Children's Birth Weight and Their Current Body Mass Index in Relation to Early Childhood Caries

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Abstract

Early childhood caries (ECC) is considered the most common chronic disease in childhood globally. Earlier reports have associated ECC with weights at birth and during early childhood, but these have never been assessed in our local populations.

Thus, the aim of this study was to find the associations between birth weight and current body mass index (BMI) and the occurrence of ECC among young children in Kuantan, Pahang.

A total of 200 children aged from two to five years were recruited for this research. Visual examination for caries detection was conducted to determine the present of caries. The information on demographic data such as age, parental education levels, socioeconomic status, and anthropometry data such as birth weight, current height and weight of the participants were obtained from the parents through a self-administered questionnaire.

The findings indicate that ECC was prevalent among 83% of the study participants. In addition, the children who were diagnosed with ECC had significantly (p=0.008) lower mean BMI (16.0 ± 12.0 kg/m²) compared to caries free children (18.7 ± 9.3 kg/m²).

There is no association between ECC and birth weight but children with ECC were significantly more likely to be underweight compared to caries free children.

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Introduction

According to the American Academy of Paediatric Dentistry, dental caries is a chronic and infectious transmissible disease resulting from tooth-adherent specific bacteria called *mutants streptococci* which causes the demineralization of tooth structure .[1] Early childhood caries (ECC) is defined as the presence of one or more decayed (non-cavitated of cavitated lesions), missing, or filled tooth surfaces in any primary tooth in a child 71 months of age or younger. This disease has been associated with habitually-developed incorrect diet such as high sugar intake, dental structure, immunological efficiency, or systemic pathological conditions.[1]

According to the National Oral Health Survey of Preschool Children 2005, the prevalence of ECC among Malaysian children (aged 5 years or younger) was 87.1%.[2] This exceeded the World Health Organization (WHO)'s goal of having 50% caries free among this age group. This can be concluded that the majority of the children in Malaysia are having a serious oral health problem. Untreated ECC can lead to pain, reduced quality of life, and impaired eating, and may adversely affect a child's nutritional status and development.[3] Furthermore, untreated ECC may affect the weight and growth of the children and be linked to caries development in permanent dentition as they grow older.[4]

One of the risk factors of ECC is low birth weight (<2,500g) which may be closely

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associated with pre-term delivery.[5] Reduced gestational duration may lead to changes in dental structures such as dental enamel opacities and hypoplasia. Hypomineralised areas at the tooth surfaces are susceptible to dental caries because the areas are more porous and less mineral content. Therefore, extra concern should be focused on these risky groups.

The development of ECC has also been linked with body mass index (BMI) in children. The BMI, expressed in kg/m^2, is a measure of body size. It combines a person's weight with their height. It is categorised into four categories; underweight, healthy, overweight and obese which tally with specific percentile ranges in children. Underweight can be a sign of malnutrition which can affect children growth and development.[6] On the other hand, overweight and obese may associated with systemic diseases such as type 2 diabetes mellitus, cardiovascular disease and other chronic diseases.[7]

Recently, there has been considerable interest in the relationship between ECC and BMI. Poor diet not only contributes to unhealthy body weight but affects oral health status as well. A study by Hong et. al, (2008) reported that children who were either at risk for or were already overweight had a higher percentage of caries than those with normal BMI.[8] Similarly, a study among 1,160 4 to 5-year-old Mexican children found that overweight children had 1.95 times greater risk of dental caries in deciduous teeth than did children of normal weight.[9] A cross-sectional study among 56 schoolchildren aged 7 to 11 years found a significant correlation between BMI and decayed, filled, missed and surface (DMFS) score ($r = 0.899$; $p < 0.001$).[10] Other research, however, did not find any association between body weight status and dental caries.[11,12] To date, there is no published local data on association between BMI and ECC in young children. Therefore, the aim of this study was to determine any potential associations between birth weight or current BMI and ECC prevalence among young children in Kuantan, Pahang.

Materials and methods

Study Area & Population

A cross-sectional study was carried out from March until May 2014. The data were collected at the Outpatient Dental Clinic, Kulliyyah of Dentistry, International Islamic University Malaysia (IIUM), eight kindergartens under Malaysian Community Development Department (TABIKA KEMAS), and two private kindergartens in Kuantan, Pahang. The inclusion criterion for subjects to participate in this study was children aged up to six years with no medical illness. The study participants were conveniently recruited. The children's teeth condition was screened for sign of dental caries under natural light and a set of questionnaires was disseminated to be completed by their parents. The children were divided into two groups according to their caries status: i) with caries and ii) without caries.

