RESEARCH ARTICLE

The relationship between caries risk assessment using the CAT-AAPD method and the incidence of caries in children

Mirza Fitria Yusfarani*✉, Nurdiana Dewi, Ika Kusuma Wardani***

*Faculty of Dentistry, University of Lambung Mangkurat, Banjarmasin, South Kalimantan, Indonesia
**Department of Pediatric Dentistry, Faculty of Dentistry, University of Lambung Mangkurat, Banjarmasin, South Kalimantan, Indonesia
***Department of Public Dental Health, Faculty of Dentistry, University of Lambung Mangkurat, Banjarmasin, South Kalimantan, Indonesia
*Jalan Veteran No. 12B, Banjarmasin, South Kalimantan, Indonesia; ✉ correspondence: mirzafitria@yahoo.com

ABSTRACT

South Kalimantan Province has a fairly high dental caries problems, and one region with this problem is South Hulu Sungai Regency with a percentage of cases of 45.56%. Dental caries is influenced by various risk factors, including socioeconomic status, eating habits, general health, fluorine use, saliva, and caries experience. Risk assessment of dental caries can be done using the Caries-Risk Assessment Tool by the America Academy of Pediatric Dentistry (CAT-AAPD). This study aims to analyze the relationship between caries risk assessment using the CAT-AAPD method and the incidence of caries in children aged 6-8 years in South Daha District, South Hulu Sungai Regency. This is an observational analytic study with a cross-sectional approach. The population of this study was children in South Daha aged 6-8 years. The total number of samples was 104 selected using the simple random sampling technique. High category caries risk was most common in children suffering from dental caries in a very high category with 64 respondents (53.3%). The results showed that there was a strong relationship (< 0.05) between caries risk assessment using the CAT-AAPD method and the incidence of caries in children aged 6-8 years. The higher the risk of caries, the higher the incidence of dental caries. Parents' increased awareness of maintaining children's dental and oral health is important to reduce cases of tooth decay caused by dental caries, and they can determine the treatments that should be undertaken.

Keywords: caries risk assessment; CAT-AAPD method; dental caries

INTRODUCTION

The biggest problem in dental and oral health that is often faced by residents of Indonesia and other developing countries is dental caries.[1] Dental caries is one of the most common chronic diseases at all ages, especially in children and adolescents.[2] Based on the results of the 2018 National Report on Basic Health Research (RISKESDAS), the percentage of dental caries problems in Indonesia was 45.3%, while the percentage of dental caries in Indonesia based on the age category of 5-9 years ranked first at 54.0%.[3]

South Kalimantan Province has a fairly high dental caries problem with a percentage of 46.9%. South Hulu Sungai District in South Kalimantan Province has a DMFT percentage of 45.56%, while in the age category of 5-9 years is 97.72%.[4] Based on age category, the percentage of decayed teeth (DT) is 56.16%, the percentage of missing or teeth extracted due to caries (MT) is 36.47%, and the percentage of filled teeth (FT) is 5.08%.[4,5] DMFT Index, which assesses dental and oral health status in dental caries problems, is 7.76.4 in South Hulu Sungai District.[6]

Dental caries is a multifactorial disease. The main factors of caries require a correlation between the main factors: host, microorganisms, substrate, and time.[7] Predisposing factors that cause caries include socioeconomic status, eating habits, general health, use of fluorine, saliva, and experience of caries.[8] The habit of consuming sweet foods is the biggest cause of caries because

foods containing carbohydrates can accelerate the occurrence of caries.[9] Dental caries can be prevented using caries risk assessment.[10]

Risk assessment of dental caries can be done using the Caries-Risk Assessment Tool by the America Academy of Pediatric Dentistry (CAT-AAPD). This method is carried out according to age groups: 0-3 years, 0-5 years, and > 6 years. This method is highly recommended because it can be used for preventive procedures or individual dental treatment for children. This method allows a caries risk assessment by assessing biological factors, protective factors, and clinical conditions. Biological factors include socioeconomic conditions, habit of eating sweet, and systemic diseases. Protective factors assess the fluoride program. Clinical conditions assess cavitated and non-cavitated lesions on the teeth.[11]

