

Knowledge and attitude towards children's oral health: findings from a sample of first-time mothers in Malaysia

Wan Mariam Wan Abdul Rahman, MBA(USM)^{1,2}, Norkhafizah Saddki, MCommMed(Oral Health) (USM)¹, Zuliani Mahmood, DClintDent(Adelaide)¹, Ruhaya Hasan, PhD(Malaya)¹, Norsamsu Arni Samsudin, MSc Paediatric Dentistry(London)¹

¹School of Dental Sciences, Universiti Sains Malaysia, Health Campus, Kubang Kerian, Kelantan, Malaysia, ²Miri Divisional Oral Health Office, Federal Government Complex Phase 2, Jalan Cahaya, Miri, Sarawak, Malaysia

ABSTRACT

Introduction: Women's important roles within families which include modelling appropriate oral health behaviours require them to have good knowledge and positive attitude in oral health. This study determined knowledge and attitude towards children's oral health among first-time mothers and factors associated with the attributes.

Materials and Methods: A total of 154 first-time mothers in the third trimester of pregnancy who attended two health clinics in the state of Sarawak, Malaysia for antenatal care participated in this cross-sectional study. A structured self-administered questionnaire was used to measure the variables of interest.

Results: Most mothers could correctly identify the aetiological factors of dental caries and strategies for preventing the disease in children. However, a substantial portion could not identify certain cariogenic and non-cariogenic foods or drinks. Most pregnant women have appropriate attitudes towards children's oral health although some showed unfavourable attitude about care of primary teeth. Women who were older and had attended a talk on children's oral health were more likely to have higher mean knowledge score than their respective counterparts, and higher mean knowledge score was associated with higher mean attitude score.

Conclusion: Most first-time mothers in this study had correct knowledge and favourable attitude about children's oral health, although misunderstandings and misperceptions in several issues were also common. Significant association found between experience of attending oral health talk and oral health knowledge, and between oral health knowledge and attitude, substantiate the importance of an educational intervention program to optimise the mothers' roles in caries prevention in children.

KEYWORDS:

Oral health; knowledge; attitude; pregnant women

INTRODUCTION

Early childhood caries (ECC) is defined as 'the presence of one or more decayed (non-cavitated or cavitated lesions), missing (due to caries), or filled surfaces, in any primary tooth of a child under age six year'.¹ ECC is one of the most prevalent

diseases in children, with a pooled global prevalence of 48%.² Affecting more than 530 million children globally,³ ECC is largely untreated.⁴ In Malaysia, the latest survey in 2015 revealed a high caries prevalence among 5-year-old children at 71.3%.⁵

ECC is a major public health issue not only because of its high prevalence and impact on the health and wellbeing of the child and the family members, but also cost to society.^{6,7} With concerted efforts, ECC can be controlled and prevented.⁷ In addition to a collaborative approach involving the dental and other stakeholders to bring about development of policies and programmes to reduce the burden of ECC, educating parents regarding the causes and prevention of ECC by delivering customised recommendations and specific parenting practices remains an important strategy.⁷

Parents play an important role in establishing their children's oral health behaviour from a young age.⁸ In early childhood, a learned behaviour, including oral health behaviour, is established by the repetition of any form of work that provides opportunities for the child to develop a skill or knowledge area. Ozbek et al.⁹ have reported that oral health behaviour of the parents is copied by their children. Adequate knowledge towards children's oral health has been shown as an important risk factor associated with parents' good oral health practices and subsequent favourable oral health status of the children.^{8,10} In addition, positive oral health attitude of the parents can also provide learning, support, and a family norm of good oral health practice.¹¹ Hence, it is essential that parents have correct oral health knowledge and positive oral health attitude so that they can successfully undertake the responsibility of being the correct role-models for their children.

Pregnancy has been described as a time when women often have increased motivation and are particularly receptive to improve their lifestyle and health behaviours.¹² For the first-time mothers, perceptions about risks to the health of the child seem to be the primary driving force for these changes.¹² Community trials and systematic review of randomised controlled trials suggest that oral health education intervention to pregnant women may reduce the risk and prevalence of ECC in their children.^{13,14} Oral health program for antenatal mothers in Malaysia has been in place since the early 1970s.¹⁵ Targeting pregnant women who attend the Ministry of Health maternal and child health clinics for their

This article was accepted: 20 November 2023

Corresponding Author: Norkhafizah Saddki

Email: fizah@usm.my

prenatal check-up, this program aims to create awareness among expectant mothers on the importance of oral health, empowering them to become the agent of change who can stimulate behavioural changes in their families.¹⁵

However, after more than 50 years, the program did not seem to achieve a satisfactory outcome; the uptake of primary oral health care services among antenatal mothers was relatively low at 44.4% in 2022 compared to the percentage of mothers receiving prenatal care at the Ministry of Health maternal and child health clinics that has been consistently above 95% since 2010,¹⁶ and the prevalence of caries among 5-year-old children in 2015 was also high despite the decline from 76.2% in 2005.⁵ One of the probable reasons this program has yet to achieve its intended objective is because the increased motivation for healthy lifestyle and behaviour changes was assumed without considering the women's risk perceptions as well as the capability and opportunity to engage in these changes.¹² Understanding the baseline knowledge and attitude towards children's oral health, which is the perception of risk, is seen as an important foundational step in planning an improved pregnancy-specific intervention program. In this study, we investigated the knowledge and attitude of first-time mothers towards children's oral health care and factors associated with their knowledge and attitude.

