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RISK FACTORS FOR DENTAL CARIES IN SCHOOL CHILDREN: A SYSTEMIC STUDY

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Abstract:
Caries tooth is multifactorial disease that is most often found in school-age children. Risk factors that need attention are age, gender, fluoride levels, role of parents, eating sweet habits and level of parental knowledge. This systematic study aims to describe the relationship between risk factors and the incidence of dental caries in school children. Search article done through the Garuda Indonesia Portal database, Scholar, Scopus, and Scene Direct and Pubmed in June 2023. The inclusion criteria were research with an observational study design and a focus on the relationship of risk factors (age, sex, fluoride levels, parental roles, eating sweet habits and level of parental knowledge) with dental caries in school children, published between 2018-2023. There are 8 articles reviewed. Risk factors such as age, gender, fluoride levels, role of parents, sweet eating habits and level of parental knowledge have been shown to be associated with an increased risk of dental caries in children. school. Age, type gender, fluoride level , role of parents, habit of eating sweet and level of knowledge of parents increase the risk of dental caries in children.

Keywords: Dental Caries, School Children, Multifactoral

INTRODUCTION

Caries is a disease that affects many children, especially aged 6 to 9 years. At the age of 6 years the permanent molars have started to grow so that they are more susceptible to caries and the age of 9 years is the mixed dentition period where the number of permanent teeth and primary teeth in the oral cavity is almost the same, namely 14 permanent teeth and 10 primary teeth (Silaban, 2013).

Dental caries is a multifactorial disease of tooth tissue that begins with tissue damage that starts from the tooth surface such as in the pits, fissures, and interproximal areas and then extends towards the pulp (Perniti, 2020). Everyone can experience dental caries and can also arise on one or more tooth surfaces, and can extend to deeper parts of the teeth. There are

several factors that cause dental caries, including carbohydrates, microorganisms and saliva, tooth surface and anatomy (Manoy et al., 2015a).

Caries in the permanent first molars is the main cause of the high prevalence of extraction due to the fact that the first molars are the first teeth to erupt so that children's behavior in maintaining dental health is still lacking, and the anatomical shape of the first molars which have pits and fissures which become a resting place for leftovers. food (Manoy et al., 2015).

Tooth decay due to caries occurs due to the intake of carbohydrates which have a low molecular weight such as sugar, so that they seep into the plaque and are metabolized quickly by bacteria. [3,4] Factors that play a role in the process of caries, include the process of resilience of tooth tissue, bacteria, food sources such as carbohydrates, tooth protective factors such as saliva, and its components, and time. In addition, there are also external risk factors, namely oral hygiene, education level, economic level and nutritional status (SETIAWAN, 2021).

Water is also an important component in dental and oral health because several chemical parameters are thought to affect dental health, including the elements fluoride, potassium, calcium, and the acidity (pH) of water (Perniti, 2020). Components and levels of dissolved substances in water are closely related to the type of water source that is good for dental health. Drinking water consumed by the public, must meet the quality and quantity requirements. Water quality parameters that are determined consist of physical, bacteriological, radioactive and chemical parameters. Several chemical parameters are thought to affect dental health, including fluoride, potassium, calcium, and the acidity (pH) of water (Putri & Abdullah, 2019).

Fluoride (F) in small amounts (0.5 mg/L water) is needed as the most effective prevention against dental caries without damaging health (Sutrisno, 2010). The concentration of fluoride in water is closely related to the type of water source. In general, fluoride concentrations in groundwater and surface water exceed the above requirements. In contrast, other types of clean water sources, such as rainwater, contain very little fluoride in water and can cause dental caries, so water fluoridation is necessary.

Dental caries often has an impact on children. One of the impacts most often experienced by students when they experience dental caries is the disruption of the child's learning concentration and affects the child's attendance at school (NUGROHO, 2019). This causes a decrease in children's performance in school. Another impact of dental caries is reduced appetite so that it can interfere with the growth and development of children (Nurwati, 2019). This will also affect the nutritional status of children and have implications for the quality of resources. On the other hand, efforts to prevent dental and oral diseases in Indonesia are considered ineffective. The number of cases of tooth and mouth pain is high and tends to increase, especially in children (Rosihan, 2015).

