Caries Risk Factors among Children Aged 3–5 Years Old in Indonesia

Abstract

Background: Dental caries is the most common oral disease in children. Dental caries is a multifactorial disease both etiologic factor and risk factor. Other factors that could not find in clinical examination or radiograph, but contribute to the disease are assumed as risk factor. A child as an un independent individual will be influenced by external risk factor, especially from the mother. Mother is an important figure for children character building. Risk factor detection is an essential effort to decrease the prevalence of dental caries. Aim: The aim of this study is to identify caries risk factor in children aged 3–5 years old in Indonesia. Setting and Design: A descriptive, cross-sectional study was conducted using a universal sampling protocol. Methods: Subject is 248 pairs of mother and children. Clinical examination and questionnaire interview are applied on the subject. Statistical Analysis: The association between caries risk factors and caries cases on children were tested using bivariate analysis, followed by identifying the most dominant factors using logistic regression multivariate analysis. Results: Each caries risk factor has a significance level which could distinct to children’s caries case. After multivariate logistic regression, maternal attitude and how to drink milk bottle were the most risk factors to childhood caries (odds ratio: 3.61; 95% confidence interval [CI]: 1.18–11.01 and 7.69; 95% CI: 1.84–32.13 respecting). Conclusions: Many risk factors contribute to childhood caries, originated from both children themselves and mothers. Caries risk factor identification is an important role in preventing childhood caries.

Keywords: Caries risk factor, caries, children, Indonesia

Introduction

Dental caries is the most common infectious oral disease in children. Its prevalence remains high, although many prevention efforts have been made. Dental caries is a global health problem around the world. Dental caries has five times more common than asthma and seven times more common than hay fever or allergic rhinitis in children. And also, it is one of the problems during the child’s growth and development, besides malnutrition, obesity, and allergies.[1-3]

Untreated dental caries will affect quality of life, because of pain and discomfort which can lead to disfigurement, cognitive development, acute and chronic infections, and altered eating and sleeping, as well as risk of hospitalization, high treatment costs, loss of school days with the consequent diminished ability to learn. According to the survey in 2018 of the Ministry of Health of the Republic of Indonesia, there were 93% of children 5–6 years have dental caries.[4-6]

Dental caries is a multifactorial disease. There are 4 major etiologic factors interaction, consist of (1) Host (saliva and susceptible tooth, (2) Micro flora; cariogenic bacteria (plaque), (3) Substrate; fermentable carbohydrates (dietary), and (4) Time. Besides, there are many factors which do not see in clinical examination but contribute to the dental caries’ incidence. Those factors are considered as a dental caries risk factor. The risk factors are an indirect cause, and play an important role in the incidence of disease, significantly associated with disease progression. In pathological conditions, risk factors can explain the treatment of imbalance after the clinical onset of disease.[7-9]

Dental caries is a preventable disease. Therefore, caries risk identification is an important step to help dentist to understand the patient’s cariogenic profile. Specific information about the caries risk factor in population will assist us in performing proper protocols and prevention.

Children are individuals who are not independent, especially depend on the...
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Methods

Ethical consideration

The Human Ethical Research Committee of the Dentistry Faculty, Indonesia University approved the study protocol, and written informed consent was obtained from each patient at the beginning of the study (protocol no. 07980915/2015).

Selection of subject

The study was conducted in Pos Pelayanan Terpadu (Posyandu) and Sekolah Pendidikan Anak Usia Dini RW 01, 02, 03, 04, 05, 10 Kelapa Gading, Jakarta, Indonesia. The subjects consist of 248 pairs of mother and children. The inclusion criteria were as follows: children aged between 3 and 5 years, boys or girls, and mother as primary caregiver.

Preparation of interview and clinical examination

An observational, cross-sectional study was conducted. Data were collected using clinical examination and questionnaire. Caries risk factors are determined based on literature analysis, clinical experience, and local community’s condition. Identified risk factor consists of demographic factors, clinical factor, maternal attitude and knowledge factor, and oral health behavior.

The demographic factor consists of mother’s age, children’s age, children’s gender, mother’s education level, and family’s income. The clinical condition was assessed through the following clinical examination by four calibrated dentists. The clinical condition was expressed as (1) mother: plaque index, saliva’s pH, caries experience; (2) children: caries experience, general health, white spot lesion, plaque’s index, saliva’s pH, brushing teeth habitual, snacking habitual, sweetened drinking habits, and consumption of bottled milk. Caries experience, was estimated by presence or number of dental caries in mother and children. Plaque index (PI) using the standard PI of Loe and Silness. Subjects are evaluated based on PI score as 0–3. Saliva’s pH was measured with plaque check – pH kit and dental saliva pH indicator.