MATERIALS AND METHODS

Study Design and Study Population

This was a cross-sectional study among pregnant women who received antenatal care from two government clinics in Malaysia between October 2021 and February 2022. This study was conducted in Sarawak, the largest state in Malaysia in the northwest of Borneo Island. Sarawak is divided into 12 divisions, and this study was conducted at Tudan Health Clinic in Miri Division and Bintulu Health Clinic in Bintulu division. The selection of these health facilities was based on the similarities in socio-demographic characteristics of the served population, health and oral health care services provided. Both Tudan Health Clinic and Bintulu Health Clinic are in the town area of the respective division. Both facilities provide similar primary health care services including antenatal health care services and oral health care services. The maternal and child health care clinic and the dental clinic are located within the same building of the respective health clinic.

First-time mothers in the third trimester of pregnancy, aged 18 years and above, without any diagnosed cognitive disorders, and able to read and write in Malay language, were eligible to participate. The sample sizes for all specific objectives of this study were calculated, and the largest affordable sample size was yielded from the objective to determine children's oral health knowledge of the pregnant women using the formula to estimate a single proportion with a 95% confidence interval (CI). The proportion was estimated at 63% which was the proportion of pregnant women who knew that primary teeth start to erupt at the age of 6 months.¹⁷ At a precision of 0.08, the largest affordable sample size of 140 was yielded. In anticipation of 10% non-response rate, a sample size of 154 was determined for this

study. The ethical approval to conduct this study was obtained from the Universiti Sains Malaysia Human Research and Ethics Committee (USM/JEPeM/21050377) and the Ministry of Health Malaysia Medical Research and Ethics Committee [NMRR-20-2141-55603 (IIR)].

Research Tools

A self-administered questionnaire developed by Noor Zamry et al.¹⁸ was used to assess knowledge and attitude towards children's oral health among the participants. The questionnaire was in Malay language with 30 items assessing the knowledge domain and 12 items assessing the attitude domain. The response options for all items were closed-ended; 'true', 'false' and 'don't know' options were given for the knowledge items and a 5-point Likert scale rating of 5 for 'strongly agree', 4 for 'agree', 3 for 'neither agree nor disagree', 2 for 'disagree', and 1 for 'strongly disagree' were given for the attitude items. Additionally, a structured form was used to collect information on demographic profile of the participants (age, highest education level, employment status and monthly household income), last dental visit, and experience of attending a talk on children's oral health.

Data Collection

Non-proportionate stratified random sampling was used to obtain equal numbers of samples from each maternal and child health care clinic, and systematic random sampling method was applied for selection of pregnant women who attended the clinics during the study period and fulfilled the study criteria. Following explanation about the study objectives and procedures, written informed consent was obtained from the women who agreed to participate. Participating pregnant women were informed that their participation in this study would be voluntary and they are free to withdraw from the study at any time. It was also emphasised that the questionnaire was anonymous, and confidentiality of data is ensured. Instructions on questionnaire completion were provided prior to the questionnaire administration. The questionnaire completion took place in a special room with good lighting and low level of noise. The time taken by most of the participants to complete the questionnaire was between 10 to 15 minutes. The questionnaire was collected immediately following completion.

Statistical Analysis

Data processing and analysis were done using the IBM SPSS software, version 26. Descriptive statistics were used to obtain the frequency and percentage (%) of categorical variables and the mean and standard deviation (SD) or median and interquartile range (IQR) of continuous variables. Linear regression analysis was performed to investigate the factors associated with children's oral health knowledge and attitude among participants. For this analysis, a mark was given to each response for all 30 knowledge items and 12 attitude items. For each knowledge item, one mark was given for correct responses, and zero mark was given for incorrect and don't know responses. For the attitude items, a mark of 1 to 5 were given according to the response given on the Likert scale, except for the negatively worded items that were re-coded in reverse direction so that a higher mark on each item indicated better attitude. The marks were later summed up to

obtain the overall score for each domain. The total knowledge score may range between 0 to 30, and the total attitude score between 12 to 60, with a higher score indicating a better knowledge and attitude respectively. In the regression analysis, starting with simple linear regression analysis, the following independent variables were tested: age, education level, employment status, monthly household income, last dental visit, and exposure to oral health talk. In addition, the mothers' mean knowledge score was tested as a potential factor associated with their attitude towards children's oral health (mean attitude score). In multiple linear regression analysis, variables were selected using forward selection, backward elimination, and stepwise selection methods. The selected variables were examined for any two-way interactions using the LR test and multicollinearity issues using the variance inflation factor (VIF) test. Assumptions of linearity, normality, and equal variance of the regression model were examined using residual plots. Presence of outliers were also identified, indicated by data points beyond +3.0 and -3.0 of standardised residuals. The final model is presented with adjusted regression coefficient and 95% (CI), t-statistics and P value. The level of significance for this analysis was set at P value of less than 0.05.

