



## The DMF-T Index and Its Association with Preeclampsia in Pregnant Women at the Wonoayu Health Center

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### ABSTRACT

**Background:** Preeclampsia is a pregnancy-specific condition marked by hypertension and proteinuria after 20 weeks of gestation, posing serious risks to both mother and fetus. Poor oral health, indicated by a high DMF-T (Decayed, Missing, and Filled Teeth) index, may contribute to adverse pregnancy outcomes, including preeclampsia. **Objective:** To analyze the relationship between the DMF-T index and the incidence of preeclampsia in pregnant women. **Methods:** A cross-sectional study was conducted involving 81 pregnant women selected through simple random sampling from a population of 417 receiving antenatal care at Wonoayu Health Center in 2023. Data were obtained from dental and maternity records. The DMF-T index was categorized into good and poor levels and analyzed using chi-square tests with a significance level of  $\alpha < 0.05$ . **Results:** Of the respondents, 4 preeclampsia cases were found in the good DMF-T group and 13 in the poor DMF-T group. Statistical analysis showed a significant relationship between DMF-T index and preeclampsia ( $p = 0.000$ ). **Conclusion:** Poor oral health, reflected by a high DMF-T index, is significantly associated with preeclampsia. Integrating oral health into antenatal care and conducting further research are recommended to improve pregnancy outcomes.

## Introduction

The most important aspect of human life is health. One crucial element to consider is oral and dental health, as it is an integral part of overall bodily health<sup>1,2</sup>. A person's quality of life can be observed from the condition of their oral and dental health<sup>3</sup>. Teeth are interconnected with other parts of the body, and damage to the teeth can affect the health of other body parts, potentially disrupting daily activities<sup>3,4</sup>.

Dental caries, or tooth decay, is a condition in the oral cavity caused by the acidic fermentation process by bacteria that affects the hard tissues of the teeth, such as enamel, dentin, and cementum. Plaque formed from food particles and bacteria in the mouth leads to tooth damage. Enamel erosion, or the process of enamel wear, can create small holes in the

enamel that trigger structural damage to the teeth. Several factors such as education level, age, socioeconomic status, culture, and knowledge are closely related to the incidence of dental caries in pregnant women<sup>5</sup>.

Based on the Decree of the Minister of Health of the Republic of Indonesia in 2015, a long-term roadmap for dental and oral health services was established for the period of 2015–2030. This roadmap was then translated into a National Action Plan, which becomes a national priority every five years<sup>6</sup>. The first phase of the National Action Plan for dental and oral health services (2015–2020) aimed to strengthen dental and oral health services. This plan was designed to support the achievement of a Cavity-Free Healthy Indonesia by 2030, with a target of reducing the prevalence of dental caries by 54.6%<sup>7</sup>.

According to the 2018 Basic Health Research (Riskesdas), the most common dental problems in Indonesia are damaged, decayed, or loose teeth, affecting 45.3% of the population. Other prevalent dental and oral health issues among the majority of Indonesians include swollen gums and abscesses, affecting 14% of the population. According to the 2018 Indonesia Health Profile, approximately 1,287,091 out of 5,283,165 pregnant women (24.3%) suffered from dental caries<sup>4</sup>. The DMF-T index is an indicator of dental health status that reflects the number of decayed, missing, and filled teeth a person has.

The DMF-T value is the sum of the D-T, M-T, and F-T indices, which indicate the number of dental issues a person has experienced, including Decay (D) – carious teeth, Missing (M) – teeth extracted due to caries, and Filling (F) – teeth that have been filled due to caries. According to the World Health Organization (WHO), the DMF-T index is used to assess dental and oral health status in terms of caries in permanent teeth, with a score of  $\leq 3$  categorized as good, and a score of  $> 3$  categorized as poor<sup>3</sup>.

Pre-eclampsia is a pregnancy complication that contributes to the highest maternal mortality. Pre-eclampsia combined with an obese maternal Body Mass Index (BMI) increases the severity of maternal and perinatal outcomes<sup>10</sup>. According to the World Health Organization (WHO) report in 2014, the global Maternal Mortality Rate (MMR) was 289,000 deaths. In mild pre-eclampsia, subjective symptoms are not yet apparent, but in severe pre-eclampsia, subjective complaints include headaches—especially in the frontal area—pain in the epigastric region, visual disturbances such as blurred vision, nausea and vomiting, respiratory problems leading to cyanosis, and impaired consciousness<sup>8</sup>. Hypertension and headaches accompanied by blurred vision in pregnant women can cause pre-eclampsia<sup>9</sup>.