Existing research suggests that the role of the mother, level of education, quality of drinking water and the habit of eating sweets and how to brush their teeth in school children are related to the incidence of dental career, but the contribution of fluoride content and Ph value

in rainwater to the incidence of dental caries in children is still unclear. Based on this description, this systematic review aims to collect the results of previous research on the relationship between risk factors for dental caries in school children.

METHOD

This study uses a systematic review method, to summarize the results of previous studies. Sources of data come from national journals and international journals. A search for journals used as review material was carried out using the keywords 'Risk Factors and dental caries' for Indonesian-language journals, while for English-language journals the keywords “Risk Factor”, “Children” and “Dental Caries” were used. A search for international journals was carried out through the Scopus, SceneDirect, Pubmed databases. National journal searches are carried out through the Garuda Portal and Google Scolar.

The selection of articles is also based on the research design used, namely observational. Article sorting begins with skimming the title, then reviewing abstracts that are relevant to the research topic. From a total of 294 articles, 22 articles were found to be appropriate. Furthermore, a full text review was carried out where articles were sorted based on inclusion and exclusion criteria. The inclusion criteria in this study were 1) Articles published in 2023-2018, 2) Articles with the type of observational research, 3) The dependent variable in the research article was the incidence of dental caries in children, 4) The independent variable in the research article was the role of the mother, Quality of drinking, level of knowledge, educational level of parents, economic level and cariogenic. Exclusion criteria were articles that did not clearly describe the risk factors for dental caries. After conducting a full text review, there were 8 articles that met the criteria. The flow chart for sorting articles can be seen in Figure 1. The next step is to conduct a critical review to assess the quality and relevance of the literature found. Guidelines used.

Guidelines used is Critical Appraisal Tools from The Joanna Briggs Institute (JBI). The data/information obtained from the article will be recapitulated and presented in the form of a synthesis matrix table. The analysis is presented in narrative form.

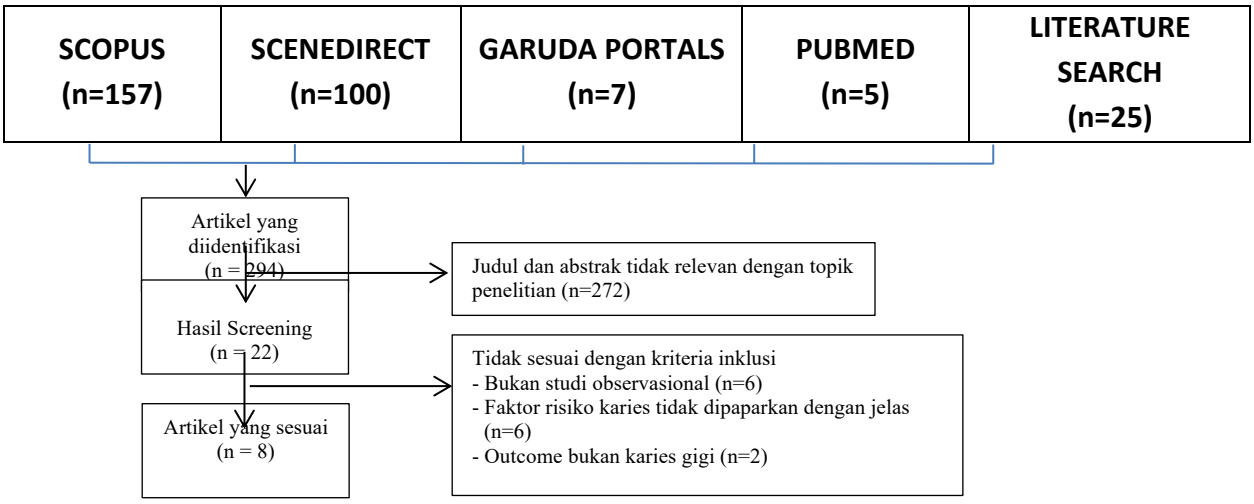

Figure 1 Article selection flowchart

RESULT AND DISCUSION

The research location of all the articles reviewed is in the Asian region. Three studies were conducted in Indonesia, and one study each was conducted in China, Saudi Arabia, Egypt and Hong Kong, Nigeria and Indonesia. The majority of research locations from the articles reviewed are developing countries.