RESULTS

All the 154 participants completed the questionnaires, giving a response rate of 100%. Table I shows the characteristics of the study participants. The age of the participants ranged from 18 to 36 years with a mean of 26.7 years (SD = 5.09). Most participants received at least secondary education (88.3%), and more than half (60.4%) were unemployed with medium monthly household income on RM3,500 (IQR 2500), which is below the threshold of RM4,850 for the 40% of low-income earners in Malaysia.¹⁹ Almost half (46.8%) had visited dentists within the past year, and slightly more than a quarter (27.3%) had attended a talk about children's oral health.

Knowledge Towards Children's Oral Health

Table II shows the knowledge towards children's oral health among the participants. Most participants knew that the first baby tooth will erupt at the age of 6–9 months (77.9%) and a baby's mouth should be cleaned even before the first tooth erupts (87.7%). Most pregnant women in this study also knew that dental plaque causes dental caries (74.7%), and that a child's teeth should be brushed at least twice daily (91.6%), particularly before bedtime (87.0%). Most participants also knew that a white spot on the tooth surface is an early sign of dental caries (78.6%), which can be prevented using fluoride toothpaste (72.7%) and were aware of the appropriate amount of fluoride toothpaste to be used in children.

More than half of participants (69.5%) knew that dental caries can affect children below 2 years of age, but only less than half of the women knew that children of mothers with caries are at risk of developing caries themselves (40.1%). Most women knew that frequent intake of sugary foods (93.5%) and pooling of milk in the mouth during sleep (74.7%) can cause dental caries. However, about half were unaware that fruit juice (54.5%), white bread (53.2%), baby

biscuits (46.8%), bananas (59.7%), and dried fruits such as dates (51.9%) and raisins (47.4%) have a high potential to cause dental caries. In addition, some (40.3%) mistakenly thought that breast milk was highly cariogenic, and another 24.7% were unsure.

Attitude Towards Children's Oral Health

Table III shows the attitude of the participants towards their children's oral health. Most participants had positive attitude and agreed on the importance of baby teeth (strongly agree = 51.9%, agree = 42.9%), the need to brush the newly erupted teeth (strongly agree = 42.9%, agree = 32.5%) at least twice daily (strongly agree = 63.0%, agree = 33.8%), and the need for them to supervise the toothbrushing (strongly agree = 63.6%, agree = 33.1%). Most women also agreed that they need to encourage their child to drink from a cup by 1 year of age (strongly agree = 29.9%, agree = 38.3%), make sure their child does not take sweet and sticky foods (strongly agree = 53.2%, agree = 42.9%), and bring their child for dental check-up before 1 year of age (strongly agree = 54.5%, agree = 35.7%).

However, a considerable proportion of the participants also showed unfavourable attitude about care of primary teeth by agreeing that primary teeth need not be given good care as they will be replaced by permanent teeth (strongly agree = 15.6%, agree = 17.5%) and carious baby teeth need not be given attention (strongly agree = 12.3%, agree = 11.7%). More than half of the women also agreed (strongly agree = 30.5%, agree = 36.4%) that permanent teeth will not last a lifetime.

Factors Associated with Knowledge Towards Children's Oral Health

The mean knowledge score was 19.5 (SD = 5.66) with the lowest score of 2.0 and the highest score of 29.0. Table IV shows results of linear regression analysis of factors associated with knowledge on children's oral health among the participants. Multiple linear regression analysis showed a significant positive relationship between age of the participants and their mean knowledge score ($p = 0.003$). More specifically, older women had higher mean knowledge score than those who were younger. Another factor found to be significant with the knowledge score was experience of attending a talk on children's oral health. Women who attended the talk had higher mean knowledge score than those who did not ($p = 0.013$). With these two significant variables, the model explained 9.3% of the variance in the knowledge score ($R^2 = 0.093$). Possible two-way interactions between variables were not significant and no multicollinearity issue was detected. All model assumptions were met, and no outliers were found.

Factors Associated with Attitude Towards Children's Oral Health

The mean attitude score was 36.2 (SD = 4.85) with the lowest score of 22.0 and highest score of 48.0. Of the tested independent variables, knowledge score was the only variable found to be significantly associated with the attitude score at both simple and multiple variable analysis (Table V). Mothers with higher mean knowledge scores had higher attitude scores ($p < 0.001$). A one-unit increase in knowledge score resulted in a 0.39-unit increase in attitude score (95% CI: 0.26-0.51).

