Nuzulisa Zulkifli, Association of Early Childhood Caries and Nutritional Status Among 5-Year-Old Children in Indonesia:. Journal of Health and Dental Sciences.e-ISSN 2807-3126 Vol. 02 No. 02: pp. 235-256

ASSOCIATION OF EARLY CHILDHOOD CARIES AND NUTRITIONAL STATUS AMONG 5-YEAR-OLD CHILDREN IN INDONESIA

(HUBUNGAN EARLY CHILDHOOD CARIES DENGAN STATUS GIZI ANAK USIA 5 TAHUN DI INDONESIA)

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JHDS.unjani.ac.id/jite
Doi: 10.54052/jhds.

Article History
Received:23/07/2022
Accepted: 07/08/2022

ABSTRACT

Oral health and nutrition problems in children cannot be separated. Both share the same risk factors. The high prevalence of malnutrition and Early childhood caries (ECC) in developing countries, especially in Indonesia, still needs attention. This study aims to analyze the relationship between ECC and the nutritional status of children aged five years in Indonesia based on the 2018 Riskesdas data. The study used a cross-sectional study using secondary data from Riskesdas 2018. A sample of 701 children aged five years was subjected to clinical examinations and questionnaires. ECC as the independent variable and other risk factors; self-reported oral health, gender, mother's education level, father's employment status, family economic status, children's dietary practices, and utilization of health facilities were analyzed against nutritional status based on weight/height categories converted by

Z-score. Results showed that the chi-square test showed a significant correlation between ECC, maternal education level, family economic status and dietary practices at risk of children on nutritional status (p-value <0.05). Multinomial logistic regression test proved a significant correlation between ECC and wasting (OR = 1.352, 95% CI: 0.989 – 2.589). ECC is not correlated with obesity. The conclusion is ECC can cause wasting in children. Meanwhile, several risk factors for nutritional problems and dental caries were similar.

Keywords: dental caries; early childhood caries; malnutrition

ABSTRAK

Masalah kesehatan gigi dan gizi pada anak tidak dapat dipisahkan. Keduanya berbagi faktor risiko yang sama. Masih tingginya prevalensi malnutrisi di negara berkembang khususnya di Indonesia yang disertai dengan tingginya prevalensi Early Childhood Caries (ECC) pada kelompok anak perlu menjadi perhatian khusus. Tujuan penelitian adalah menganalisis hubungan ECC dengan status gizi anak usia lima tahun di Indonesia berdasarkan data Riskesdas 2018. Metode penelitian adalah penelitian cross sectional menggunakan data sekunder Riskesdas 2018. Sampel 701 anak usia lima tahun yang dilakukan pemeriksaan klinis dan kuesioner. ECC sebagai variabel independen utama dan faktor risiko lainnya; self-reported oral health, jenis kelamin, tingkat pendidikan ibu, status pekerjaan ayah, status ekonomi keluarga, praktik diet anak, dan pemanfaatan fasyankes dianalisis terhadap status gizi berdasarkan kategori berat badan/tinggi badan yang dikonversikan dengan standard Z-score. Hasil penelitian menunjukkan uji chi-square menunjukkan korelasi signifikan antara status ECC, tingkat Pendidikan ibu, status ekonomi keluarga dan praktik diet berisiko anak terhadap status gizi (p-value<0,05). Uji regresi logistik multinomial membuktikan korelasi signifikan antara ECC dengan wasting (OR = 1,352, 95% CI: 0,989 – 2,589). ECC tidak berkorelasi terhadap obesitas. Kesimpulan adalah ECC dapat menjadi salah satu penyebab

wasting pada anak. Beberapa faktor risiko terjadinya masalah gizi juga merupakan faktor risiko yang sama terhadap kejadian karies gigi.