Questionnaire is about maternal attitude and knowledge concerning oral health. The reliability and validity test was carried out for the questionnaire and based on Cronbach’s alpha and corrected correlation coefficient. Cronbach’s alpha > 0.7 required for a scale that is considered already established or stable. Researcher determines a minimal value of the validation, correlation’s coefficient > 0.4. The question about the mother’s attitude and knowledge consist of: (1) brushing teeth after meals, (2) caries restoration, (3) extraction of radix or un restorable teeth, (4) the importance of primary teeth, (5) cariogenic foods, (6) plaque removal, and (7) periodical checking.

Results

The study provides a validating questionnaire of maternal attitude and knowledge for identifying children’s caries risk factor. The reliability of the obtain questionnaire about maternal attitude was estimated using Cronbach's alpha which yielded a value of 0.775, and 0.661 for questionnaire about maternal knowledge. The evidence of validity was obtained through the consideration of corrected item-total item correlation coefficient for each item. The value of corrected item-total item correlation exceeded 0.4 for all questionnaires about maternal attitude, and not all of the questionnaires about maternal attitude have the value of corrected item-total item correlation exceeded 0.4.

The result of bivariate analysis between (1) caries risk factor of the mother with caries incidence in children and (2) caries risk factor of children with caries incidence in children are presented in Tables 1 and 2.

Multivariate analysis was logistic regression. The variables in multivariate analysis Step 1 are presented in Table 3, and the final result of multivariate logistic regression is presented in Table 4.

Table 4 shows that caries risk factors mostly dominant either from mother or child which is for caries occurrence.

Table 1: Bivariate analysis of maternal caries risk factor

| Variables                  | P    | OR   | 95% CI         |
|----------------------------|------|------|----------------|
| Age                        | 1.000| 1.022| 0.52 – 2.00    |
| Education                  | 0.044| 2.38 | 1.01 – 5.64    |
| Family income              | 0.175| 4.76 | 0.62 – 36.33   |
| Maternal attitude          | 0.027| 2.67 | 1.19 – 5.99    |
| Maternal knowledge         |      |      |                |
| Cariogenic foods           | 0.061| 6.78 | 0.90 – 51.19   |
| Plaque removal             | 0.033| 3.52 | 1.04 – 11.93   |
| Brushing teeth             | 0.042| 3.72 | 1.08 – 12.06   |
| Noncariogenic foods        | 0.073| 4.11 | 0.95 – 17.78   |
| Periodical checking        | 0.155| 1.83 | 0.87 – 3.84    |
| Caries experience          | 0.03 | 4.78 | 1.76 – 12.98   |
| Plaque index               | 0.015| 2.87 | 1.27 – 6.53    |
| Saliva’s pH                | 0.500| 1.37 | 0.66 – 2.85    |

OR: Odds ratio; CI: Confidence interval
in children in this study are: How to drink bottle milk, maternal attitude, maternal knowledge about cariogenic foods, maternal knowledge about plaque’s removal, plaque’s index of children, saliva pH of children, bottle milk feeding, and white spot lesion.

**Discussion**

Many efforts have been made (promotion, preventive, and curative), but dental caries’ prevalence worldwide remains high. Dental caries prevention is not only supported by clinical symptoms and radiographic examination. There are many factors that cannot be seen in clinical examination but have already contributed to the dental caries incidence. These things are considered as dental caries risk factor. The detection of caries risk factors is an important step in dental caries prevention, as well as for selecting the treatment plan. The treatment plan strategy based on individual risk factors is a gold standard in minimal intervention.[13,14]

Caries risk assessment aims are as follows: (1) determine the etiological factors of current or future caries; (2) as a clinical diagnostic tool; (3) to motivate and educate the patient about their oral health status; (4) performing the treatment plan; and (5) determine the prognosis of disease.[15] The combination of clinical examination, detection of risk factors, and investigation are the proper step in caries prevention.

The variables examined for caries risk assessment in children in the study were selected based on expert discussions, literature reviews, clinical experience, and local community conditions. The question of caries indicators of children in this study instrument is an observation that indicates a carious symptom or an environment indicating that the child will likely have caries.