The type of research in the articles studied is analytic observational. All articles use a cross sectional design. Based on a review of the 8 selected articles, the number of samples in the study varied, ranging from 24 to 3871. All study subjects were aged between 3 and 12 years, and the majority of research subjects were children aged 6-12 years. There is one study with children aged 3-4 years. Measuring tools or instruments used in research related to risk factors for dental caries and in all articles used structured questionnaires and dental and oral health medical examinations. Not all articles mention that the questionnaire used has been tested for validity and reliability.

In the Zidong Zang study, the questionnaire used was adapted from previous research and modified according to the conditions at the research location. Determination of the incidence of dental caries is determined based on the diagnosis of dentists and paramedics, so that objectivity is not disturbed. Measurement of risk factors using a questionnaire, and assessed based on several variables.

Based on the results of a review of the 8 selected articles, all articles stated that age, child sex, parental educational level, economic status, role of parents, knowledge about dental caries, levels of water fluoride and pH, eating sweet habits, how to brush your teeth were significantly related. with the incidence of dental caries in children, seen from the results of statistical analysis in each study which showed that the p value <0.05, or the OR value and the lower and upper limits of the 95% CI value were more than 1. The habit of eating sweets was assessed as a factor significant risk of childhood pneumonia. The magnitude of the risk of developing dental caries in

children is due to several factors, both internal and external. External factors as mentioned above are indicated by the OR value. The OR values for each of the articles studied varied (Table 1).

Table 1 Article Findings

First Author & Year	Location	Method	Population and Subjects	Findings	Uniqueness
Zhidong Zhang 2023 [10]	Gansu Province, China	Cross Sectional Interview and examination of dental caries	3871 youth aged 12-15 years	Female students, living in rural areas, frequency of visits to the dentist, and experience of toothache were risk factors for dental caries, with ORs ranging between 1.280 and 3.831 (P<0.05).	Female students who live in rural areas are more at risk of dental caries than those who live in urban areas.
Rasuna Ulfah 2018 [11]	Banjar Regency, South Kalimantan	Cross Sectional Interview and examination of dental caries	136 School children	Logistic regression test showed that three variables that had a significant relationship and were risk factors for dental caries were sweet food consumption (p = 0.000; OR = 16.980),	Level of mother's knowledge of the incidence of dental caries in school children.

				dental and oral hygiene (p = 0.000; OR = 62.126), mother's knowledge = 0.009 ; OR = 9, 927) and the factor that most influences the incidence of dental caries is the habit of maintaining oral hygiene (OR = 62,126).	
Maha El Tantawi, 2019 [12]	Egypt	Cross Sectional Interview and examination of dental caries	450 children (246 families, seven villages],	Child age was significantly associated with the incidence of caries (B = -0.48, p < 0.001) and gingival inflammation (B = 0.032, p < 0.001). Children who brushed their teeth twice a day had a more significant incidence of caries (B = 1.04, p = 0.01)	Children who brush their teeth twice a day have caries incidence.

Morenike Oluwatoyin Folayan 2022 [13]	Nigeria	Cross Sectional Interview and examination of dental caries	1233 children Age 6 – 11 Years.	Children who have never used fluoride toothpaste have a higher chance of developing dental caries to severe gingivitis (AOR; 1.671; 95% CI: 1.003–2.786; p=0.049). Children of middle socioeconomic status have significantly lower probability of moderate to severe gingivitis (AOR: 0.573; 95% CI: 0.330–0.994; p=0.048).	Children with middle socioeconomic status are not at risk of severe dental caries (gingivitis).
Fatin Nur Jauhara, 2021 [14]	South Tangerang	Cross Sectional Interview and examination of dental caries	107 Student	knowledge level of dental health maintenance with the incidence of dental caries showed p=0.01. PR value=3.93	There is a significant relationship between tooth brush change period

