by IIUM Research Ethics Committee (IREC 2019-014). Several kindergartens were approached and invited to participate in this study. Interested participants and parents were asked to fill up a consent form prior to conducting the clinical examination.

## Statistical analysis

Data analysis was carried out using SPSS 21.0 software package (SPSS Inc., IBM, and Chicago, IL, USA). Data was analyzed by One-way ANOVA, Chi-square and Pearson correlation coefficient software.

## RESULTS

A total of 180 preschool children were involved in this study. The intra-examiner reliability score is 0.94. Table 1 shows the socio demographic data of the children. The mean age of the participants in this study is 5.13 with male-to-female ratio of 45:54. Pertaining to dental caries, 73.3% of the participants had dental caries. The overweight group recorded the highest caries index (mean DMFT of 4.92) and the highest percentage of visible plaque (mean percentage of 25%). The mean number frequency of food intake for overweight and underweight children are similar with the mean of 2.6 times daily. Overall, frequency of toothbrushing for all groups are almost the same. From the total, 44% of the participant's parents are classified into high income group.

Table 2 shows the correlation between the studied variables. There is significant correlation found between visible plaque and BMI ( $p=0.027$ ), and between visible plaque and DMFT ( $p<0.05$ ). Our study found no correlation between BMI value, caries index, frequency of toothbrushing, and amount of visible plaque.

Table 3 shows the correlation between three BMI groups with mean DMFT of each group. No significant correlation was noted between the BMI groups and DMFT score from our study.

## DISCUSSION

Our study utilized the cross-sectional methods and convenience sampling to determine the caries experience and BMI index among preschool children in Kuantan. The mean DMFT of our participants was lower compared to previously reported studies in the same demographic area (Ismail, et al. 2018) but similar to the national report (Che Salleh, et al. 2015). While the previous study consisted of 93.5% of parents with lower than average income, our study enrolled 35% of parents with higher than average monthly income.

Higher intake of sugar and carbohydrates lead to an increase in weight of the children and also lead to greater accumulation of sugar in plaque that will feed the biofilm for the formation of dental caries. Based on current research, this can be understood due to the highest number of visible plaque scored by the children in the overweight group. It is agreed that plaque is one of the factors that cause the formation of dental caries. Even though the frequency of food intake is same as other groups, it can be postulated that children in this group may eat a larger amount of food during each meal, which explains the high plaque score. A study also

mentioned that there is higher significance of children with caries having visible plaque based on their research (Johansson, et al. 2010). However there is a study that opposed this statement saying that these overweight children might consume food with higher fat and unrefined carbohydrates, but not necessarily high in sugar and refined carbohydrates (Alshihri, et al. 2019). This could increase obesity, but not necessarily have a direct link to visible plaque as plaque are mostly made up from carbohydrates (Brown, 2009).

The current study showed that children with high BMI values did have a high DMFT score compared to the underweight and normal grouped but it is not significant. Being overweight can be due to an increased intake of dietary fats. A diet high in fat has less influence on the development of caries than a diet high in sugar. This could be a possible explanation for the lack of association between obesity and dental caries (Tramini, et al. 2009). Furthermore, caries is a multifactorial disease. It is more complex than could be explained by carbohydrate consumption alone. Other etiological factors that can cause caries in children are oral cavity quantitative and qualitative bacterial components, overall oral health status (Shahraki, et al. 2013) including the frequency and efficacy of plaque removal (Alkarimi, et al. 2014) and the amount and components of saliva (Lempert, et al. 2013).

Our data showed children who brushed their teeth more has a higher visible plaque score. This might be due to incorrect toothbrushing techniques practiced by the children and also the time when the teeth are being brushed. The children might also be using toothbrush longer than 3 months period which affect the quality of the bristle on the brush. Some researches proved that there is an insignificant difference in plaque content regardless of the frequency of toothbrushing (Lang,

Cumming, Loe, 1973; Attin, Hornecker, 2005). Study stated that there is little difference between the amounts of plaque based on the frequency of toothbrushing of the groups (Lang, Cumming, Loe, 1973). It is assumed that the amount of plaque present may be due to other factors such as oral bacterial flora and saliva. There is also research showing that the efficacy of the toothbrushing practice is rather important than the frequency of toothbrushing for the quality of plaque removal (Attin, Hornecker, 2005). However, numerous research proposed that the frequency of toothbrushing improves oral hygiene by reducing the amount of plaque (Barenie, Leske, Ripa, 1976; Attin, Hornecker, 2005). A study claimed that gingivitis in school children who brush more than once daily is significantly different compared to those that only brush once daily (Barenie, Leske, Ripa, 1976). while another study mentioned that those who brush their teeth frequently are less prone to new carious lesions (Kumar, Tadakamadla, Johnson, 2016).

## CONCLUSION

Our study concluded that caries experience among preschool children in Kuantan is high, and there is no association between body mass index and dental caries among the groups.

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## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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