Kata kunci: *early childhood caries; malnutrition; status gizi*

INTRODUCTION

Nutritional problems are one of the important aspects that greatly affect public health. The quality of human resources in the future is strongly influenced by nutritional status. Malnutrition can cause health problems (morbidity, mortality, and disability) and reduce the quality of human resources. On a broader scale, malnutrition can be a threat to the resilience and survival of a nation.[1] The group of children under five is the age group most vulnerable to nutritional problems.[1,2] Globally, according to UNICEF, half of all deaths in children under five are caused by malnutrition. In 2018 150.8 million children were suffering from stunting. From 2000-2018, stunting in children under five decreased from 32.6% to 21.9%, the highest number in Asia and Africa, with 2 out of 5 children under five experiencing stunting. Around 50.8 million children suffer from waste, and Southeast Asia ranks first with the most waste. More than half of children under five with wasting are in Southeast Asia, and a quarter is in Sub-Saharan Africa.[3] While the prevalence of Obesity in the world is still high, in 2018, the number of overweight children under five years has reached more than 41 million. Half of the obese child population worldwide comes from Asian countries, including Indonesia. According to WHO today, the double burden of malnutrition is one of the problems faced by various countries worldwide. Conditions associated with the double burden of malnutrition are underweight and overweight.[3,4] Malnutrition prevalence among children under five in Indonesia in 2013 was 19.6%, with a malnutrition rate of 5.7% and underweight at 13.9%. 2018 Malnutrition prevalence decreased to 17.7%, although the percentage of undernourished did not experience a significant change, with the percentage of malnutrition at 3.9% and underweight at 13.8%. Reducing the prevalence of wasting and stunting in children under five is the main target of the 2020-2024 RPJMN. The 2013 and 2018 children under five wasting prevalence decreased from 12.1% to 10.2% (Riskesdas 2013-2018). 2019 fell to 7.4% (SSGBI 2019).[5,6] The incidence of obesity in children under five years in 2018 by

5.9%, and in 2019 by 5.6%. Millions of children and young people in Indonesia are still threatened with high rates of stunting, wasting, and obesity. Indonesia is included in the 17 countries that have these three nutritional problems.[3,5,7] Various risk factors for the occurrence of nutritional status problems have been investigated, including sociodemographic factors, gender, and age of the child, as well as behavioral factors such as the use of health service facilities. Infectious diseases and dental health problems can affect children's growth and development. This includes nutritional status.[4,8] Dental caries is a chronic disease that most often affects individuals of all ages; dental caries is a major dental and oral health problem in children and adolescents.[8,9] It is estimated that 60%-90% of preschool-aged children worldwide and most adults have suffered from caries. The highest prevalence is in Asia and Latin America, and the lowest prevalence is in Africa.[9] The 2018 Basic Health Research (Riskesdas) states that the prevalence of active caries in Indonesia is 82.6% on average, in the 3–4-year-old age group of 90.2%, 5-6 years of 93%, 12 years of 65.5%, 15 years of 32.6%, 35-44 years of 92.2% and the age group of 65 years and over is 95%. The 2018 Riskesdas also showed that 67.3% of children aged five years had a dental caries experience rate (dmft) > 6, which was included in the Severe Early Childhood Caries category. It can be concluded that the 5-6 year age group who still have primary or deciduous teeth are included in the second highest age group with dental caries problems.

Early childhood caries (ECC) is the most important dental health problem in children, affecting the health and development of children's teeth. ECC can cause chewing function disorders that disrupt the absorption and digestion of food. In addition, dental gangrene is a focal infection that causes disease in other organs.[10,11] Based on references and results of previous studies, there are several relationships between dental caries and the nutritional status of children.[8,12-15] The high prevalence of dental caries in Indonesia and the high nutritional problems of children require further research regarding the relationship between the two. There has not been much research done on a national scale on this matter. Therefore, the authors want to know the relationship between dental caries, especially early childhood caries as the main independent variable on the nutritional status of children aged 5 years in Indonesia based on data analysis of Riskesdas 2018.

