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**ORIGINAL ARTICLE**

## **Caries Risk Profiles amongst Preschool Aged Children Living in the Sleman District of Yogyakarta, Indonesia**

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### **ABSTRACT**

**Objective:** To assess the caries risk factors of preschool aged children. **Methods:** Data was collected from a sample of 85 preschool children and their mothers. An interview, and a clinical and microbiology assessment was included in this study. Clinical examinations were performed to measure the dental caries experience and plaque visibility of the children and mothers. The presence and levels of *Mutans Streptococci* (MS) in the saliva was measured using a commercial kit by Dentocult SM and evaluated using the manufacturer's chart. **Results:** Sixty-five children had a high risk of caries (76.5%), 12.9% had a low risk, and 10.6% had a moderate risk of caries. Active cavities were found in more than half of the mothers and children. The majority of the child subjects had a snacking habit between meals (85.9%). High risk scores of 2 and 3, indicating salivary levels of MS, was found in 41.1% of children. Fluoride exposure experienced by the study population was very limited. **Conclusion:** Results suggest that the majority of the population had a high caries risk. There was a high occurrence of teeth with cavities in children and active carious lesions in the mothers. There was a high frequency in snacking habits, the presence of plaque and bleeding gums, high levels of salivary MS, and low protective factors for the children. Results suggest that management of caries related factors are needed in order to prevent caries in the future.

**Keywords:** caries experience, children, fluoride, MS, snacking habits

### **INTRODUCTION**

Whilst the prevalence of dental caries has declined in the general population over the past decades, dental caries continues to be a major health problem worldwide.<sup>1</sup> More than half of the children living in developing countries suffer from dental caries, particularly in several Asian and Latin American countries.<sup>2</sup> The Indonesian Ministry of Health reported that the national DMFT index was high at 4.6 and the dental health of Indonesian has not improved significantly since 2007 as outlined in the basic health research report.<sup>3,4</sup> The DMFT of Indonesia is greater than the worldwide average DMFT of 2.11, which was analysed from 190 countries that belong to the WHO region.<sup>5</sup> Based on this report, Indonesia was placed in the highest DMFT and caries risk categories along with India, Thailand, and Korea in the Southeast Asian region. It was found that of 152 preschool children in Serpong, a suburb area near the capital city of Indonesia, 70% suffered from

dental caries with a DMFT of 3.67.<sup>6</sup> It was reported that the caries experience of 1406 children aged 12 years in Yogyakarta was high, with a DMFT of 3.8.<sup>7</sup> Additionally, Yogyakarta, a densely populated province in Indonesia, has a higher caries experience (DMFT = 5.9) when compared with other provinces on the island of Java.<sup>3</sup> The high caries experience in Yogyakarta raises a question on whether prevention strategies have been carried out properly based on risk factors.

Dental caries is an intricate disease in preschool aged children that can become more complicated due to the characteristics of deciduous teeth, bacterial colonies, and the patterns of child behaviour.<sup>8</sup> There are several factors reported to contribute to dental caries, including the host, microflora, substrate, and time.<sup>9</sup> It was conveyed that genetic and biological factors, social and physical environment, health behaviours,

dental and medical care, and time, as a multilevel conceptual model on children's oral health, results in a complex interplay of causal factors in the prevalence of caries.<sup>10</sup> The process of dental caries begins at a very early age and progress steadily thereafter. An interventional program aimed at preventing caries in preschool aged children is needed urgently, by assessing the individual risk factors through caries risk assessment.<sup>11</sup> Caries risk assessment is the inference of the probability of developing a new dental caries lesion, within a particular timeframe, and also the estimation of the probability of an alteration in the size or activity of existing lesions in the mouth. Caries management by risk assessment (CAMBRA) has been used since 2007 and is scientifically proven to assess an individual's caries risk by altering the caries balance and assessment of risk factors for each individual.<sup>12-15</sup> Unfortunately, the study population of the present study of caries risk related factors of preschool aged children in Yogyakarta, Indonesia is limited. As such, the purpose of this study is to assess the caries risk factors of Yogyakarta preschool aged children, in order to help develop systematic approaches for preventive oral health programs and provide essential information for oral health promotion and public oral health care.