Maternal mortality rates in Indonesia

remain high, although data from the 2010 population census and the 2015 Intercensal Population Survey (SUPAS) show a decline from 346 per 100,000 live births to 305 per 100,000 live births. Reports and local area monitoring (PWS) identified the direct causes of maternal deaths as bleeding, miscarriage, and infection. These conditions are also exacerbated by the socioeconomic status of some communities still living below the poverty line, as well as uneven distribution of healthcare facilities and health workers across Indonesia<sup>10,8,11</sup>.

The leading causes of maternal death are hypertension in pregnancy (HDK) at 27%, bleeding at 30%, and infection at 7%. Hypertension (high blood pressure) is closely related to the occurrence of pre-eclampsia in pregnant women. Pre-eclampsia is defined as an increase in blood pressure  $\geq 140/90$  mmHg and the presence of proteinuria  $\geq 300$  mg/24 hours that appears during the second trimester of pregnancy and typically improves during the postpartum period. Pre-eclampsia can occur antepartum, intrapartum, and postpartum. It results from impaired differentiation and invasion of trophoblasts early in pregnancy, which can trigger oxidative stress and a systemic inflammatory response<sup>10</sup>.

Oral diseases during pregnancy are an important public health issue due to their prevalence and their impact on daily life, which can adversely affect pregnancy outcomes, early childhood caries, and chronic diseases. Maintaining oral health during pregnancy is a significant public health concern worldwide. Several statements and guidelines have been issued emphasizing the importance of improving oral healthcare during pregnancy.

The purpose of this study is to determine the DMF-T index value in relation to the incidence of pre-eclampsia at the Wonoayu Health Center in Sidoarjo. This serves as a

foundation for further research on the risk of pre-eclampsia among pregnant women in the Sidoarjo area, as well as to improve the quality of life for pregnant women through better oral health care and nutritional intake during pregnancy.

## Materials and Methods

### Research Design

This study used an analytic observational design with a cross-sectional approach to identify the relationship between risk factors (independent variable: DMF-T index value) and outcomes (dependent variable: incidence of preeclampsia). Observations or data collection for both variables were conducted simultaneously<sup>3</sup>.

### Sample

The population consisted of 417 pregnant women who received integrated antenatal care (ANC) services at the Wonoayu Health Center from January to December 2023. The sample included 81 pregnant women who met the inclusion criteria: not being at high risk for preeclampsia, no history of hypertension, compliance with dental and maternal health clinic visits, and complete medical records. The sample size was calculated using the formula for a known population:

$$n = \frac{N}{1 + N(d^2)}$$

(d<sup>2</sup>) = 10%, yielding n = 81. Sampling was conducted using simple random sampling with an interval of 5.

### Data Collection Techniques

This study used secondary data collected from the Dental Clinic and the Maternal Cohort at the Maternal and Child Health (MCH) Clinic at the Wonoayu Health Center during the study period.

### Data Analysis Techniques

Data were recapitulated and presented in the form of frequency distribution and cross-tabulation tables. To examine the relationship between the DMF-T index and the incidence of preeclampsia, the Chi-square test was used at a significance level of  $\alpha < 0.05$ , with the assistance of computer-based statistical software.

### Ethical Consideration

Although no explicit ethical approval process was mentioned, the study adhered to ethical principles by using secondary data with no direct involvement of patients and by ensuring confidentiality and anonymity of all personal health records used in the analysis.

## Results

Based on the results of research conducted at the Wonoayu Community Health Center, the following results were obtained:

### Respondents' Distribution Based on Physical Characteristics and DMF-T Index

Based on Table 1, the average age of pregnant women attending Wonoayu Health Center was 27.3 years, with a standard deviation of 3.28. The P-value = 0.62, which is greater than  $\alpha = 0.05$ , indicates that the age distribution among respondents is homogeneous. This age range falls within the non-risk reproductive age group, meaning the risk for complications such as pre-eclampsia is lower. Pregnant women under 20 or over 35 years old are at greater risk of pre-eclampsia due to either underdeveloped reproductive organs or degeneration of reproductive function, respectively<sup>12</sup>.

**Table 1.** Distribution of Respondents Based on Physical Characteristics, DMF-T Index, and Pre-eclampsia Incidence

Variable	Category	Mean $\pm$ SD	Freq	%
Age (years)	-	27.3 $\pm$ 3.28	-	-
Parity	-	2.17 $\pm$ 0.70	-	-
DMF-T Index	Good	-	57	70.4
	Poor	-	24	29.6
Pre-eclampsia	Yes	-	17	21.0
	No	-	64	79.0
Total respondents			81	100

The parity of respondents averaged 2.17 with a standard deviation of 0.70, and the P-value = 0.11 ( $> \alpha = 0.05$ ), also indicating homogeneity. Parity below 2 and above 3 is considered risky for pre-eclampsia. Low parity is associated with incomplete formation of blocking antibodies against placental antigens, while high parity may reflect declining reproductive health, fatigue, and less attention to nutrition due to increased household responsibilities<sup>12</sup>.