South Daha District is a sub-district located on the banks of Sungai Negara, and part of it is a wetland area surrounded by swamps and peat.[12] The amount of swamp water that flows into the river makes the water acidic, which has a major impact on the progression of dental caries.[13] The incidence of dental caries in South Daha District is very high. Based on the results of research conducted by Utami et al in Samuda Village of 8.20.14, South Daha sub-district is one of the target villages.[13] With regards to the above-mentioned background, we are interested in conducting research on the relationship between caries risk assessment using the CAT-AAPD method and the incidence of caries in children aged 6-8 years in South Daha District, South Hulu Sungai Regency.

MATERIALS AND METHODS

This is observational analytic research with a cross-sectional method. The population of this study was 120 children aged 6-8 years in South Daha District, Hulu Sungai Regency, who met the inclusion and exclusion criteria, were cooperative, and their parents agreed to sign the informed consent form. This research obtained an ethics approval from The Research Ethics Commission of The Faculty of

Table 1. Caries risk assessment indicators

Caries risk indicators	Low risk	Medium risk	High risk
Clinical condition	- No dental caries for 24 months - No enamel, demineralization (caries enamel, white spot lesion) - No plaque, no gingivitis	- Caries present for the past 24 months - One area of enamel demineralization present (caries enamel, white spot lesion) - Gingivitis	- Caries present for the past 12 months - One area of enamel demineralization present (caries enamel, white spot lesion) - Radiographic detection found enamel caries - Plaque present
Environmental characteristics	- Optimal state of fluorine users systemically (drinking water) and topically - Consumption of a small amount of sugar/ food closely related to the onset of caries, especially at meals - High socioeconomic status - Regular visits to the dentist	- Suboptimal conditions of systemic fluorine users (drinking water) and optimal in topical application users - Once in a while (once or twice) between meals exposed to simple sugar or foods strongly related to caries - Intermediate socioeconomic status - Irregular visits to the dentist	- Suboptimal use of topical fluoride - Frequent consumption of sugar or foods strongly associated with caries between meals - Low socioeconomic status - Active caries in mothers - Infrequent visit to the dentist
General state of health			- Children with special needs - Conditions that affect salivary flow

Dental Medicine, Lambung Mangkurat University Banjarmasin Number 052/KEPKG-FKGULM/EC/V/2022. The study was conducted during the COVID-19 pandemic, so health protocols using level 3 PPE were implemented. The tools included writing instruments, disposable diagnostic tools, caries risk assessment forms using the CAT-AAPD method, and DMFT and deft index measurement sheets.

The sample of this study was based on primary data. Data were obtained from questionnaires and oral examinations. The caries risk questionnaire using the CAT-AAPD method consisted of 13 questions, which were divided into 3 sections: biological factors, protective factors, and clinical conditions. Each question had a categorical column, namely low, medium, and high. Selection rating in the low category column was given a score of 1, selection in the medium category column was given a score of 2, and selection in the high category column was given a score of 3. The caries risk assessment indicator was used to determine the category (Table 1).[14,15]

The caries incidence can be assessed by directly examining the oral cavity to calculate the DMFT and deft indices. Assessment of the decay components was carried out on patchable dental caries, secondary caries that occurred in teeth with fillings, and teeth with temporary fillings. Assessment of missing/ extracted components was carried out on permanent teeth or deciduous teeth that were extracted due to caries and carious teeth with indications for extraction. Filled/ filled components assessment was carried out on the teeth with permanent fillings. For teeth

Table 2. DMF-T and def-t index assessment categories according to WHO

Category	Value
Very low	0.0- 1.1
Low	1.2- 2.6
Keep	2.7- 4.4
Tall	4.5- 6.5
Very high	> 6.6

assessment, teeth with DMFT/ deft numbers were summed up, and the results were categorized as follow (Table 2).[5,16] The resulting data were then collected, entered into a table, and calculated using SPSS (Statistical Package for the Social Science) program.