METHOD

The Ethics Committee approved

this cross-sectional observational study of the Faculty of Dentistry, University of Indonesia (Ijazah Number: 28/Ethical Exempted/FKGUI/XII/2021) and is a study that determines the relationship between Early childhood caries (ECC) and risk factors (gender, mother's education level, father's employment status, family economic status, children's dietary behavior and utilization of health care facilities) children aged five years with nutritional status categorized based on the child's weight/height (wasting, normal, and obese)). Secondary data is generated based on the 2018 RISKESDAS data in Indonesia. The 2018 RISKESDAS questionnaire survey was conducted in 26 provinces and 106 districts/cities in March 2018 by trained enumerators and examiners with a minimum kappa score of 0.8. The Riskesdas survey observed probability proportional to the sampling size, using systematic linear sampling with a two-stage approach. Data were taken from interviews and clinical examinations to obtain the dmf-t score. Questionnaires were administered to all participating household members. Seven hundred thirty-one subjects who met the inclusion criteria were used in this study. The nutritional status of children aged five years was obtained by measuring weight using a digital scale that has an accuracy of 0.1 kg, while height was measured using a height measuring instrument with an accuracy of 0.1 cm and converted into a standard value (Z-score) using a standard WHO anthropometry. ECC was obtained from a clinical examination with the measurement result as a dmf-t score categorized based on severity. Self-reported oral health was obtained from interviews with parents of children aged five years, using a dichotomous answer (Yes/No) to the question: "In the past year, have you had any problems with (a) Tooth decay, cavities, or pain? (b) Tooth loss due to extraction or fall out on its own? (c) Teeth that have been filled because of cavities?". The questionnaire also assessed sociodemographic background, including gender, mother's educational level, and father's employment status. Behavioral factors were also assessed by asking questions about the child's and mother's eating patterns, including the consumption of healthy and risky foods or drinks, and the utilization of health service facilities by looking at the affordability of the nearest health center household. Data on family economic status were obtained from the National Socio-Economic Survey.

Data management and analysis were carried out using SPSS ver. 25. Variables are transformed before analysis. Univariate analysis was conducted to determine the characteristics of the

participants. Bivariate analysis used chi-square analysis to determine the relationship between variables. At the same time, the multinomial logistic regression test was carried out to see the magnitude of the effect of ECC and other independent variables on the nutritional status of children aged five years.

RESULT

A total of 701 research subjects were carried out with univariate analysis. The distribution of research subjects based on the dependent variable, namely nutritional status, was as follows:

Table 1. Characteristics of nutritional status based on BW/BH children aged five years

Nutritional Status	Total	(%)
Normal	543	77.5
Obesity	101	14.4
Wasting	57	8.1
Total	701	100

*Frequency table

The results for the nutritional status of children aged five years from a total of 701 research subjects, the majority were children with normal nutritional status of 77.5%, Obesity of 14.4%, and wasting of 8.1%. While the distribution of samples based on decay, missing, and filling conditions can be seen in the following table:

Table 2. Characteristics of research subjects based on decay, missing, and filling

Component	Mean	Median	Min	Max	SD
Decay	8,19	8	0	20	5,39
Missing	0,12	0	0	18	0,81
Filling	0,02	0	0	3	0,19
dmf-t	8,33	8	0	2	5,44

*n= 701

The distribution of dmf-t scores was found with an average of 8.33 (SD=5.44) in children aged five years as research subjects, with the highest mean decay of 8.19.

Table 3. Characteristics of research subjects based on ECC status

ECC Status	Total	(%)
Free ECC	63	8.99
ECC	174	24.82
Severe ECC	464	66.19
Total	701	100

*Frequency table

Table 4 describes the distribution of the largest ECC status of the subjects studied, namely those with severe ECC of 66.19% and those who do not have ECC, only 8.99%.

Table 4. Characteristics of research subjects based on self-reported oral health

Self-reported oral health	Yes(n)	(%)	No (n)	(%)
Decay teeth	369	52,64	332	47,36
Filling teeth	20	24,82	681	97,15
Missing teeth	118	16,83	583	83,17
Mobility teeth	84	11,98	617	66,19

*n=701

The distribution of research subjects based on complaints reported through interviews related to health

problems showed variations for each question. 52.64% of parents answered that their child had damaged/cavities/sick teeth, only 24.82% stated that their child's teeth had been filled, and 83.17% stated that their child's teeth had been lost or extracted because they were damaged or fell out by themselves.

Table 5. Characteristics of research subjects based on sociodemography

Variable	Total	(%)
Gender		
Male	363	51.8
Female	338	48.2
Mother's education level		
Not going to school	56	7.99
Unfinished elementary school	51	7.28
Finished elementary school	165	23.54
I finished junior high school	186	26.53
I finished senior high school	193	27.53
Graduated	50	4.14
Father's work status		
Unemployment	7	1
Student	2	0.29
PNS/TNI/POLRI/BUMN/BUMD	9	1.28
Employees	95	13.55
Entrepreneur	151	21.54
Farmer	114	16.26
Fisherman	6	0.86
Laborer/driver/maid	112	15.98
Other	205	29.24
Family economic status		
Very poor	149	21.26
Poor	141	20.11
Modest	216	30.81
Rich	110	15.69
Very rich	85	12.13
Total	701	100

*Frequency table

From Table 5. it can be seen the distribution of research subjects is based on sociodemographic factors. More boys than girls are the research subjects, with the highest maternal education status being a high school graduate or equivalent. The father's employment status is dominated by other groups outside of formal workers, with the largest family economic status being in the moderate group.