Table I: Characteristics of participants (n = 154)

Variable	Frequency (%)
Age (Year)*	26.7 (5.09)*
Education level	
No formal education	2 (1.3)
Primary education	16 (10.4)
Secondary education	83 (53.9)
Post-secondary (e.g., diploma, vocational)	35 (22.7)
Tertiary education	18 (11.7)
Employment status	
Yes	61 (39.6)
No	93 (60.4)
Monthly household income (MYR)	3500 (2500)**
Last dental visit	
Within 1 year	72 (46.8)
Within 1-2 years	26 (16.9)
More than 2 years ago	31 (20.1)
Never had dental examination	25 (16.2)
Ever attended oral health talk	
Yes	42 (27.3)
No	112 (72.7)

*Mean (SD)

**Median (IQR)

Table II: Knowledge towards children's oral health (n = 154)

Variable	Frequency (%)		
	Correct	Incorrect	Don't know
Calcium intake during pregnancy helps in the formation of strong teeth	134 (87.0)	2 (1.3)	18 (11.7)
The first baby tooth will erupt at the age of 6–9 months	120 (77.9)	2 (1.3)	32 (20.8)
Plaque is a white layer containing bacteria that accumulates on tooth surface	121 (78.6)	1 (0.6)	32 (20.8)
Plaque can cause dental caries	115 (74.7)	2 (1.3)	37 (24.0)
Frequent intake of sugary foods can cause dental caries	144 (93.5)	3 (1.9)	7 (4.5)
Children are at risk of dental caries if they fall asleep with milk pooling in the mouth	115 (74.7)	14 (9.1)	25 (16.2)
Tooth decay can affect children below 2 years of age	107 (69.5)	7 (4.5)	40 (26.0)
Early sign of caries can be seen as a white spot on the tooth surface	121 (78.6)	1 (0.6)	32 (20.8)
Children of mothers with caries are at risk of developing caries themselves	63 (40.1)	25 (16.2)	66 (42.9)
Foods or drinks with high potential to cause dental caries:			
Formula milk	86 (55.8)	24 (15.6)	44 (28.6)
Breast milk	54 (35.1)	62 (40.3)	38 (24.7)
Fruit juice	70 (45.5)	41 (26.6)	43 (27.9)
Fortified drink	99 (64.3)	24 (15.6)	31 (20.1)
White bread	72 (46.8)	43 (27.9)	39 (25.3)
Chocolate	128 (83.1)	11 (7.1)	15 (9.7)
Baby biscuit	82 (53.2)	37 (24.0)	35 (22.7)
Banana	62 (40.3)	58 (37.7)	34 (22.1)
Dates	74 (48.1)	41 (26.6)	39 (25.3)
Peanut	36 (23.4)	77 (50.0)	41 (26.6)
Sweets	131 (85.1)	11 (7.1)	12 (7.8)
Cheese	19 (12.3)	102 (66.2)	33 (21.4)
Raisin	81 (52.6)	38 (24.7)	35 (22.7)
Sticky dessert	108 (70.1)	18 (11.7)	28 (18.2)
A baby's mouth should be cleaned even though the teeth have not yet erupted	135 (87.7)	3 (1.9)	16 (10.4)
Dental plaque can be removed with toothbrushing	113 (73.4)	11 (7.1)	30 (19.5)
A child's teeth should be brushed twice daily	141 (91.6)	5 (3.2)	8 (5.2)
Brushing before bedtime is essential	134 (87.0)	6 (3.9)	14 (9.1)
Fluoride toothpaste can be used to prevent dental caries	112 (72.7)	8 (5.2)	34 (22.1)
Only a smear of fluoride toothpaste is needed to brush teeth of children below 3 years old	112 (72.7)	7 (4.5)	35 (22.7)
Only a pea size of fluoride toothpaste is needed to brush teeth of children above 3 years old	112 (72.7)	7 (4.5)	35 (22.7)

Table III: Attitude towards children's oral health (n = 154)

Variable	Frequency (%)				
	Strongly agree	Agree	Neither disagree nor agree	Disagree	Strongly disagree
Baby teeth are important	80 (51.9)	66 (42.9)	6 (3.9)	2 (1.3)	0 (0.0)
Cariou baby teeth need not be given attention	19 (12.3)	18 (11.7)	12 (7.8)	85 (55.2)	20 (13.0)
Baby's teeth need not be given a good care as they will be replaced by permanent teeth	24 (15.6)	27 (17.5)	15 (9.7)	75 (48.7)	13 (8.4)
Premature loss of baby teeth due to caries can affect the normal eruption of the permanent teeth	64 (41.6)	62 (40.3)	22 (14.3)	4 (2.6)	2 (1.3)
Permanent teeth will not last a lifetime	47 (30.5)	56 (36.4)	25 (16.2)	20 (13.0)	6 (3.9)
A baby's mouth needs to be cleaned even though the teeth have not yet erupted	96 (62.3)	46 (29.9)	9 (5.8)	3 (1.9)	0 (0.0)
I need to brush my child's newly erupted teeth	66 (42.9)	50 (32.5)	27 (17.5)	11 (7.1)	0 (0.0)
I need to make sure my child brushes teeth twice daily	97 (63.0)	52 (33.8)	5 (3.2)	0 (0.0)	0 (0.0)
I need to supervise my child's toothbrushing	98 (63.6)	51 (33.1)	5 (3.2)	0 (0.0)	0 (0.0)
I need to encourage my child to drink from a cup by 1 year of age	46 (29.9)	59 (38.3)	40 (26.0)	8 (5.2)	1 (0.6)
I need to make sure my child does not take sweet and sticky foods	82 (53.2)	66 (42.9)	5 (3.2)	0 (0.0)	1 (0.6)
I need to bring my child for dental check-up before 1 year of age	84 (54.5)	55 (35.7)	14 (9.1)	1 (0.6)	0 (0.0)