RESULTS

One hundred and twenty children aged 6-8 years old in Daha Selatan District, Hulu Sungai Selatan Regency participated in this study, which was conducted in May 2022. The sample characteristics were shown in Table 1. The largest population was 8-year-olds with a total number of 58 children (48.33%). Sixty-two were female (51.67%), and 58 were male (48.33%).

Caries risk assessment level used the CAT-AAPD method, as shown in Table 2. The highest category was 8 years old with 34 respondents (50%), and the lowest was 6 years old with 4 respondents (5.9%). Based on gender, the highest category was in males with 35 respondents (51.4%), while in females, 33 respondents were in the highest category (48.6%).

The results of the incidence of dental caries based on DMFT and deft indices scores are shown in Table 3. Tooth decay accounted for the majority of cases with 1,293 cases (97.95%), while the number of cases of filled teeth was the lowest with 0 case (0%). Meanwhile, there were 27 cases of missing teeth (2.04%).

The results of the statistical analysis using the gamma tests showed a significant value of 0.000 (< 0.05), indicating a correlation between caries risk assessment using the CAT-AAPD method and the incidence of caries in children aged 6-8 years in Daha Selatan District, Hulu Sungai Selatan Regency. The correlation value was 0.631, which showed that the relationship was strong and positively valued. The higher the caries risk, the higher the incidence of dental caries.

DISCUSSION

The results of the study showed that most respondents had caries risk. Some factors that

Table 3. Sample characteristics

	Variable	Total (N)	Percentage (%)
Age			
	6 Years	7	5.83%
	7 Years	55	45.83%
	8 Years	58	48.33%
	Total	120	100%
Gender			
	Download	62	51.67%
	Women	58	48.33%
	Total	120	100%

Table 4. Caries risk assessment level data using the CAT-AAPD method

Variable	Caries risk assessment		
	Low	Moderate	High
Age			
6 Years	0 (55.6%)	3 (8.3%)	4 (5.9%)
7 Years	10 (62.5%)	15 (41.7%)	30 (44.1%)
8 Years	6 (37.5%)	18 (50%)	34 (50%)
Total	16 (100%)	36 (100%)	68 (100%)
Gender			
Download	7 (43.8%)	20 (55.6%)	35 (51.4%)
Women	9 (56.2%)	16 (44.4%)	33 (48.6%)
Total	16 (100%)	36 (100%)	68 (100%)

Table 5. The results of the incidence of dental caries are based on DMF-T and def-t index scores

Category	Total (N)	Percentage (%)
Decay/ decay	1,293	97.95%
Missing/ extraction	27	2.04%
Filled/ filled	0	0%
Average	11	100%

placed the respondents at high caries risk were consumption of sugary foods or drinks more than 3 times a day, brushing teeth every day with fluoride toothpaste, having 1 interproximal caries lesion, and having an active white spot lesion.

The results of the study showed that a significantly high percentage of the respondents had a habit of consuming sugary food or drinks more than 3 times a day. High percentage of caries risk was due to excessive food and drink intake consisting of 4 meals and 3 snacks. Based on research by Setiawan et al. (2016), the habit of consuming sugary food or drinks more than 3 times a day is one of the problems that increases the risk of caries.[14] This indicates that children with a habit of snacking, the intake of sucrose is high. It has been reported by Tamrin et al. that there is a close relationship between the occurrence of dental caries and eating cariogenic foods. Cariogenic foods are fermented by bacteria and produce acids that cause cavities.[14]

Another factor that causes a high risk of caries was brushing teeth with fluoride toothpaste. The results of the study showed that a high percentage of the respondents brushed their teeth with fluoride toothpaste. Fluoride can slow down the development of carious lesions, increase enamel resistance to acid attacks, and improve the remineralization process, thus preventing the occurrence of dental caries.[15] Based on research by Mukhbitin (2018), the use of fluoride toothpaste when brushing teeth is much more effective than using non-fluoridated toothpaste. This is because fluoride-containing toothpaste can help remove food residue from the teeth and plaque that can cause dental caries.[16]

The other factors that caused a high caries risk were interproximal lesions and white spot lesions. This might be due to the wrong way of brushing teeth, and the timing of brushing teeth which was not fixed. Based on research by Setiawan et al. (2016), interproximal lesions and white spot lesions are other factors that cause a high caries risk.[14] The relationship between caries experience and future caries development can be a risk factor for caries. This is because the teeth of