Table 6. Characteristics of research subjects based on behavioral factors

Variable	Total	(%)
Child diet practice		
Healthy food consumption		
Not consume	114	16.26
1-2 portion	280	39.94
3-4 portion	195	27.82
>5 portion	112	15.98
Risky food consumption		
>1 per day	22	3.14
1 per day	50	7.13
3-6 per week	162	23.11
1-2x per week	296	42.23
<3x per month	109	15.5
Unknown	62	8.84
Utilization of health facilities		
Easy	581	82.88
Difficult	39	5.56
Very difficult	81	11.55
Total	701	100

*Frequency table

The distribution of subjects based on the behavioral factors studied were the healthy and at-risk dietary practices and health service facilities. The largest group of subjects with the frequency of eating vegetables and fruit categorized as healthy foods were those who consumed 1-2 servings a day (39.94%). Meanwhile. the frequency of the highest-risk foods was in the group that consumed risky foods 1-2 times a week (42.23%). For the variable of

the utilization of health service facilities, the largest is in the group that is easy to reach, namely 82.88%.

Bivariate analysis with a chi-square test was conducted to determine the variables affecting children's nutritional status based on weight/BH aged five years. Table 7 presents the relationship between children's nutritional status, early childhood caries, and other independent variables as risk factors for nutritional status**.**

Table 7. Relationship between children's nutritional status and ECC, self-reported oral health sociodemographic factors, and behavioral factors

	Nutritional Status based on Height and Weight						p-value
	Normal	(%)	Obesity	(%)	Wasting	(%)	
ECC status							**0,02**
Free ECC	48	76,2	9	14,3	6	9,5	
ECC	131	75,3	31	17,8	12	6,9	
Severe-ECC	364	78,4	61	13,1	39	8,4	
Self-Reported Oral health							0,055
No	225	75,3	51	17,1	23	7,69	
Yes	318	79,1	50	12,4	34	8,46	
Gender							0,08
Male	281	77,4	50	13,8	25	8,8	
Female	262	77,5	51	15,1	32	7,4	
Mother's education level							**0,000**
High	35	70	8	16	27	14	
Low	508	78	93	14,3	30	7,7	
Father's work status							0,626
Formal	77	74	18	17,3	9	8,7	
Informal	466	78,1	83	13,9	48	8	
Family economic status							**0,025**
High	317	77,1	62	15,1	32	7,8	
Low	226	77,9	39	13,4	25	8,6	
Child diet practice							
Healthy food consumption							0,432
High	451	76,8	89	84,6	47	8	
Low	92	80,7	12	10,5	10	8,8	
Risky food consumption							**0,04**
Low	365	78,2	63	13,5	39	8,4	
High	178	76,1	38	16,2	18	7,7	
Utilization of health facilities							0,21
Easy	450	77,5	86	14,8	45	7,7	
Difficult	93	77,5	15	12,5	12	10	

*Chi-Square Test (signifikan if *p-value* < 0.05), n=701

Wasting and Obesity were more common in children with free ECC, followed by children with severe ECC and ECC, and more in boys. Parents who reported that their children had dental health problems were more likely to be in the normal nutritional status of children. The status of children with the most waste and Obesity was also found at the level of the mother's education and low family economic status, with the father's employment status being informal. A statistically significant relationship was found between the nutritional status of children under five based on weight/weight, ECC status, maternal education level, and family economic status (p-value <0.05).