## METHODS

A cross sectional study, using a protocol approved by the Medical and Health Research Ethics Committee (MHERC) from the Faculty of Medicine, Universitas Gadjah Mada, Yogyakarta, Indonesia (KE/44/07/2014), was performed to assess the caries risk profile of preschool aged children. Bianglala Kindergarten, Playgroup, and Daycare, which is located in the Sleman District of the Special Province of Yogyakarta, Indonesia was randomly selected as the sample population. Due to the availability of resources, examination appointments could only be arranged for 100 mothers and their children. From the 96 mothers and children examined, only 90 mothers signed the informed consent forms for participation in this study (93.75%). Children with good general health were included in the study, whilst those who had erupted permanent teeth and those who were not cooperative and refused examinations were excluded from the study. As such, only 85 children were fit for inclusion in the study. Examinations consisted of the following steps; interview, clinical examination, and bacterial measurement based on a modification of the CAMBRA form.<sup>16</sup> Mothers completed the interview process in the classrooms prior to examinations. Personal interviews were completed by two trained research assistants, the questions included diet, fluoride program, feeding habits, tooth brushing habits, medical history, and dental treatment experience.

The clinical examinations were carried out by a licensed dentist using a mouth mirror and probe in

daylight. Clinical examinations, conducted according to the WHO's criteria, determined dental status by measuring the decayed, missing, and filled primary teeth of the children and the mother's permanent teeth.<sup>17</sup> The measurement of salivary *Mutans Streptococci* (MS) was done using a commercial system, Dentocult SM Strip Mutans test from Orion Diagnostica Espo, Finland. The colony density on the strips was compared with the standard interpretation chart (provided by the manufacturer) and the grading of the strips was recorded as a score of 0, 1, 2, or 3 by observing them with the naked eye.<sup>18</sup>

Following the data collection, caries risk assessment was performed to quantify the caries risk profile of the population. Based on CAMBRA, there are several categories of caries risk profiles ranging from low, moderate, high, to extremely high risk. No signs or symptoms and no risk factors are categorised in low risk. Moderate risk shows that there are active carious lesions that are non-cavitated. Additionally, a patient that has a positive caries balance diagnosis but several risk factors will also be included in this category. A patient who has at least one existing cavity that needs restorative treatment and active white spot lesions are grouped in high risk. If the patient does not have a cavitated lesion but has two or more high risk factors, they may also be included in this group. A patient with special needs or hyposalivation would be included in the extremely high risk category.

The data was recorded in clinical forms and questionnaires, which were then entered into a computer. Data analysis was performed using the statistical software package SPSS; Chicago, IL, USA, college station, version 20.

## RESULTS

A total of 85 children aged 2 to 5 years, together with their mothers, were included in this study. The majority of the children were male (61.2%) and the mean age of the children was 4.02 ( $\pm$  1.02), whilst the mean age of their mothers was 32.05 ( $\pm$  2.01). The majority of the mothers had a graduate level of education (82.4%) and there were no barriers in receiving information regarding oral health.

Table 1 presents information on the risk factors, disease indicators, and protective factors for dental caries. Overall, 75.3% of mothers had active dental decay in the past 12 months. The use of bottles containing liquids other than water and sugar showed in 35.3% of the population. Less than half of the children used bottles continuously (34.1%) and the same amount of children used a bottle at bedtime. Snacking habits between meals appeared in the majority of children (85.9%). The sample population did not live in a community that had a water fluoridation program. As such, the entire population did not consume water containing

**Table 1.** The frequency distribution of caries related factors based on CAMBRA

No	Factors	Yes (%)	No (%)
1	Caries risk indicators - Clinical examination on mother Mother had active dental decay in the past 12 months	75.3	24.7
2	Caries risk indicators - Parent interview Mother has low socio-economic status and/or health literacy (education status, health information)	0.0	100.0
3	Child has developmental problems (child with special health care needs) Caries risk indicators – Clinical examination on child	0.0	100.0
4	Restorations present in the last two years	2.4	97.6
5	Obvious white spots, decalcifications enamel defects or obvious decay present on the child’s teeth	76.5	23.3
6	Plaque is obvious on the teeth and/or gums bleed easily	50.6	49.4
7	Visually inadequate saliva flow Caries risk factors – Parent interview	0.2	98.2
8	Frequent (greater than three times daily) between-meal snacks of sugars/cooked starch/sugared beverages	85.9	14.1
9	Saliva-reducing factors are present, including: 1. medications (e.g., some for asthma or hyperactivity) 2. medical (cancer treatment) or genetic factors	0.0	100.0
10	Continual bottle use - contains fluids other than water	0.0	100.0
11	Child sleeps with a bottle, or nurses on demand Protective factors – Clinical examination on mother	35.3	64.7
12	Child drinks fluoridated water	34.1	65.9
13	Child’s teeth brushed with fluoride toothpaste (pea-size) at least 2x daily	0.0	100.0
14	Fluoride varnish in last six months	94.1	5.9
15	Mother/caregiver chews/dissolves xylitol chewing gum/lozenges 2–4x daily	2.4	97.6
		8.2	91.8

flouride, however the majority of the children brushed their teeth using flouridated toothpastes 2 times a day (94.1%). The majority of mothers did not consume gum containing xylitol (91.8%). A very limited number of children (2.4%) received topical applications of flouride in the last six months.