				(95% CI=1.66-9.27 How to brush your teeth is related to the incidence of dental caries with p=0.02 the frequency of dental check-ups showed p=0.14 (p>0.05) toothbrush replacement period with the incidence of dental caries with p=1.00.	
Angga Prawira Kusuma 2020 [15]	Selan River, Central Bangka Regency	Cross Sectional Interview and examination of dental caries	24 Students	cariogenic food consumption and tooth brushing frequency had a significant effect p=0.001 and p=0.002 at the 0.05% level.	Cariogenic effect on the incidence of dental caries
Zakiyah Yasin 2020 [16]	Sumenep Regency	Cross Sectional Interview and examination	30 respondents	Tooth brushing technique factors affect dental caries in school-age	Dental care affects the incidence of dental caries in elementary

		of dental caries		children with a significance of 0.000 <0.05. Dental treatment factors affect dental caries in elementary school-age children due to the significant results of 0.002 <0.05.	school children.
Pei Liu 2023 [17]	Hong Kong	Cross Sectional Interview and examination of dental caries	741, Children aged 3 -4 Years	The prevalence of children with NC (Carries Noncavitation) and CL (Carries Lesi) was 29.1% and 49.4%, respectively, with an early childhood caries prevalence of 78.5%. The highest proportion of children brushing their teeth twice or more than twice a day was in CF (Carries Free)	Poor oral hygiene and poor oral health knowledge and attitudes of parents are associated with the presence of lesions or cavities .

		(71.7%), followed by NC (58.3%), and the least was in CL (57.7%). A higher percentage of CL children (56.2%) had twice or more than twice the frequency of snacking between meals than CF children (41.7%) and NC (41.1%) (P < 0.001).	

Table 2 Result Synthesis Matrix

No.	Main idea	Similarity of Findings	Source
1	Level of knowledge of parents about dental and oral health	The results of existing research reveal that the level of parental knowledge is a risk factor for school children's dental caries	Source 1 - 8
2	Demographic location	The results of existing studies reveal that demographic location is a risk factor for dental caries.	Source 1
3	Age factor on dental caries	The results of existing studies reveal that age is a risk factor for dental caries.	Source 3 and 4
4	Tooth brushing technique and dental care	The results of existing research reveal that tooth brushing technique and dental care are risk factors for dental caries.	Source 3,5,6,7,8

5	Habit of consuming cariogenic food	The results of existing studies reveal that cariogenic food is a risk factor for dental caries.	Source 6 and 8

Dental caries often has an impact on children. One of the impacts most often experienced by students when they experience dental caries is the disruption of the child's learning concentration and affects the child's attendance at school. This causes a decrease in children's performance in school. Another impact of dental caries is reduced appetite so that it can interfere with the growth and development of children. This will also affect the nutritional status of children and have implications for the quality of resources. On the other hand, efforts to prevent dental and oral diseases in Indonesia are considered ineffective. The number of cases of tooth and mouth pain is high and tends to increase, especially in children (Wala, 2014).

In general, children who experience caries occur from the age of 6-12 years because at this age they like to snack on sweet and sticky foods and drinks both at school and at home according to their wishes. Teeth Children at this age are very vulnerable to dental and oral health because at the age of 6-12 years there is a transition or change of teeth from baby teeth to permanent teeth. For this reason, special attention is needed regarding oral health so that growth and development can be maintained properly (Erris & Rosiana, 2017).

Dental caries occurs due to a number of factors (multiple factors) that influence each other, namely the four main internal factors, namely teeth, saliva, microorganisms and substrate and time as an additional factor. According to (Kidd and Bechal, 2013) the four factors are described as a circle, if the four factors overlap, dental caries will occur. In addition, dental caries is also influenced by factors which are indirectly referred to as external factors or external factors, namely behavior, environment, health services and heredity.