Table IV: Factors associated with mean knowledge score (n = 154)

Variable	Simple linear regression		Multiple linear regression		
	Crude b (95% CI)	p value	Adjusted b (95% CI)	t-statistics	p value
Age (Year)	0.26 (0.09, 0.43)	0.004	0.26 (0.09, 0.43)	3.04	0.003
Education level					
No formal education/primary/secondary*					
Post-secondary/tertiary	0.18 (-1.73, 2.08)	0.854	-	-	-
Employment status					
No*					
Yes	0.82 (-1.02, 2.67)	0.380	-	-	-
Monthly household income (MYR)	0.0 (0.00, 0.00)	0.159	-	-	-
Last dental visit					
More than 1 year ago/Never*					
Within 1 year	2.01 (0.23, 3.79)	0.027	-	-	-
Ever attended oral health talk					
No*					
Yes	2.44 (0.45, 4.43)	0.017	2.48 (0.53, 4.42)	2.52	0.013

* Reference category

Table V: Factors associated with mean attitude score (n = 154)

Variable	Simple linear regression		Multiple linear regression		
	Crude b (95% CI)	p value	Adjusted b (95% CI)	t-statistics	p value
Age (Year)	0.06 (-0.10, 0.21)	0.209	-	-	-
Education level					
No formal education/primary/secondary*					
Post-secondary/Tertiary	0.53 (-1.10, 2.16)	0.522	-	-	-
Employment status					
No*					
Yes	0.46 (-1.12, 2.05)	0.563	-	-	-
Monthly household income (MYR)	-0.00 (0.00, 0.00)	0.910	-	-	-
Last dental visit					
More than 1 year ago/never*					
Within 1 year	0.46 (-1.09, 2.01)	0.558	-	-	-
Ever attended oral health talk					
No*					
Yes	1.32 (-0.41, 3.04)	0.135	-	-	-
Knowledge score	0.39 (0.26, 0.51)	<0.001	0.39 (0.26, 0.51)	6.20	<0.001

* Reference category

DISCUSSION

Pregnancy has been described as the time when women are more motivated to adopt healthy behaviour.²⁰ ECC intervention during pregnancy therefore becomes important as women may be particularly receptive to oral health education message with subsequent changes in behaviour to keep their child's mouth healthy.^{13,14} Becoming a parent for the first time can be physically and emotionally intense as mothers navigate a major life transition without the benefit of experience.²¹ First-time mothers need clear and comprehensive information and instructions on children's oral health care as part of their preparation for motherhood. Understanding the women's knowledge and attitude towards children's oral health can help the oral health care providers to be more focused in planning an antenatal education program to reduce the risk and prevalence of ECC.

Parents' knowledge about nutrition has been shown to be an important determinant of their food choices and nutritional intake.²² Most of the mothers in this study knew about the role of calcium to help ensure formation of strong teeth, although calcium was commonly reported to be deficient in pregnant women.²³ Women in our study were also mostly aware about the etiological factors of dental caries including dental plaque and sugary foods, although a substantial proportion of participants did not know that formula milk, fruit juice, white bread, baby biscuits, bananas, dates, and raisins that are commonly given to children, also have high potential to cause dental caries. On the other hand, foods with low potential to promote dental caries like breast milk, peanut and cheese were incorrectly thought to be cariogenic. Most of our findings are in agreement with the results reported by Noor Zamry et al.¹⁸ in a study among pregnant women in Kelantan, a state in the northeast of Peninsular Malaysia. Comparable findings from two studies conducted in different settings in Malaysia indicate the likelihood that the results can be generalised to the larger population. Recognising the important role of diet in caries development,²⁴ a re-look into the current oral health education message to antenatal mothers is therefore indicated as parents are highly motivated by health and nutrition, in addition to the child's taste preferences, when choosing foods for their children.²⁵ Mothers should be educated about strategies to translate their health motivations into healthy food choices and feeding practices for their family, including the ability to correctly identify cariogenic foods and drinks and take the appropriate preventive strategies.