Table 6. Data on the Relationship of Caries Risk Assessment Using the CAT-AAPD Method with Caries Incidence

Variable		Caries Incident					Sig. Value	Correlation Value
		Very Low	Low	Moderate	Low	Very High		
Caries Risk Assessment Using the CAT-AAPD Method	Low	0 (0%)	1 (50%)	3 (33.3%)	1 (9.0%)	11 (11.3%)	0.000*	0.631
	Moderate	0 (0%)	1 (50%)	6 (66.7%)	7 (63.7%)	22 (22.7%)		
	High	1 (100%)	0 (0%)	0 (0%)	3 (27.2%)	64 (66.0%)		
Total		1 (100%)	2 (100%)	9 (100%)	11 (100%)	97 (100%)		

*Gamma Test, p ≤ 0.05

children who have experienced caries tend to have a large number of cariogenic bacteria, which can infect other teeth that have not been infected with bacteria. However, the caries risk will be different if the teeth have been infected. Caries restoration is done by filling. Oral hygiene score is a risk factor because one of the etiologies of caries is bacteria that accumulate in plaque.[17]

The results of the DMFT and deft indices in children aged 6-8 years showed that most respondents had a very high level of dental caries. The measurement of dental caries was determined from the results of the completed dental status form by looking at the number of cavities, missing teeth, and fillings. These results indicated that 97.95% of respondents had cavities, 2.04% of respondents experienced tooth loss, and 0% of respondents had fillings. The average index score of DMFT and deft was 11, indicating a very high category.

This is in accordance with the data from the 2018 Riskesdas which reported that South Kalimantan Province had a fairly high level of dental and oral problems with a percentage of dental caries problems of 49.6%. Hulu Sungai Selatan, a district in South Kalimantan, showed dental caries problems of 45.56%.[6] The results of this study are also in line with the data from the 2013 Riskesdas, which showed that the prevalence of very underweight according to body mass index in children aged 5 to 12 years was the highest in East Nusa Tenggara Province by 7.8%.

This suggests that these children had nutritional problems and needed high-quality nutrition diet to prevent infectious diseases, including dental caries. The data reported DT score of 1.5, MT score of 1.7, FT score of 0.04, and DMFT score of 3.2 for children aged 12 years in East Nusa Tenggara. These results show that on average, children aged 12 years have 3 carious teeth. This figure is still far from the expectation of WHO (2001) that the DMFT index for children aged 12 years should not be more than 1 tooth per child. The mean DMFT score of children at SDI Kaniti, Kupang Regency had a very high caries incidence rate with 29 children (37.17%).[18]

Based on the results of this study, the level of dental caries by gender showed that most respondents who had a very high level of dental caries were boys (53.7%). The results of this study are in line with those of research conducted by Mukhbitin which found that boys experience dental caries more than girls with 26 children.[16] This might be because girls usually tend to pay more attention to the aesthetic aspects, such as beauty, cleanliness, and grooming, and therefore, are more concerned about the health of their teeth and mouth. By contrast, boys seem to place less emphasis on beauty, cleanliness, and grooming because in general they are prone to violent behavior, destruction and chaos.[19]

The level of dental caries by age showed that most respondents in our study had dental caries

levels that were in the very high category in the 7-year age group. Our findings are in line with those of research conducted by Mayasari which found that children aged 7 years have a very high caries incidence rate with 18 children. This is due to the increasing age in children. Children will have a higher caries risk when the last tooth erupts because it is difficult to clean the teeth when the teeth are erupting.[18]

Based on the results of our observations, many children in Daha Selatan Subdistrict, Hulu Sungai Selatan Regency, paid less attention to dental and oral problems, and did not carry out dental and oral hygiene and health care properly. Children often consumed sugary foods and drinks and brushed their teeth when bathing, even though they brushed their teeth properly.

