Average DMF-T Index and Performed Treatment Index (PTI) Achievement of Class X High School Students in Tangerang City

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Abstract

The escalating prevalence of dental caries and other oral diseases in Indonesia underscores the urgency of targeted health promotion, particularly among school students who represent a critical demographic for such interventions. Recent findings from the National Basic Health Research (Riskesdas) highlight a concerning rise in dental caries, signaling a need for comprehensive strategies to curb this trend and improve oral health outcomes. This research aimed to measure the average DMF-T Index and achievement of the Performed Treatment Index (PTI) in class X high school students in Tangerang City. The research design used is to research a situation objectively to solve or answer the problems being faced in the current situation. The population in this study was class The data collection method is by examining the teeth that have these components using instruments, recording forms, and other equipment. The data analysis used in this research is an analysis of two variables. The results of this study found that the average permanent dental caries experience index (DMF-T) of respondents in this study was 2.32. This means that on average there are 2 to 3 teeth per person with tooth decay, while the indicators for achieving healthy teeth determined by WHO for the age category over 12 years include DMF-T ≤ 3. This shows that the average DMF-T index of respondents includes good criteria. The Performed Treatment Index (PTI) or a person's effort to maintain permanent teeth for class X students at Tangerang State High School was 11.11%; referring to the indicators and targets for achieving healthy teeth determined by WHO, including Good PTI if ≥ 50% and this shows that the respondent's PTI achievement rate includes poor criteria.

Keywords: *DMF-T Index, Performed Treatment Index (PTI), Class X SMA Tanggerang City Students.*

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A. INTRODUCTION

The World Health Organization (WHO) advises targeting school students for initiatives aimed at promoting oral and dental health. Data from the 2013 Basic Health Research (Riskesdas) indicates a rise in the prevalence of active dental caries in Indonesia, from 43.4% in 2007 to 53.2% in 2013 (Dimopoulou et al., 2023). A common issue in Indonesian dental health is the prevalent occurrence of hard tissue disease, or caries. According to the 2013 Riskesdas, the DMF-T index (Decay, Missing, Filled Teeth) for Indonesians over the age of 12 was 4.6, equating to 460 affected teeth per 100 individuals. Generally, the oral health of a population is evaluated through the prevalence of dental caries and periodontal disease, which nearly everyone worldwide experiences (Riolina et al., 2020). The DMF-T index is typically utilized to gauge the dental and oral health in instances of caries. Development in the dental health sector is an integral part of national health development, meaning that in

implementing health development, development in the dental health sector must not be left out of the broader framework, namely development in the general health sector (Gudipaneni et al., 2022).

Measuring the severity of dental disease in society requires indicators and assessment standards. According to WHO, the DMF-T index is to assess dental health status in cases of dental caries in permanent teeth, while for primary teeth the DMF-T index is used. The DMF-T index describes the severity of tooth decay (Hakeem et al., 2021). Thorstensson stated that caries is the main cause of tooth loss which is influenced by poor lifestyle factors, low socio-economic class, and low education level. Di Clemente stated that intention and motivation are the most important parts of the process of changing behavior, seeking treatment, and achieving goals for recovery (Bongo et al., 2020). The average DMF-T index for Banten Province is 318 with respective values: D = 0.84% M = 2.37% F = 0.05%, which means tooth decay for the Indonesian population is 310 teeth/100 people. Meanwhile, the Performed Treatment Index (PTI), namely a person's motivation to fill cavities to maintain permanent teeth, in Banten province has a percentage of 1.6%.

B. LITERATURE REVIEW

1. Dental Health Checkup

The history of dental examination was introduced by Klein H, Palmer CE, and Knutson JW in 1938 to measure a person's experience of dental caries. The examination includes a dental examination (DMF-T). All teeth are examined except that the third molars do not grow, have been removed, or are not functioning (Schmoeckel et al., 2021). This index does not use scores; In the column provided, immediately fill in the codes D (teeth affected by caries), M (missing teeth), and F (filled teeth) and then add them up according to the code. Permanent teeth and milk teeth are only differentiated by assigning the DMF-T code. An index is a measure expressed by numbers of the condition of a group/group against a particular dental disease (Ibañez et al., 2021). These measurements can be used to measure the severity of an illness ranging from mild to severe. To obtain data about a person's caries status, a caries index is used so that the assessment given by the examiner is the same or uniform (Li et al., 2022).