Erroneous knowledge about the cariogenic potential of breast milk among the first-time mothers in this study should be of concern as it may deter the women's intention to breastfeed after delivery. Breast milk is the best source of nutrition for infants, and its bioactive components can provide protection against infection and inflammation.²⁶ The Government of Malaysia is committed to promote and support breastfeeding through development of the National Breastfeeding Policy, in line with the World Health Organization recommendations.²⁷ While breastfeeding should be encouraged among the first-time mothers, the women must also be cautioned against night-time breastfeeding. Although breast milk has low cariogenic potential, the pooling of milk around teeth during

sleep can increase the risk for dental caries.²⁸ The medical professionals and breastfeeding advocates are in an excellent position to advise mothers that the benefits of breastfeeding should not be imperilled by the increased risk for caries due to improper feeding habit. It is good to note that most women in our study were aware that the pooling of milk in the mouth can contribute to the development of dental caries.

ECC is highly preventable,²⁹ hence oral health care should begin as soon as the first primary tooth erupts between 6 and 9 months of age which was correctly identified by most pregnant women in this study. Most first-time mothers in this study could correctly answer questions regarding caries prevention, particularly oral hygiene care and use of fluoride toothpaste. There is good evidence that higher dental caries rate is associated with lower toothbrushing frequency, and the effect is more pronounced in the deciduous than in the permanent dentition,³⁰ giving credence to the general toothbrushing recommendation of at least twice daily.³¹ Most participants in this study were aware that a child's teeth should be brushed twice daily, and that brushing before bedtime is essential. Saliva flow is greatest during the waking hours of the day and diminishes considerably during sleep.³² Hence, toothbrushing before bedtime is recommended not only to remove plaque and all traces of food, but also to allow fluoride to remain in the mouth for a prolonged time and not be quickly cleared by the saliva.³¹

Parental knowledge on children's oral health have a significant impact on the oral health status of their children.³³ Children whose mothers had good oral health knowledge were less likely to have ECC when compared with children whose mothers had poor oral health knowledge.¹⁰ Furthermore, children of mothers with active caries are at risk of developing caries themselves,^{34,35} and only less than half of mothers in this study knew about this risk. The relationship between oral health of young children and that of their mothers was attributed to poor oral health behaviour of the mothers.^{34,35} This evidence concurs the important role of mothers in oral health care of their children by modelling and imparting correct oral health information, positive oral health attitude, and appropriate oral health care practice, and mothers should be made aware of their important roles.

Parental attitude to children's oral health has a direct significant influence on their preventive oral health behaviors.¹¹ While most first-time mothers in our study showed favourable attitude towards children's oral health, a considerable proportion also had unfavourable attitude with regards to care of primary teeth, including carious primary teeth. The consequences of having untreated carious teeth can extend beyond pain, infection, and eating difficulties.³⁶ Disturbed sleep, loss of school days, reduced activity, visits to emergency departments, and hospitalisations, can negatively affect the young children's health-related quality of life with significant social and economic consequences for the family, and cost to the society.³⁶ Primary teeth are important to maintain space for the permanent teeth developing underneath. Early loss of primary teeth due to caries will allow the adjacent teeth to move into the space and block the erupting permanent teeth, leading to crowding and future orthodontic issues.³⁷ Findings of this study suggest the need

for intervention programs to educate mothers about the importance of primary teeth and to teach essential skills needed to effectively perform preventive oral hygiene care for their children.

Factors previously shown to be associated with mothers' knowledge include age, education level, and household income.^{38,39} In this study among first-time mothers, the influence of education level and household income on the mothers' knowledge was not apparent. However, the age of the mothers and experience of attending a talk on children's oral health were found to be significantly associated with their knowledge. Our study also found that women who had better knowledge about children's oral health were more likely to have favourable attitude. These findings substantiate the benefit of providing oral health education intervention to antenatal mothers geared to improve their knowledge and attitude, which have been shown to be important predictors of preventive oral health behavior.^{8,40}

Our study adds to the growing body of evidence on knowledge and attitude of mothers towards children's oral health care and factors associated with their knowledge and attitude. While there have been a considerable number of studies reporting the knowledge and attitude of mothers towards children's oral health care, literature on first-time mothers is scarce. Nevertheless, this study has a limitation related to the integral issue of using a self-administered questionnaire due to the subjectivity of responses that depend on the participants' honesty and motivation to answer.

CONCLUSION

Most first-time mothers in this study have correct knowledge and favourable attitude towards children oral health. However, a substantial proportion were not aware of the positive association between mother and child caries experience and could not identify foods commonly given to children as cariogenic including formula milk, baby biscuits, and bananas. Instead, foods with low potential to promote dental caries like breast milk was incorrectly thought to be cariogenic. In addition, some had unfavourable attitude about care of primary teeth and believed that permanent teeth will not last for life. Age and experience of attending a talk on children's oral health were significantly associated with the mothers' knowledge, which in turn, was found to be associated with their attitude towards children oral health.