Multinomial logistic regression was carried out in this study. The independent variable with a p-value <0.25 from the bivariate test met the requirements for further multivariate analysis to determine the relationship between the nutritional status of children aged five years and the selected variables. The results as in table 8 below:

Table 8. Multinomial logistic regression analysis between nutritional status of obesity and wasting with ECC and significant independent variables

Nutritional status	Variable	OR	95% CI	p-value
Obesity	**Mother's education level**	1.142	1.006-2.577	0.026
	High *ref			
	Low			
	Family economic status	1.12	0.715-1.753	0.03
	High *ref			
	Low			
Wasting	**ECC status**	1.352	0.989-2.589	0.02
	Free ECC *ref			
	ECC			
	Gender	1.214	0.961-2.132	0.05
	Male *ref			
	Female			
	Mother's education level	2.285	1.930-3.613	0.000
	High *ref			
	Low			

a. The reference category is: normal.
b. Nagelkerke R^2: 0,036, n = 701

The multinomial logistic regression describes the relationship between several independent variables and a multinomial dependent variable. The independent variable with a p-value from bivariate analysis <0.25 met the requirements for further analysis to determine the relationship between the nutritional status of children under five based on weight/height and the selected variables. This logistic regression test was used with the enter method. Based on the result, if excluded, variables that are not significant (p-value < 0.05) do not make the other variables have a difference of 10% from the OR of the full model. They will be excluded from the model until they find a significant variable.

Based on multinomial logistic regression analysis on the ECC variable, there was a statistically significant relationship between Obesity and maternal education level (OR=1.142, 95% CI: 1.006-2.577) and family economic status (OR=1.120, 95% CI: 0.715 – 1.753).). For wasting nutritional status, the independent variables that had a significant effect were ECC status (OR = 1.352, 95% CI: 0.989 – 2.589), sex of the child (OR = 1.214, 95% CI: 0.961 - 2.132) and mother's level of education (OR = 2.285, 95% CI: 1.930 – 3.61) with a Nagelkerke R Square value of 0.036 or 3.6%. The Nagelkerke R2 value of 0.036 in the multivariate analysis means that the ability of the independent variable to explain the model is 3.6%. These results explain that outside of the model, many other independent variables have a relationship with the status of children aged five years**.**

DISCUSSION

Protein-energy malnutrition occurs when the body does not receive the nutrients needed for its physiological metabolism due to a lack of protein and energy intake or an inability to carry out the metabolic processes of nutrients that enter the body. In most cases, clear and supported by proper research, malnutrition results from a diet lacking basic nutrients due to insufficient intake or chronic hunger.[12,16] Malnutrition

in the first years of life as reflected by anthropometric indicators, including indicators of body weight compared with length or height. Nutritional status is one of the main health problems faced by developing countries. There is complete evidence that growth deficits in childhood are associated with higher mortality rates, increased incidence of infectious diseases, impaired psychomotor development, poorer academic performance, and lower productive capacities in adulthood.[16,17]

Dental caries is a multifactorial disease that affects a large number of populations worldwide. It is one of the most common chronic childhood diseases and can be considered an epidemic in low-income families and less developed parts of the world. ECC can quickly damage the primary teeth of toddlers and young children and, if left untreated, can cause pain, acute infection, nutritional deficiencies, and learning and speech problems.[18] Early childhood caries have significant public health implications but have not received adequate attention for prevention and treatment. Several countries have limited information about the success of oral health policies implemented to overcome the challenges of ECC.[18,19] ECC remains a global health challenge with the condition of dental and oral health human resources and limited budget. Many countries, including Indonesia, have not prioritized national and regional programs to address ECC.[19] Publications on ECC in Indonesia are still limited in scope. Most of these studies were conducted in cities with few respondents.[8,19]

In contrast to the ECC, the nutritional status of children under five remains a major focus worldwide. At least 1 in 3 children under five years of age is malnourished or overweight, and 1 in 2 suffers from hidden hunger, impairing the capacity of millions of children to grow and develop to their full potential. Do not grow properly due to malnutrition in more visible forms: stunting, wasting, and Obesity.[1,3] Malnutrition continues to have a large impact.

In 2018, nearly 200 million children under five years of age were stunted or underweight, while at least 340 million suffered from hidden hunger.[20] Various international, regional, and international policies have been published to reduce the incidence of under-fives who are malnourished; Various studies have been conducted to look at what risk factors influence the nutritional status of children under five, including the experience of caries in toddlers.[19] Several studies have investigated the relationship between weight status and caries, mostly because health problems associated with growth and

development and oral diseases can share pathways—the same as dietary behavior.[21,22,23] While several studies have shown an association between body weight in children and caries development; the results are mixed and conflicting.[24,25,26]