Ethical approval and written permission for this study were obtained from relevant authorities (approval reference KAHS/RES-APP/12MARCH2014-23). The project's objectives and methodology were explained to the parents and caregivers, and written informed consent was obtained from all participants prior to the study commencement.

Questionnaire

A bilingual (Malay and English) self-administered questionnaire was designed. It was reviewed by a content expert and a pilot study had been conducted on 10% (n=20) from the total sample size prior to data collection.

The questionnaire consisted of demographic details such as age, gender, ethnicity, religion, parent's highest education level and socioeconomic status. The children's birth weight, current weight and height of the participants, were self-reported by their parents. The BMI of the children were calculated as weight (in kilograms) divided by height (in metres) squared.

Each participant's BMI was assessed by using the nutritional survey model in AnthroPlus V3.2.2 software established by the WHO. The children were categorized as severely thin (<−3SD), thin (<−2SD), normal weight (−2SD to +2SD), overweight (>+2SD) or obese (>+3SD).[13]

Statistical Analyses

SPSS® software (Version 14) was used for to perform statistical analyses in the current study. The results were expressed as mean and standard deviation. Descriptive frequency was used to describe the characteristic of demographic data. Independent sample t-test was used as to find whether there was any

association between birth weight/BMI and ECC occurrence. The statistical significance test was set at $p < 0.05$.

Results

Demographic profile

A total of 200 research participants aged two to six years (mean 4.9 ± 1.2 years) were included in the current study. Their demographic characteristics were presented in Table 1. About half (n=105) of them were female. A majority of the participants were Malay (96.5%). Others included two Chinese, one Indian, and four *pribumi* (i.e Kadazan, Iban and Melanau) ethnicities. The highest education level of the parents was tertiary degree (39.5%), followed by Malaysian Certificate of Education (44%). As for household income, about half (50.7%) of the parents were earning between RM 2,001 and RM 4,000 per month. Among the participants, 83% (n=166) were found to have ECC (Table 1).

Characteristics		Frequency (%)
ECC	Has caries	166 (83)
	No caries	34 (17)
Age	2	11 (5.5)
	3	15 (7.5)
	4	25 (12.5)
	5	149 (74.5)
Gender	Male	95 (47.5)
	Female	105 (52.5)
Race	Malay	193 (96.5)
	Chinese	2 (1)
	Indian	1 (0.5)
	Others	4 (2)
Parent's Education Level	No education	2 (1)
	Primary School	4 (2)
	PMR	22 (11)
	SPM/ STPM	88 (44)
	University	79 (39.5)
	Others	5 (2.5)
Household Income	< RM 1000	14 (7)
	RM1001-RM 2000	42 (20.7)
	RM2001-RM 3000	47 (23.6)
	RM3001- RM4000	54 (27.1)
	RM4001-RM5000	18 (9)
	>RM5001	25 (12.6)

Table 1. Demographic characteristics of the study participants (n= 200).

Birth weight and ECC

The mean birth weight of the study participants was 2.95 ± 0.49 kg and this falls in the normal category (2,500 - 4,000g) (Lai et al., 1997). A majority of the participants (85.4%) were born with normal birth weight. Only 14.6% were born with low birth weight (<2,500g). In the current study, no significant difference (*p=0.550*) was found between the mean birth weights of subjects who were diagnosed with ECC (2.94 kg) and those who were not (3.00 kg).

Body mass index and ECC

The mean BMI of the participants was 16.5 ± 5.4 kg/m² with their BMI status as demonstrated by Figure 1. Based on the WHO Growth Standards (2006), almost half (47.3%) of the participants were found to have normal BMI. A total of 25.8% of the children were categorized as thin or severely thin, whereas 26.9% were either overweight or obese.

In the current study, the children who were diagnosed with ECC were found to be of significantly (*p=0.01*) lower mean BMI (16.0 ± 12.0 kg/m²) compared to those without ECC (18.7 ± 9.3 kg/m²) (Figure 2).

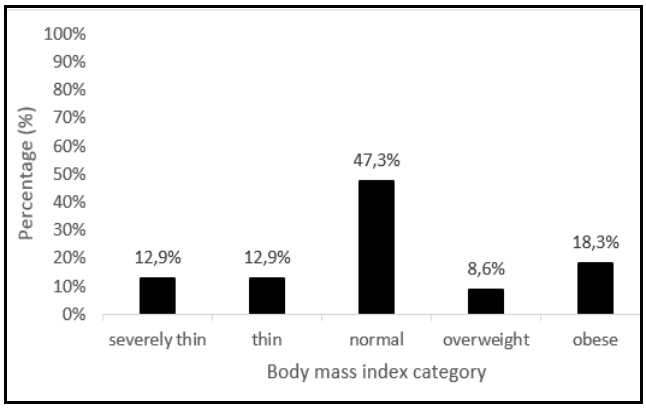

Figure 1. The BMI status of the study participants (n=200).