In the research, 18 caries risk factors have been selected, consist of 8 maternal caries risk factors and 10 children’s caries risk factors. Statistical analysis shows that in the final stage, 6 most dominant caries’ risk factors: bottle milk

| Table 2: Bivariate analysis of children’s caries risk factor |
|-----------------|--------|--------|--------|--------|--------|--------|
| Variables       | P      | OR     | 95% CI | Minimum | Maximum |
| Age             | 0.692  | 1.21   | 0.62   | 2.37    |
| Sex             | 0.035  | 2.11   | 1.04   | 4.24    |
| White spot lesion | <0.001 | 6.26   | 2.95   | 13.31   |
| Plaque index    | <0.001 | 20.95  | 8.47   | 51.86   |
| Saliva’s pH     | 0.015  | 3.87   | 1.32   | 11.31   |
| Brushing teeth  | 0.234  | 2.40   | 0.70   | 8.24    |
| Tooth paste     | 1.000  | 0.89   | 0.18   | 4.26    |
| Snacking habit  | 0.917  | 1.10   | 0.56   | 2.18    |
| Sweetened drink | 0.779  | 1.18   | 0.59   | 2.34    |
| Bottle milk feeding | 0.905 | 1.11   | 0.56   | 2.17    |
| How to drink bottle milk | 0.010 | 2.75   | 1.31   | 5.79    |

OR: Odds ratio; CI: Confidence interval

| Table 3: Multivariate logistic regression analysis Step 1 |
|-----------------|--------|--------|--------|--------|--------|--------|
| Variable        | B      | SE     | P      | OR     | 95% CI | Minimum | Maximum |
| Step 1          |        |        |        |        |        |         |         |
| Children’s age  | 0.456  | 0.498  | 0.360  | 1.58   | 0.59   | 4.19    |
| How to drink bottle milk | 2.232 | 0.840 | 0.008  | 9.32   | 1.80   | 48.37   |
| Tooth paste     | 0.132  | 1.025  | 0.898  | 1.14   | 0.15   | 8.51    |
| Snacking habit  | 0.287  | 0.521  | 0.582  | 1.33   | 0.48   | 3.70    |
| Sweetened drink | −0.139 | 0.535 | 0.795  | 0.87   | 0.30   | 2.48    |
| Maternal attitude | 1.475 | 0.651 | 0.023  | 4.37   | 1.22   | 15.65   |
| Maternal knowledge |        |        |        |        |        |         |         |
| Cariogenic food | 1.387  | 1.218  | 0.255  | 4.00   | 0.37   | 43.59   |
| Plaque’s removal| 1.287  | 0.292  | 0.120  | 3.62   | 0.71   | 18.39   |
| Brushing teeth timing | 0.044 | 0.810 | 0.956  | 1.05   | 0.21   | 5.11    |
| Noncariogenic foods | 0.756 | 0.960 | 0.431  | 2.13   | 0.32   | 13.97   |
| Periodical checking | 0.339 | 0.573 | 0.554  | 1.40   | 0.46   | 4.31    |
| Mother’s education | 0.475 | 0.643 | 0.460  | 1.61   | 0.46   | 5.67    |
| Family income   | 1.297  | 1.265  | 0.305  | 3.66   | 0.31   | 43.64   |
| Mother’s caries  | 0.143  | 0.931  | 0.878  | 1.15   | 0.19   | 7.15    |
| Mother’s plaque index | 0.651 | 0.548 | 0.235  | 1.92   | 0.66   | 5.61    |
| Mother saliva’s pH | 0.018 | 0.551 | 0.974  | 1.02   | 0.35   | 2.99    |
| Children’s plaque index | 3.082 | 0.697 | 0.000  | 21.81  | 5.57   | 85.42   |
| Children’s saliva’s pH | 2.073 | 0.804 | 0.010  | 7.95   | 1.64   | 38.41   |
| Milk bottle feeding | 1.560 | 0.820 | 0.057  | 4.76   | 0.95   | 23.71   |
| Gender          | 0.671  | 0.500  | 0.179  | 1.96   | 0.73   | 5.21    |
| White spot      | 1.112  | 0.588  | 0.058  | 3.04   | 0.96   | 9.62    |
| Constant        | −12.707| 2.896  | 0.000  | 0.00   |        |         |

Logistic regression. OR: Odds ratio; CI: Confidence interval; SE: Standard error
feeding, maternal attitude, maternal knowledge, plaque’s index of children, saliva pH of children, and white spot lesion.