The level of knowledge and behavior of parents also affect the behavior of maintaining oral health in children. Parental knowledge and behavior can maintain dental and oral hygiene. Parents' lack of knowledge about giving sweet foods and the development of dental caries leave children exposed to risk factors for dental caries more often. Since children are still dependent on their parents, maternal behavior is needed in supervising and teaching children to maintain dental and oral hygiene to prevent dental caries. [20]

The results showed that caries risk in the high category was mostly found in children who suffered from very high category dental caries. We obtained a correlation value of 0.631, indicating a strong relationship and a positive value. The higher the caries risk, the higher the incidence of dental caries.

The results of this study are consistent with those of Angel which reported that high caries risk is associated with high caries incidence. This suggests that children who are at high caries risk should receive special attention. Intensive and extra care can help eliminate caries or at least reduce the occurrence from high levels of caries to low levels. A better preventive measure is primary prevention by modifying a child's habits and protecting the teeth.[21]

The results of this study corroborate the findings of research conducted by Lubis which found a relationship between caries risk assessment according to AAPD and caries experience. This is because children considered to be at low risk have a low mean deft, and the average deft increases as the child's caries risk increases. This is in accordance with a theory which states that the level of caries risk can be measured using deft.[22]

There were obstacles to conducting this research. Local residents feared seeing the researchers who wore masks because the majority of the residents in Daha Selatan Subdistrict, Hulu Sungai Selatan Regency did not wear masks during their daily activities and assumed the researchers were vaccination officers who wanted to force vaccination. There was a refusal by prospective respondents when the researchers tried to explain the aims and objectives of the study because previous cases of fraud in the sale of herbal medicines by fake health workers caused some prospective respondents to feel uneasy.

CONCLUSION

This research has shown the relationship between caries risk assessment using the CAT-AAPD method and the incidence of caries in children aged 6-8 years in South Daha District, South Hulu Sungai Regency. Increasing parental awareness of the importance of maintaining the health of children's teeth and mouth to reduce cases of tooth decay caused by dental caries should be a priority. Parents can also determine the treatment to be followed.

CONFLICT OF INTEREST

The authors declare no conflict of interest with the data contained in the manuscript.

REFERENCES

1. Handayani R, Safitri M. The relationship between dental care and the incidence of dental caries in the working area of the Padang Freshwater Health Center in 2016. Ners Journal of Nursing. 2016; 12(2): 194. doi: 10.25077/njk.12.2.193-200.2016

2. Barahama F, Masie G, Hutauruk M. The relationship of dental and oral hygiene care with the incidence of caries in children at SD Gmist Smirna Kawio, Marore Islands District, Sangihe Regency. e- Journal of Nursing. 2018; 6(2): 1-7. doi: 10.35790/jkp.v6i2.21574

3. Ministry of Health of the Republic of Indonesia. National Basic Health Research. Research and Development Agency of Tenaga Kesehatan: Jakarta; 2018.

4. Ministry of Health of the Republic of Indonesia. National Basic Health Research. Tenanga Kesehatan Research and Development Agency: South Kalimantan; 2018.

5. Dewi PK, Aripin D, Suwargiani AA. DMF-T and DEF-T Index for Children in Mekarjaya State Elementary School (SDN), Cimenyan District, Bandung Regency. Padjajaran J Dent Res Student. 2017; 1(2): 122-129.
doi: 10.24198/pjdrs.v2i2.22311

6. Listrianah, Zainur RA, Hisata LS. Description of permanent first molar tooth caries in students of State Elementary School 13 Palembang in 2018. JPP (Palembang Poltekkes Health Journal). 2018; 13(2): 136-149.
doi: 10.36086/jpp.v13i2.238

7. Reca. The relationship between types of hawker food and caries status in students of SDN Lampreuneurut Aceh Besar. Journal of Averrous. 2018; 4(2): 1-9.
doi: 10.29103/averrous.v4i2.1036

8. Pasaribu KO. Risk assessment of caries according to AAPD in Children under 2 years old in Medan Tuntungan and Medan Johor sub-districts. 2017; 1(2). Available at https://123dok.com/document/ye8kkr7y-penilaian-risiko-karies-menurut-dibawah-tahun-kecamatan-tuntungan.html.