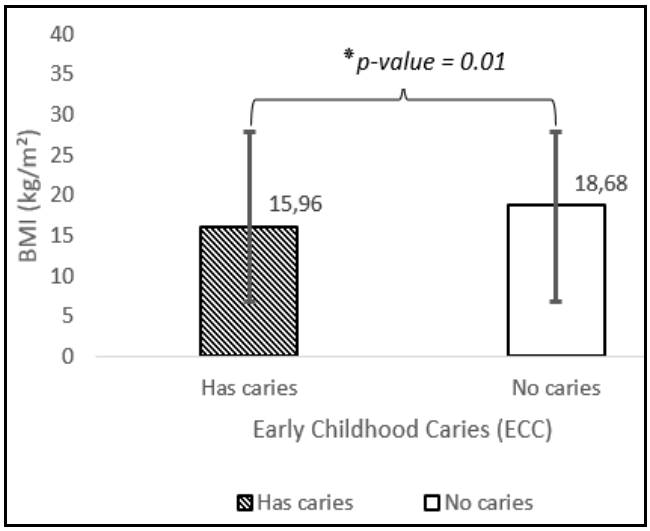

Figure 2. Mean BMI and the prevalence of ECC (n = 200).

Discussion

Dental caries is the most prevalent infectious disease among children. It causes pain and suffering and contributes to increased dental health costs. Among the research participants of the current study, more than 80% of them were identified to have ECC. This prevalence has increased compared to the national statistics from a decade ago. The National Oral Health Survey Malaysia in 2007 reported that caries prevalence among 6-year-olds was 74.5%.[14]

Earlier studies have reported potential links between the prevalence of ECC and body weight at birth as well as in early childhood. However, the current study could not detect any association between the ECC prevalence and the birth weights. Previous findings have shown that children of low birth weight would subsequently develop more caries in primary dentition than children with normal to large birth weight.[15] A study by Nelson et al., (2010) also found that low birth weight children could become more susceptible to dental caries due to biological factors. These include increased prevalence of developmental defects of enamel, DDE (hypoplasia, demarcated and diffuse opacities) of the primary and permanent dentition due to environmental disturbance during tooth formation and development[5]. Children born prematurely or with low birth weight may have changes in their dental structures which could contribute to progressive development of caries.

In the current study, the mean BMI was found to be significantly lower in children with ECC compared to those without. This finding is in line with a previous study which found associations between abnormal BMI categories (underweight or obese) and the occurrence of ECC. A study by Heinrich-Weltzien et al. (2013) demonstrated that children with a high decayed, missing, and filled teeth (DMFT) ratio indicating ECC were more likely to be underweight than children with a lower ratio of DMFT. [16] On the other hand, another study among 121 children aged 18-15 years found significantly lower DMFT ratio among obese children (3.2±1.3) compared to normal-weight children (2.5±1.2).[17]

However, the occurrence of ECC and its association with unhealthy BMI is complex to explain as each has its multiple contributing risk factors such as health behaviours, social-economic determinants, and genetic factors.[13] For example, it has been suggested that the relationship between being underweight and dental caries is confounded by inadequate nutritional intake.[10] This is because poor nutrition may increase susceptibility to dental caries through alteration in saliva composition and impairment of saliva secretion. Thus, it may not be solely due to being underweight or obese. On the other hand, one study found the association between ECC prevalence and low BMI as well as lower socioeconomic status.[16] In addition, children whose parents were of higher education levels had significantly lower incidence of dental caries compared to otherwise.[3] The conflicting results was also supported by a recent systematic review.[18] The review concluded that no consensus was reached on the relationship between BMI and dental caries. This was contributed by the varied associations of the studies reviewed and no inclusion of confounders effect and effect modifiers.

The current study aimed to assess the potential association between birth weight and current BMI, and ECC prevalence among young children. To the best of knowledge, it was the first of such studies to be conducted in Kuantan, Pahang. However, it is not without limitations. The results may have been improved with a longitudinal study design to enable the determination of cause-effect relationships. Future studies should also look into other factors that may influence dental caries prevalence among children such as parental knowledge, attitude, and practice regarding dental health and hygiene, and access to dental care.

Conclusions

It can be concluded that, the ECC prevalence was found to be linked with lower BMI status but not with birth weight, among the toddlers and pre-schoolers in Kuantan, Pahang. Further research is needed in this area to fully understand the multiple and intertwining risk factors of abnormal weight status and dental caries. This is vital in order to increase awareness among the parents and to determine appropriate preventive actions to control the epidemic.

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Declaration of Interest

The authors report no conflict of interest.

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