Our findings substantiate the benefit of providing oral health education intervention to first-time mothers that is geared towards optimising the roles of mothers as the agent-of-change in controlling and preventing ECC. A well-planned program using suitable and easy-to-understand oral health education materials is indicated to make sure the mothers are equipped with adequate information on children's oral health that may promote development of positive attitude and subsequent favourable preventive oral health behaviour.

ACKNOWLEDGEMENTS

The authors would like to thank the Director General of Health Malaysia for the permission to publish this article. The authors are also grateful to the Sarawak Oral Health

Division, Ministry of Health, Malaysia, Miri and Bintulu Divisional Dental Officer, and all staff from Miri and Bintulu MCHC for their cooperation. Our special thanks go to Dr. Mu Nyuk Ching for her assistance in data entry and analysis.

REFERENCES

1. Drury TF, Horowitz AM, Ismail AI, Maertens MP, Rozier RG, Selwitz RH. Diagnosing and reporting early childhood caries for research purposes. a report of a workshop sponsored by the national institute of dental and craniofacial research, the health resources and services administration, and the health care financing administration. *J Public Health Dent* 1999; 59(3): 192-97.
2. Uribe SE, Innes N, Maldupa I. The global prevalence of early childhood caries: a systematic review with meta-analysis using the WHO diagnostic criteria. *Int J Paediatr Dent* 2021; 31(6): 817-30.
3. World Health Organization. Ending Childhood Dental Caries: WHO Implementation Manual. Geneva: World Health Organization; 2019.
4. Kassebaum NJ, Bernabé E, Dahiya M, Bhandari B, Murray CJL, Marcenes W. Global burden of untreated caries: a systematic review and metaregression. *J Dent Res* 2015; 94(5): 650-58.
5. Ministry of Health Malaysia. National Oral Health Survey of Preschool Children 2015 (NOHPS 2015), Vol. 1: Oral Health Status and Caries Treatment Needs of 5-Year-Old Children. Putrajaya: Oral Health Division, Ministry of Health Malaysia; 2017.
6. Zaror C, Matamala-Santander A, Ferrer M, Rivera-Mendoza F, Espinoza-Espinoza G, Martínez-Zapata MJ. Impact of early childhood caries on oral health-related quality of life: a systematic review and meta-analysis. *Int J Dent Hyg* 2022; 20(1): 120-35.
7. Tinanoff N, Baez RJ, Diaz Guillory C, Donly KJ, Feldens CA, McGrath C, et al. Early childhood caries epidemiology, aetiology, risk assessment, societal burden, management, education, and policy: global perspective. *Int J Paediatr Dent* 2019; 29(3): 238-48.
8. Kumar N, Nabi AT, Kavita K, Choudhary P, Huda I, Dubey SK. Familial oral hygiene practices and its influence among rural youths-exploring primary preventive measures. *J Family Med Prim Care* 2020; 9(8): 4353-57.
9. Ozbek CD, Eser D, Bektas-Kayhan K, Unur M. Comparison of the tooth brushing habits of primary school age children and their parents. *J Istanbul Univ Fac Dent* 2015; 49(1): 33-40.
10. Folayan MO, Kolawole KA, Oziegbe EO, Oyedele T, Oshomoji OV, Chukwumah NM, et al. Prevalence, and early childhood caries risk indicators in preschool children in suburban Nigeria. *BMC Oral Health* 2015; 15: 72.
11. Aliakbari E, Gray-Burrows KA, Vinal-Collier KA, Edwebi S, Salaudeen A, Marshman Z, et al. Facilitators and barriers to home-based toothbrushing practices by parents of young children to reduce tooth decay: a systematic review. *Clin Oral Investig* 2021; 25(6): 3383-93.
12. Rockliffe L, Peters S, Heazell AEP, Smith DM. Understanding pregnancy as a teachable moment for behaviour change: a comparison of the COM-B and teachable moments models. *Health Psychol Behav Med* 2021; 10(1): 41-59.
13. Riggs E, Kilpatrick N, Slack-Smith L, Chadwick B, Yelland J, Muthu MS, et al. Interventions with pregnant women, new mothers and other primary caregivers for preventing early childhood caries. *Cochrane Database Syst Rev* 2019; 2019(11): CD012155.
14. George A, Kong A, Sousa MS, Villarosa A, Ajwani S, Dahlen HG, et al. Long-term effectiveness of the midwifery initiated oral health-dental service program on maternal oral health knowledge, preventative dental behaviours and the oral health status of children in Australia. *Acta Odontol Scand* 2023; 81(2): 164-75.