9. Erlin T, Saptarini R. Infant oral care program in early childhood caries preventive efforts. Journal of Indonesia Dental Association. 2018; 1(1): 37- 41. Available at: http://jurnal.pdgi.or.id/index.php/ijpd/article/view/314.

10. Nadia, Widodo, Hatta I. Perbandingan indeks karies berdasarkan parameter kimiawi air sungai dan air PDAM pada lahan basah Banjarmasin. Dentin Journal of Dentistry. 2018; 2(1): 13- 18.
doi: 10.20527/dentin.v2i1.403

11. Utami NK, Bainah, Pahruddin. Perbedaan rata-rata DMF-T pada masyarakat yang mengkonsumsi air minum kemasan isi ulang dan air sungai yang diendapkan. Journal of Environmental Health. 2020; 17(1): 43- 48.
doi: 10.31964/jkl.v17i1.221

12. Dahlan MS. Statistik untuk kedokteran dan kesehatan: deskriptif, bivariat, dan multivariat dilengkapi aplikasi dengan menggunakan SPPS. Seri Evidence Based Medicine 1. Edisi 3. Salemba Medika; 2019.

13. Sundari P, Suwargiani AA, Wardani R. Perbedaan risiko pada anak usia 11-12 tahun di SDN Sirnagalih dan SDN Cibeusi Kecamatan Jatinangor. Pedjadjaran J Dent Res Student. 2018; 2(1): 23- 30.
doi: 10.24198/pjdrs.v3i1.21432

14. Setiawan EM, Sasmita IS, Riyanti E. Hubungan status ekonomi keluarga dengan resiko karies gigi usia 6-12 tahun. J Ked Gig. 2016; 28(2): 1- 8. doi: 10.24198/jkg.v28i2.18705

15. Hayat NFA, Sugito BH, hadi S. SLR: systemic and local use of fluorine against the prevention of dental caries. Scientific Journal of Dental Nursing (JIKG). 2022; 3(1): 130- 146. doi: 10.37160/jikg.v3i1.878

16. Mukhbitin F. Gambaran kejadian karies gigi pada siswa kelas 3 MI Al-Mutmainnah. Jurnal Promkes. 2018; 6(2): 155-166. Available at https://e-journal.unair.ac.id/PROMKES/article/viewFile/6745/6021.

17. Neves AB, Loboo LA, Pinto KC, Pires ES, Requejo MEP, Maia LC, Antonio AG. Comparison between clinical aspects and salivary microbial profile of children with and without early childhood caries: a preliminary study. J Clin Pediatr Dent. 2015; 39(3): 209-214. doi: 10.17796/1053-4628-39.3.209

18. Fankari F. Relationship between the Incidence Rate of Dental Caries and the Nutritional Status of Children Aged 6-7 Years at SD Inpres Kaniti in Central Kupang District, Kupang Regency. Journal of Health

Information. 2018; 16(1): 32-34.
doi: 10.31965/infokes.Vol16.Iss1.167

19. Mbipa MM, Pay MN, Manu AA, Nubatonis MO. Differences in the incidence rate of dental caries (DMF-T) between men and women aged 12-14 years. Dental Therapist Journal. 2019; 1(1): 23- 27.
doi: 10.31965/dtj.v1i1.355

20. Ulfah R, Utami NK. Hubungan pengetahuan dan perilaku orang tua dalam memelihara kesehatan gigi dengan karies gigi pada anak taman kanak - kanak. An-Nadaa: Jurnal Kesehatan Masyarakat. 2020; 7(2): 146-150.
doi: 10.31602/ann.v7i2.3927

21. American Academy of Pediatric Dentistry. Policy on Use of a Caries- Risk Assesment Tool (CAT) for Infant, Children, and Adolescent, American Academy of Pediatric Dentistry. 2019; 243- 247.

22. Mayasari Y. Hubungan faktor risiko karies gigi dengan status karies gigi pada anak usia dini (Studi pada TK Pelita Takwa, Pondok Betung, Tangerang Selatan). e-GiGi. 2021; 9(2): 266-272. doi: 10.35790/eg.v9i2.35013