The caries experience of the mothers and children is represented by caries, missing teeth due to caries, and filled teeth. A vast majority of the children had cavities (76.5%) and Table 2 presents the caries experience of the children and their mothers. The mean dmft of the children was 5.31 ( $\pm$  5.04), with the d component being 5.09 ( $\pm$  5), the m component was 0.16 ( $\pm$  0.7), and the f component was 0.05 ( $\pm$  0.3). The caries experience of the children (dmft index) tended to increase by age (Figure 1). The mean DMFT of their mothers was 2 ( $\pm$  1.6), with the D component being 1.62 ( $\pm$  1.38), the M component was 0.34 ( $\pm$  0.72), and the F component was 0.34 ( $\pm$  0.24). Thick dental plaque and bleeding gums were found in more than half of the population (50.6%). In the salivary scores of MS, 22.4% were classed as a score of 0, whilst 36.5% had a score of 1, 28.2% had a score of 2, and 12.9% had a score of 3 (Table 3). According to CAMBRA, the majority of preschool aged children were in the high risk group (76.5%), 10.6% had a moderate risk of caries, and only 12.9% were in the low risk group.

## DISCUSSION

CAMBRA provides essential information relating to caries for determining prevention and treatment plans.

In the present study the prevalence of dental caries in the primary dentition was very high. These findings are similar to findings in the Philippines and China.<sup>19</sup> Moreover, carious teeth were largely left unattended. It was reported that clinical variables such as caries experience were the strongest predictor factors for the occurrence of caries in the future.<sup>20</sup> As such, there were a large number of teeth that suffered from caries in the sample population that should be addressed by oral health professionals. Additionally, it was reported that caries experience in mothers was one of the strongest predictors of caries experience in their children.<sup>21</sup> Previous study of 152 preschool aged children under 5 years and their mothers in Jakarta, Indonesia reported that only 30% children were caries free.<sup>6</sup> Whilst 90% of their mother had caries, with a DMFT of 7.8. In the present study, of the 61 children who had active carious lesions, 75.3% of their mothers had untreated caries.

Another contributing factor to dental caries is a diet high in sucrose. More than half of the study population exhibited poor diet choices and consumed high sucrose foods more than 3 times per day. Previous studies have found that the emergence of dental caries has a close relationship with the levels of sucrose consumed. It was shown that the emergence of caries in children 6 years of age was associated with the consumption of high sucrose diets starting at age 3.<sup>22</sup> In Yogyakarta, it was reported that oral health behaviour, particularly sugar consumption, was found to strongly cause dental caries when compared to dental visits and tooth brushing in subjects who received school based dental programs.<sup>7</sup>

The relationship between sucrose consumption and caries experience did not come from the amount of

**Table 2.** Caries experience status of children and their mother

Caries experience status	Mean (SD)
Children	
d-t	5.09 ( $\pm$ 4.92)
m-t	0.16 ( $\pm$ 0.72)
f-t	0.05 ( $\pm$ 0.31)
dmf-t	5.31 ( $\pm$ 5.04)
Mother	
D-T	1.62 ( $\pm$ 1.38)
M-T	0.34 ( $\pm$ 0.72)
F-T	0.04 ( $\pm$ 0.24)
DMF-T	2 ( $\pm$ 1.61)

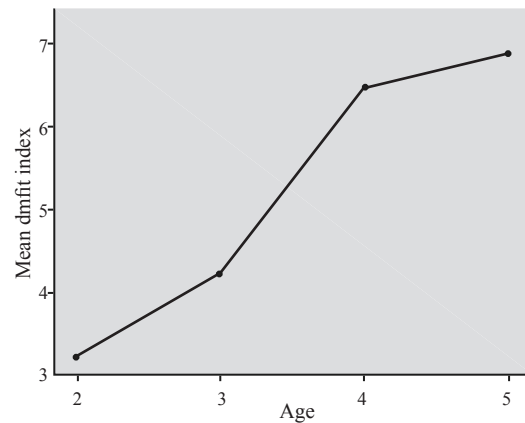
**Table 3.** Children's salivary score of *Mutans Streptococci*