From the results of research conducted by Erris, the value of OR = 5.556 means that respondents who consume rainwater have a chance of experiencing caries 5.556 times compared to respondents who do not consume rainwater. respondents who suffer from dental caries because most of the respondents consume rainwater as a source of drinking water. One of the ingredients contained in rainwater is fluorine if the fluorine content is low in rainwater it will trigger caries.

Fluorine is an important element in the formation of teeth and bones. Fluorine is a mineral that naturally occurs in all water sources, including sea water. Fluorine is never found free in nature; it combines with other elements to form fluoride compounds. The recommended optimum concentration of fluoride in drinking water is 0.7-1.2 ppm. Indications for the use of fluorine are children under 5 years who have a moderate-to-high risk of caries, teeth with exposed root surfaces, sensitive teeth, children with motor

abnormalities, making it difficult to clean teeth (example: Down *syndrome*), and patients undergoing *orthodontic treatment* (Utami, 2018).

People who consume water sources with low fluorine content for >10 years have a higher DMF-T than those who consume them for 5 years or 10 years. This is because dental caries is a multifactorial dental disease and the demineralization process that occurs is also a factor that takes a long time to occur in the oral cavity. The frequency of caries can be affected by the levels in drinking water. Fluorine can help rebuild calcium and *phosphate minerals* in the teeth so that the demineralization process in the teeth can be stopped. However, if people consume water sources with low levels of fluoride every day, both for drinking and brushing their teeth, then for a period of more than 3 years the low fluoride content in the water consumed can be one of the factors causing caries (Fahmi et al., 2021).

Dental caries in children is a multifactorial disease, caused by various determinants and risk factors. 1 These risk factors include family environment, socio-economic, culture, utilization of dental health services, education, oral hygiene and environmental factors. 4 Risk factors for dental caries include salivary factors, dietary factors, fluoride factors, biofilm and dental plaque factors, and modification factors. The incidence of caries is influenced by oral hygiene, dental plaque will form if a person does not maintain proper oral hygiene (Fahmi et al., 2021).

From the results of Sri Utami's research, the OR value for the frequency of tooth brushing factor was 6.5 so that it can be stated that children who rarely brush their teeth have a 6.5 times greater risk of suffering from caries than children who brush their teeth frequently. The results of the descriptive analysis showed that the incidence of dental caries tended to be more in boys than girls and was most frequent at the age of 5 years. The results of bivariate and multivariate tests showed that dental plaque, salivary pH and tooth brushing frequency were related and were risk factors for children's dental caries (Ihsanti, n.d.).

Damage to the teeth such as caries, malocution, dental plaque, tartar, can affect the health of other members of the body, even if a child's teeth hurt, it is likely that the child's appetite will decrease, this needs to be considered early by parents. The role of parents in providing educators, motivators and facilitators to children so that children can maintain oral hygiene.

Parents, especially mothers, must know how to care for their child's teeth and must also guide their children on how to brush their teeth properly and correctly. However, many parents think that baby teeth are only temporary and will be replaced by permanent ones, so they often think that damage to baby teeth caused by poor oral hygiene is not a problem (Salsabila & Widhianingsih, 2022) (Suciari et al., 2015).

Research conducted by Ihsanti et al stated that there was an average DMF-T index value for river water users higher than for those using mountain water. In their research, Ihsanti et al also stated that the water used for drinking should have a neutral pH (7). This is

also in accordance with the research of Widyaningtyas et al which states that remineralization can occur when the pH is neutral (pH 7). The pH of water in the acidic category can accelerate the caries process. According to Musadad and Irianto in their research, the use of acidic water can have a negative impact on dental and oral health because it can cause demineralization of tooth enamel and cause the formation of holes or cavities in the teeth (Rahayu, 2014).

CONCLUSION

Dental caries is a multifactorial disease with risk factors as a cause of dental caries, both internally and internally. Internal factors related to the incidence of dental caries in school children in this study were age, gender, fluorine content of drinking water, pH of drinking water, level of parental knowledge, habit of brushing teeth, role of parents. The results of this systematic study are expected to be the basis for further research related to the incidence of dental caries,

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