The results of the univariate study for the distribution of nutritional status in the research subjects showed that the percentage of obese children was higher than children with wasting conditions, namely 14.4%. This phenomenon is quite interesting, considering that Indonesia is a developing country with a middle-class economy that still has problems with malnutrition and stunting in children. However, this is in line with Galgamuwa's research which found that consumption of unhealthy foods such as processed foods and sugar is not limited to rich households and also occurs in poor households because they are easily obtained at affordable prices. The research further strengthens the need for regulation of risky food intake, especially sugar intake, in countries such as Indonesia.[27]

Univariately, the results of the severe-ECC distribution were also quite high in the research subjects, namely 66.19% with a mean DMFT score of 8.33. The study illustrates the condition of Indonesian children who have a fairly high caries experience. The etiology of ECC itself has been studied in life-course epidemiology and has multicausality. A person's dental and oral health condition can be affected since the fetus is in the womb, including ECC. Tooth enamel is the hardest tissue in the body. Its formation (amelogenesis) starts before birth and covers the first years of life up to 11. According to the critical period model, disturbances during tooth enamel development can cause visible and irreversible defects. Dental hard tissue can also provide important information about environmental exposures. In this case, nutritional problems can also be a causality of ECC.[28]

The results of the bivariate test showed that ECC significantly affected the nutritional status of children under five based on indicators of BW/BH, namely normal nutritional status, Obesity, and wasting (p-value <0.05). However, from the results of multivariate analysis, it was found that ECC only had a significant effect on the incidence of wasting (OR = 1.352, 95% CI: 0.989 – 2.589) and did not have a significant effect on the nutritional status of obese children under five after adjusting for other independent variables. The same results were found in Ha Na Kim et al. l study of 610 children aged 3-5 years in Korea. Children with undernutrition status had a high DMFT score compared to those with

normal nutritional status.[29] Su Hyun Shim (2018) aimed to assess the relationship of dental caries with anthropometric outcomes in children aged 4 to 6 years who participated in the Korea National Health and Nutrition Examination Survey (KNHANES). The sample size is 1.910 children from the 4th and 5th KNHANES. The results showed that children with high DMFT scores were more likely to be malnourished (OR 1.77, 95% CI 1.14-2.74). After adjusting for sociodemographic factors and nutritional deficiencies, it was also found that a high DMFT score was associated with low body weight (OR 1.70, 95% CI 1.15-2.51). Vanishree et al.'s study of 208 children aged 3-5 years in Bangalore, India, demonstrated a positively assessed association between BMI and caries rates in preschool children aged 3-5 years. Children with a higher caries incidence lack height, weight, and BMI.[10] It was concluded from the study that primary dental caries hampered the nutritional status of toddlers.

There are various logical mechanisms for the Association of dental caries with underweight and poor-growth of toddlers. First, untreated caries and the infection can cause pain and discomfort and reduce food intake because eating becomes an unpleasant activity in children.[23] Second, dental caries can cause appetite and sleep disturbances that impact children's growth and development. Overall. Disturbed sleep can affect the production and growth of glucosteroids. Chronic inflammation from pulpitis and tooth abscess affects metabolic pathways involving cytokines. Recent evidence suggests that children with ECC have higher levels of proinflammatory cytokines. Cytokines act as mediators of inflammation, infection, and immunological processes, increasing with ECC's increasing severity. The proinflammatory cytokines generate peroxide-generating free radicals, prostaglandin E2, interleukin 6, necrotizing tumor factor, and alpha and cysteine leukotrienes, potent agents in the inflammatory response that are significantly associated with increased nutritional risk. The inflammatory activity seen in ECC is a component of the pathogenesis of disease-associated malnutrition and may impair growth. Severe ECC is associated with iron deficiency anemia, which reduces salivary flow and vitamin D, vitamin A, calcium, and albumin deficiency. It leads to hypoplasia/hypomineralization of enamel and loss of the protective effect of iron, vitamins and zinc on teeth.