**Bottle milk feeding and children’s caries**

Bottle milk feeding and infant formula are the most common foods consumed by infants and toddlers. Both contain many essential nutrients for the growth and development of infants and toddlers, including carbohydrates. The cariogenic carbohydrates in breast milk and formula are lactose. Children who consume breast milk or formula have the same caries risk. It depends on the habit of consuming milk and breast milk. The proper regulation of consuming and performing good oral hygiene will reduce the risk of caries.\(^{[15]}\)

**Mother’s attitudes and children’s caries**

Parents’ attitudes and behavior will affect their children. The mother’s attitude is mother’s opinion about oral hygiene. A good mother’s attitude toward oral health suggested a positive influence to her children. Wigen and Wang in their study state that parental attitudes toward oral health can influence their child’s behavior. This is in line with the results obtained in this study. Some conditions such as knowledge and sociocultural can affect beliefs and attitudes. Beliefs and attitudes can be modified and individually.\(^{[16]}\)

**Mother’s knowledge and children’s caries**

Mother with a good knowledge of oral health will certainly do things as she knows. Several factors will play a role such as economic problems, fear, health-care facilities, attitudes, and beliefs in the family. It is similar with Bozorgmehr et al., who mention in the research that factors such as education, employment, age, knowledge, attitudes, and behavior of mothers can affect their children’s oral health status indirectly.\(^{[17]}\)

Research by Jain et al., was reported that although mothers mostly agreed on regular dental visits, in reality, only a few of them had implemented this visit. This is due to the perception of fear, expensive medical expenses, less motivation, and willingness.\(^{[18]}\) Meanwhile, Oredugba et al. (2014) in the research states that the emphasis of health promotion on mothers cannot be excessive because most of their decisions regarding the health of their children remain based on their knowledge.

**Plaque index of children and children’s caries**

Plaque is the main cause of the dental caries. The more plaque accumulation, it will be to increase the risk of caries. Plaque is a thin layer attached firmly to the tooth surface and contains a collection of bacteria, and cannot be cleaned by rinsing. According to research conducted by Utami, said that dental plaque is a risk factor for the severity of dental caries in preschool student. Children with high dental PI had a 3.3 times greater risk for severe dental caries compared with low PI.\(^{[19]}\)

**Saliva pH of children and children’s caries**

Saliva buffer capacity is an important factor in caries process. Bicarbonate in saliva has the ability to dissolve into dental plaque which will neutralize the acid formation by microorganisms. The critical pH (5.5) is a pH in which all particles or saliva material cease and become saturated with calcium and phosphate. When the pH is below, the inorganic material of the tooth can dissolve. The content of bicarbonate in saliva can dissolve into dental plaque and can neutralize the acid that is formed. Therefore, in this study, the pH of salivary children has a significant relationship with the occurrence of caries in children.\(^{[20,21]}\)

**White spot lesion and children’s caries**

The initial sign of an invisible enamel caries lesion is a white spot lesion; therefore, white spot lesions are often a significant risk factor and play an important role in childhood caries. This phenomenon occurs due to loss of calcium phosphate from subsurface E-mail and is reversible. Dental images due to optical phenomena associated with enamel porosity. Children with lesions should be included

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| Table 4: Multivariate logistic regression analysis final step |
| --- |
| **Variable** | **B** | **SE** | **P** | **OR** | **95% CI** |
| **Step 14** | | | | | |
| How to drink bottle milk | 2.039 | 0.730 | 0.005 | 7.69 | 1.84 | 32.13 |
| Maternal attitude | 1.282 | 0.570 | 0.024 | 3.61 | 1.18 | 11.01 |
| Maternal knowledge | | | | | |
| Cariogenic foods | 1.679 | 1.183 | 0.156 | 5.36 | 0.53 | 54.47 |
| Plaque’s removal | 1.264 | 0.788 | 0.010 | 3.54 | 0.76 | 16.57 |
| Plaque’s index of children | 3.134 | 0.629 | <0.001 | 22.97 | 6.70 | 78.72 |
| Saliva’s pH of children | 1.881 | 0.715 | 0.009 | 6.56 | 1.62 | 26.67 |
| Bottle milk feeding | 1.573 | 0.710 | 0.027 | 4.82 | 1.20 | 19.39 |
| White spot | 1.205 | 0.533 | 0.024 | 3.34 | 1.17 | 9.49 |
| Constant | -8.911 | 1.698 | <0.001 | 0.000 | | |

Logistic Regression, Hosmer and Lemeshow test=0.770, AUC 0.879 95% 0.820–0.939. OR: Odds ratio; CI: Confidence interval; SE: Standard error; AUC: Area under curve
in high caries risk groups, as these pre-cavitation lesions indicate carious activity.[22,23]

Conclusions

Dental caries is a multifactorial disease. There are many factors which do not show clinical sign but contribute to the dental caries’ incidence. Those factors are considered as dental caries risk factor. Children’s caries risk is influenced by parents, especially mothers. Detection and identification caries risk factors in children are an important step in dental caries prevention.

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Conflicts of interest

There are no conflicts of interest.

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