15. Ministry of Health Malaysia. Oral Healthcare for Antenatal Mothers. Kuala Lumpur: Oral Health Division, Ministry of Health Malaysia; 2004.
16. Ministry of Health Malaysia. Oral Health Programme Annual Report 2022. Putrajaya, Malaysia: Oral Health Programme, Ministry of Health Malaysia; 2022.
17. ElKarmi R, Aljafari A, Eldali H, Hosey MT. Do expectant mothers know how early childhood caries can be prevented? A cross-sectional study. *Eur Arch Paediatr Dent* 2019; 20(6): 595-601.
18. Noor Zamry NN, Mahmood Z, Saddki N. Influence of oral health literacy on knowledge and attitude towards children's oral health among pregnant women in Malaysia. *Med J Malaysia* 2022; 77(5): 534-41.
19. Household Income & Basic Amenities Survey Report 2019 [press release]. Putrajaya: Department of Statistics Malaysia; 2020.
20. Olander EK, Smith DM, Darwin Z. Health behaviour and pregnancy: a time for change. *J Reprod Infant Psychol* 2018; 36(1): 1-3.
21. Kristensen IH, Simonsen M, Trillingsgaard T, Pontoppidan M, Kronborg H. First-time mothers' confidence mood and stress in the first months postpartum. A cohort study. *Sex Reprod Healthc* 2018; 17: 43-9.
22. Scalvedi ML, Gennaro L, Saba A, Rossi L. Relationship between nutrition knowledge and dietary intake: An assessment among a sample of Italian adults. *Front Nutr* 2021; 8: 714493.
23. Saunders CM, Reh binder EM, Carlsen KCL, Gudbrandsgard M, Carlsen KH, Haugen G, et al. Food and nutrient intake and adherence to dietary recommendations during pregnancy: a Nordic mother-child population-based cohort. *Food Nutr Res* 2019; 63.
24. Giacaman RA. Sugars and beyond. The role of sugars and the other nutrients and their potential impact on caries. *Oral Dis* 2018; 24(7): 1185-97.
25. Russell CG, Worsley A, Liem DG. Parents' food choice motives and their associations with children's food preferences. *Public Health Nutr* 2015; 18(6): 1018-27.
26. Nuzzi G, Trambusti I, DI Cicco ME, Peroni DG. Breast milk: more than just nutrition! *Minerva Pediatr (Torino)* 2021; 73(2): 111-14.
27. UNICEF, WHO. Capture the Moment – Early Initiation of Breastfeeding: The Best Start for Every Newborn. New York: UNICEF; 2018.
28. Branger B, Camelot F, Droz D, Houbiers B, Marchalot A, Bruel H, et al. Breastfeeding and early childhood caries. Review of the literature, recommendations, and prevention. *Arch Pediatr* 2019; 26(8): 497-503.
29. American Academy of Pediatric Dentistry. Policy on Early Childhood Caries (ECC): Consequences and Preventive Strategies. The Reference Manual of Pediatric Dentistry. Chicago, Ill: American Academy of Pediatric Dentistry; 2021.
30. Kumar S, Tadakamadla J, Johnson NW. Effect of toothbrushing frequency on incidence and increment of dental caries: a systematic review and meta-analysis. *J Dent Res* 2016; 95(11): 1230-36.
31. Levine R, Stillman-Lowe C. The Scientific Basis of Oral Health Education. 8th edition. Switzerland: Springer Nature; 2019.
32. Feng G, Zhao J, Peng J, Luo B, Zhang J, Chen L, et al. Circadian clock-A promising scientific target in oral science. *Front Physiol* 2022; 13: 1031519.
33. Rai NK, Tiwari T. Parental factors influencing the development of early childhood caries in developing nations: a systematic review. *Front Public Health* 2018; 6: 64.
34. Lee S, Kim H, Lee J, Kim J. Association between maternal and child oral health and dental caries in Korea. *J Public Health: From Theory to Practice* 2019; 27: 219-27.
35. Shin BM, Park DY. Association between the prevalence of dental caries in children and factors related to their mothers. *Int J Dent Hyg* 2017; 15(4): e173–e9.
36. Saikia A, Aarathi J, Muthu MS, Patil SS, Anthonappa RP, Walia T, et al. Sustainable development goals and ending ECC as a public health crisis. *Front Public Health* 2022; 10: 931243.
37. Zou J, Meng M, Law CS, Rao Y, Zhou X. Common dental diseases in children and malocclusion. *Int J Oral Sci* 2018; 10(1): 7.
38. Chala S, Houzmali S, Abouqal R, Abdallaoui F. Knowledge, attitudes and self-reported practices toward children oral health among mother's attending maternal and child's units, Salé, Morocco. *BMC Public Health* 2018; 18(1): 618.
39. Chen L, Hong J, Xiong D, Zhang L, Li Y, Huang S, et al. Are parents' education levels associated with either their oral health knowledge or their children's oral health behaviors? A survey of 8446 families in Wuhan. *BMC Oral Health* 2020; 20(1): 203.
40. Aliakbari E, Gray-Burrows KA, Vinall-Collier KA, Edwebi S, Marshman Z, McEachan RRC, et al. Home-based toothbrushing interventions for parents of young children to reduce dental caries: a systematic review. *Int J Paediatr Dent* 2021; 31(1): 37-79.