The severity of caries in children,

according to DMFT correlated with the likelihood of experiencing oral pain and with chronic and acute malnutrition according to BH/AGE, BW/AGE, and BMI/AGE scores. Severe caries in the pulp are also significantly correlated with malnutrition based on BH/AGE and BW/BH scores. Chloe Tsang et al. demonstrated the risk factors and the onset of ECC starting during the first two years. Most Nepalese children aged 5-6 years have untreated tooth decay, and 1 in 5 children suffer from severe tooth decay and mouth sores that can cause tooth decay. Interfere with their eating, sleep, and concentration at school and a significant association between severe early childhood caries and chronic and acute malnutrition, similar to other dental studies in low- and middle-income countries. Chronic malnutrition in early childhood is strongly associated with poorer cognitive and educational outcomes, lower wages, and productivity in adulthood.[31]

Regarding the relationship between ECC and Obesity from previous studies, there is evidence of an inverse relationship between the two, where Obesity has a significant effect on the incidence of ECC. Several studies that examine this include systematic review research conducted by Narendra Manohar in 2019 aims to look at the caries risk in children under six years of age who are obese. From 6 studies found that overweight and obese children had a significantly higher dental caries experience than children with normal weight. The aggregated estimates indicate that the difference in caries experience between the two groups was statistically significant. Low parental income and education levels were identified as being associated with both conditions in the sample population. Overweight and obese children are more prone to dental caries. The low parental income and education level affects the relationship between the two conditions. However, the quality of evidence varies widely; therefore, the findings should be interpreted with caution.[32]

Evidence supporting the relationship between dental caries and the problem of undernutrition comes mainly from studies conducted in low- and middle-income countries, where the severity of dental caries is high.[4,8,10] Iana's study also found that malnutrition was associated with dental caries among children from low-income families.[24] Children with high caries rates in both primary and permanent teeth had a significantly lower BMI for their age. Several mechanisms have been postulated to explain this relationship, including the

direct effect of dental caries on children's eating ability and nutritional intake and the indirect effect of chronic dental inflammation on growing children through metabolic and immunological pathways. The Association between dental caries and being overweight was more evident in studies conducted in high-income countries such as Europe, the UK, and Canada. The mechanisms follow a different path. Dental caries and overweight are likely related because they share the same cariogenic and obesogenic dietary risk factors (such as a sugar-rich diet).[36,37]

Self-reported oral health, both bivariate and multivariate tests, did not have a significant relationship with the nutritional status of children. In line with the research conducted by Agustanti et al., who validated self-reported oral health and perceived need in 15-year-old adolescents in Indonesia, they found that self-reported oral health's validity (sensitivity and specificity) was still lower than the clinical examination.[35] Although clinical examination serves as the gold standard in oral health surveys, self-reports are useful in settings with limited resources and common dental and oral health problems. Self-reporting oral health has been accepted as a data collection method in many oral health epidemiological surveys. Because it is practical in its implementation, requires lower costs compared to clinical assessments, and is easy to incorporate into health surveys.[36,37]

The gender variable in the study was found to have a significant effect on the nutritional status of children under five. From the multivariate analysis, it was found that girls were more at risk of wasting than boys. This result is consistent with several previous studies which stated that gender contributed to the nutritional status of children under five. [38,39] Das et al. research stated the same regarding the female gender having higher malnutrition than boys. [38] Contrary to Ahmadi's research, boys had a higher prevalence of wasting, stunting, and being underweight than girls. Also, Nigatu found the same thing in his research. The prevalence of malnutrition, stunting and being underweight, was higher in boys than girls. However, this study also found that the criteria for nutritional status based on BW/BH, namely wasting and anemia, did not find differences in prevalence between the sexes of children under five.[40] This inconsistent finding could arise from variations in sample size, method of analysis, and time of data collection. The study findings warrant the importance of considering the sex of the child during case finding and in managing and intervening for some anthropometric deficits. Men have a higher level of intuitive food consumption

or food consumption based on the internal system of biological hunger signals than women, so they respond more quickly to the satiety effect (hunger, desire to eat).

The variable of the level of parental education in this study was that the mother's education had a significant influence on the nutritional status of children under five based on bivariate and multivariate tests. This result is in line with the research by Ahmadi et al. It proved that educated mothers had children under five with better nutritional status based on BMI/AGE, BW/BH, and BH/AGE compared to mothers who were not educated and following Geda et al. research which examined 9218 children. Aged 6-59 months in Ethiopia found that the results of parental education, which was dominated by the mother's education, strongly influenced the nutritional status of children.[40,41] Although contrary to Potocka et al., who studied 430 mothers of children under five in Poland, there was no significant difference between the BMI of educated and uneducated mothers' children.[42]

The father's employment status variable in this study did not significantly affect the nutritional status of children under five. The father is the head of the household in a country that adheres to a paternalism system, especially in Indonesia. So, the father's role is as the main breadwinner in the family and influences the family's economic status. However, in the bivariate test, this study found that the results were not statistically significant for the effect of father's occupation on the nutritional status of children under five. The same thing was found in the research of Karkuki et al. that the father's and mother's work did not have a significant relationship with the incidence of stunting and anemia in children under five in Nepal and does not affect the nutritional status of children in Poland.42 The results of this study are possible because the parents' employment status must be linked to the family's economic status to show a significant relationship.