In terms of dental health, 70.4% of respondents had a good DMF-T index, while 29.6% had a poor DMF-T index. Additionally, 21% of respondents experienced pre-eclampsia, while 79% did not.

### ***Hypothesis Testing: Relationship Between DMF-T Index and Pre-eclampsia***

**Table 2.** Relationship Between DMF-T Index and Pre-eclampsia Incidence

DMF-T Index	No Pre-eclampsia	Pre-eclampsia	Total	P-value
Good	54 (94.7%)	3 (5.3%)	57	0.000
Poor	10 (41.7%)	14 (58.3%)	24	
Total	64 (79.0%)	17 (21.0%)	81	

Table 2 shows that 58.3% of respondents with a poor DMF-T index experienced pre-eclampsia, compared to only 5.3% among those with a good DMF-T index. In contrast, 94.7% of pregnant women without pre-eclampsia had a good DMF-T index, while only 41.7% of those with a poor index did not develop pre-eclampsia. The Chi-square test yielded a P-value of 0.000, which is lower than the significance level of  $\alpha = 0.05$ . This result indicates a statistically significant association between DMF-T index and the incidence of pre-eclampsia. In other words, pregnant women with poor oral and dental health, as reflected by a higher DMF-T index, are at a greater risk of developing pre-eclampsia. These findings support the importance of oral health assessments as part of routine antenatal care to

potentially reduce the risk of pre-eclampsia and improve maternal health outcomes<sup>12</sup>.

### **Discussion**

Wonoayu Health Center is one of the community health centers located in the Sidoarjo Regency area. Health services for pregnant women are provided according to standards, including identification of pregnant women, monitoring and antenatal care at least six times, abdominal palpation, management of anemia in pregnant women, early management of hypertension during pregnancy, and preparation for delivery. The health center also provides integrated quality antenatal services, including pregnancy examinations by midwives, laboratory tests such as hemoglobin, blood type, and triple elimination tests, dental and oral health examinations, as well as health and nutrition counseling for pregnant women<sup>8</sup>.

Based on the research results, a p-value of 0.00 was obtained, where  $p < 0.05$ , indicating a significant relationship between the DMF-T index value and the occurrence of preeclampsia. The better the DMF-T index value, the fewer pregnant women experience preeclampsia, and conversely, the worse the DMF-T index value, the more pregnant women experience preeclampsia.

This is consistent with the studies conducted by Assandi P, Rahayu SY in 2013 and Anne et al. in 2018, which found that dental caries can influence the occurrence of preeclampsia. During pregnancy, the pH of saliva and gingival fluid in pregnant women becomes more acidic due to changes in buffering capacity, as well as nausea and vomiting that cause stomach acid to rise into the oral cavity. The increased acid production in the oral cavity, combined with insufficient attention by pregnant women to oral hygiene, accelerates the development of dental caries<sup>13,14</sup>.

Pregnant women are at a higher risk of developing dental caries compared to non-pregnant women. Approximately 74% of pregnant women have dental caries. The prevalence of dental caries during pregnancy is 41%–52% in developed countries, whereas it ranges from 60% to 87% in developing countries<sup>15</sup>. A study conducted in 2021 found that the majority of pregnant women experienced deep caries (caries profunda), which is suspected to have begun before pregnancy. Dental caries in pregnant women can appear as early as the first trimester, but can also develop in the second or third trimester. Dental caries appearing in the first trimester may occur due to two reasons. First, the teeth were already decayed before pregnancy but were not clearly visible and only manifested during the first trimester. Second, the caries developed purely during the pregnancy period<sup>16,15,17</sup>.

Previous research has shown that a mother's education level influences her understanding of nutritional intake and dietary patterns during pregnancy<sup>11</sup>. Dietary patterns play an important role in determining oral hygiene conditions, which aligns with the findings of this study showing that pregnant women with a good DMF-T index experience fewer cases of pre-eclampsia.

Pre-eclampsia is a pregnancy-specific condition characterized by placental dysfunction and a maternal response to systemic inflammation involving endothelial activation and coagulation<sup>10</sup>. The diagnosis of pre-eclampsia is established based on pregnancy-induced hypertension accompanied by other organ system impairments occurring after 20 weeks of gestation. Previously, pre-eclampsia was always defined by the new onset of hypertension with proteinuria during pregnancy<sup>18,19</sup>.

This study has a data limitation in that the DMF-T index before pregnancy was not

recorded, indicating the need for improvement in future research.

## Conclusion

The study conclusion shows that there is a relationship between the DMF-T index and the incidence of pre-eclampsia in the respondents. Based on these results, it is recommended to provide education on oral health and to foster good collaboration between dentists and midwives to motivate pregnant women to maintain their oral health in order to prevent and reduce the risk of pre-eclampsia during pregnancy.

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