Score	n	%
0 (<1x10 <sup>4</sup> CFU/ml)	19	22.4
1 (10 <sup>4</sup> -10 <sup>5</sup> CFU/ml)	31	36.5
2 (10 <sup>5</sup> -10 <sup>6</sup> CFU/ml)	24	28.2
3 (>1x10 <sup>6</sup> CFU/ml)	11	12.9

sucrose consumed but rather the frequency.<sup>23</sup> The frequency of consumption of snacks between meals has an important role in the aetiology of caries.<sup>24</sup> Sucrose has been identified as a cariogenic component that can be used by *S. mutans* to produce dextran. These chemical agents are used by bacteria to adhere to and colonise in the oral cavity. In addition, an increase in the frequency of consumption of snacks in between meals will increase the acidity of the plaque and the domination of natural aciduric bacteria.

Dental plaque and bleeding gums were found in more than half of the sample population and the majority of the study population brushed their teeth 2 times daily. The National Basic Health Survey reported that only a limited number of people brushed their teeth properly.<sup>3</sup> The occurrence of dental plaque, bleeding gums, and tooth brushing methods are important factors of dental caries experience and should be considered in caries risk profiles. A previous study reported that the presence of plaque on the teeth of children had a positive relationship with the colonisation of *S. mutans* and has shown to have an influence over early childhood caries (ECC) in children.<sup>25</sup> The number of *S. mutans* is a strong indicator for the occurrence of ECC.<sup>26</sup>

The results of the present study reveals that almost half of the sample population had a high risk of salivary MS colonies and the emergence of caries. The existence of colonies of *S. mutans* in saliva, as reported by Reich et al<sup>27</sup>, had a strong relationship with the presence of caries in the future. The early colonisation and higher amount of *S. mutans* in children may contribute to the development of ECC. The number of low scores



**Figure 1.** Distribution of dmft index based on children's age

in *S. mutans* count will result in lower predictions of the emergence of carious lesions in the future.<sup>27</sup> The colonisation of *S. mutans* in children had positive implications for the risk of caries.<sup>28</sup> There was a close relationship between *S. mutans* in saliva and dental plaque in preschool children with caries occurrence over a span of 6 months.<sup>29</sup> Therefore, the presence of higher scores of *S. mutans* in this study should be considered for prevention action.

Topical application of fluoride is an effective mechanism of caries prevention that involves inhibition of the demineralisation of enamel, improvement of the remineralisation processes, and inhibits the working mechanism of bacterial enzymes.<sup>30</sup> The use of fluoride tablets has also been confirmed by various studies as a good preventive measure. Research conducted in Sweden reported that the effect of parental assistance in tooth brushing and the use of fluoride tablets had a significantly beneficial effect on caries experience after 3 years when compared to the group who did not receive any intervention.<sup>31</sup> Maintenance of oral hygiene and the use of flouridated toothpaste twice daily are an important part of a comprehensive program for the control of caries in children.<sup>32</sup> The sample population was not a part of a community that had access to fluoridation programs and did not consume water containing fluoride. However, almost the entire study population (94.1%) had used fluoridated toothpaste.

The number of children who received fluoride varnish applications was very small. Thus, it can be concluded that the sample population's fluoride exposure was limited. As such, almost the entire population were classified in the high risk group. A longitudinal research conducted by Kraglund<sup>33</sup> in a 28 month period, reported that high caries risk groups have a very strong correlation with the emergence of caries. The result of the present study emphasises the importance of strengthening community based dental services for preschool aged children in Indonesia based on caries related factors.

There were certain limitations to the present study. As this research was a cross-sectional study, which was conducted on a modest sample size of 85 subjects, studies with larger sample sizes are needed in the future to endorse the results observed in this study. Future work with larger, more diverse populations and more complete information would be essential to complete our findings.

## CONCLUSION

The majority of the study population were found to be at a high risk of developing caries within the coming year. Based on data, the caries risk profiles were developed using the occurrence of a high number of teeth with cavities in children, active carious lesions in the mothers, a high frequency of snacking habits, the presence of plaque and bleeding gums, high levels of salivary MS, and lower protective factors in children. Prevention strategies need to be implemented in order to stop the disease progression based on the existence of risk factors. Thus, the management of caries related factors must be taken to prevent caries in the future.

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## CONFLICT OF INTEREST

There are no potential conflicts of interest, or any financial or personal relationships with people or organizations that could inappropriately bias the conduct and findings of this study.

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