The variable of family economic status, which is categorized based on overall household expenditure compared to income, shows a significant relationship to the nutritional status of children under five. From the results of the bivariate analysis, it was found that the low economic status of the family had the prevalence of children under five with poor nutritional status. In line with the research conducted by Karkuki et al. on 3630 under-fives in Nepal, it

proved that children with poor nutritional status were more common in groups of families with low economic status. socioeconomic status was seen in the improvement of the malnutrition status of children under five in India. Overall, household economic status, maternal education, and maternal nutritional status contributed almost 80% to inequality in stunting and 90% to underweight children in India in 2016.[44] This is due to access to food, nutrition information, and health and sanitation services. The household is easier to reach and provided by households with good economic status.

The variable of children's dietary practice was assessed based on a questionnaire filled out by respondents regarding the consumption of healthy foods in the form of vegetables and fruit per day and the consumption of risky foods that contain high sugar. Like other middle-income countries, Indonesia experiences a double burden regarding the nutritional status of children under five, cases of malnutrition, and Obesity. Some people with middle and upper income have produced consumption patterns that consume more processed foods and fast food, which are often high in energy and low in nutrient density. Moreover, the consumption of unhealthy foods such as processed foods and sugar is not limited to rich households and also occurs in poor households. [45.46] Dietary practice of consuming healthy children's foods does not have a significant relationship. Still, bivariate the variable consumption of children's risky foods has a significant influence on children's status. toddler nutrition. The study is in line with Choy's research on households with children under five in Samoan Polynesia.[47] Healthy and risky diet practices in children share the same risk factors for caries and nutritional problems. So special attention is needed regarding the child's dietary practices. The variable of the utilization of health services in this study from the bivariate test showed insignificant results on the nutritional status of children under five. Contrary to Yirga's research, children aged 6-59 months in Ethiopia with poor economic status had low access to health services, impacting the high prevalence of malnutrition. Various factors determine 48 Nutritional problems, including individual characteristics, household conditions, and behavior. Proxy variables in the form of personal hygiene, sanitation, children's feeding practices, and health services strongly influenced children's nutritional status.[39] However, from this study, both bivariate and multivariate tests, the variable utilization of health services did not have a significant relationship. The result is possible because

the utilization of health service facilities examined in this study is only in the form of affordability access, and no more in-depth interviews were conducted with the respondents.

CONCLUSION

The relationship between oral health and children's general health has become the subject of increasingly interesting research. Malnutrition remains a major public health problem in most low- and middle-income countries. Still, Obesity is rising due to socioeconomic developments, globalization, and associated shifts in food intake and physical activity patterns through the nutritional transition. The coexistence of underweight and overweight in childhood is also referred to as the 'double burden of malnutrition. Dental caries, especially ECC, is the most common pediatric disease worldwide, which is still a challenge. Accumulating evidence shows that dental caries harms children's nutritional status and growth. However, the nature of this relationship remains controversial, both in terms of direction and the underlying mechanism. The results of this study using a bivariate test showed a significant relationship between ECC, the mother's education level, the family's economic status, and the child's risky dietary practice.

Meanwhile, self-reported oral health, gender, and utilization of health service facilities did not have a significant relationship. However, after multivariate analysis was carried out, the results obtained for wasting nutritional status influenced by ECC after being tested together with other independent variables. However, in multivariate analysis, ECC did not significantly affect the nutritional status of Obesity. Indonesia and several other developing countries still occupy the top rank for cases of under-fives with malnutrition. For this reason, various integrated efforts are needed to solve the problem of nutrition and caries in toddlers comprehensively.

CONFLICT OF INTEREST

We declare no potential conflict of interest in the scientific articles we write.

ACKNOWLEDGEMENT

Our thanks go to the professionals who assisted in the research and preparation of the paper.

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