Several caries indices are commonly used, such as the Klein index and the WHO index, but recently the Significant Caries Index (SIC) has been introduced to complement the previous WHO index. DMF-T is a dental condition in which an examination is carried out on a person's permanent teeth who have experienced caries, missing or repaired. The permanent dental caries experience index/DMF-T is a number that shows the clinical nature of dental caries (Bundugji et al., 2021). The DMF-T number describes the number of caries a person has suffered from the past until now. DMF-T is used for fixed or permanent teeth. The number of damaged, missing, and repaired teeth in permanent teeth caused by caries (DMF-T = D+M+F). PTI, which stands for Performed Treatment Index, is an effort to improve self-care abilities in the field of dental and oral health to achieve teeth preservation rates (Orsós et al., 2021). Assess the PTI index, using the following formula:

$$PTI = \frac{F \ X \ \ 100\%}{DMF\text{-}T}$$

Information:
Filling = good tooth filling
DMF-T = Number of caries experience numbers.

2. Cavity Teeth

Dental caries is tissue damage caused by acids in carbohydrates through microorganisms in saliva. Brauer describes caries as a disease affecting tissues, beginning with damage on the tooth surface, including pits, fissures, and interproximal areas, and progressing toward the pulp (Elgezawi et al., 2022). Kidd and Bechal define dental caries as a condition that impacts the hard tissues of the teeth, such as enamel, dentin, and cementum, caused by the activity of microorganisms on fermentable carbohydrates. The initial sign of this disease is the demineralization of these hard tissues, which subsequently leads to the deterioration of the organic components (Komarudin et al., 2021).

Putri, Herijulianti, and Nurjannah explain that caries arises from the interaction among bacteria on the tooth surface, dental plaque, and diet—particularly the carbohydrate components that are fermented by plaque bacteria into acids like lactic and acetic acid (Ribeiro & Paster, 2023). This process leads to the demineralization of the hard tooth tissue over a significant period. According to Srigupta, the term "caries" originates from the Greek word "ker," meaning death, and in Latin, it signifies destruction. Caries is characterized by the formation of cavities on the tooth surface, which are caused by germs or bacteria present in the mouth (Pang et al., 2021).

According to Newbrun, as cited by Suwelo, there are four primary factors in the development of caries: microorganisms, teeth and saliva, substrate, and time as an additional factor. Internal factors also play a role, such as:

a. Microorganisms
   Microorganisms adhere to teeth accompanied by plaque or debris. Dental plaque is a non-mineralized, soft substance that firmly clings to the teeth, comprising about 70% microorganisms and 30% intercellular material. Kessel notes that the microorganisms associated with tooth decay include Lactobacillus, Streptococcus, and Bacillus acidophilus (Jakubovics et al., 2021).
b. Teeth and saliva
   Kidd and Bechal explain that the presence of bacteria in plaque initiates cavity formation. The regions of teeth where plaque is more likely to adhere, and thus are more susceptible to cavities, include:
   1). Pits and fissures on the biting surfaces of molars and premolars, pits on the buccal sides of molars, and pits on the palatal sides of incisors.
   2). Smooth surfaces in the interproximal area just below the contact point.
   3). Enamel at the cervical margin of the tooth, just above the gingival line.

4). Root surfaces that are exposed, which is a common site for plaque accumulation in patients experiencing gingival recession from periodontal disease.
5). Margins of restorations, particularly where they are deficient.
6). Tooth surfaces that lie next to dentures and bridges (Rowińska et al., 2021).

c. Substrate

Newburn describes the substrate as a combination of fine foods and beverages consumed daily that adhere to the teeth's surface. This substrate influences the formation of local cavities in the mouth. The fundamental components of the human diet are carbohydrates, fats, and proteins. Carbohydrates, particularly those containing sugars, can quickly lower the pH level of plaque, leading to enamel demineralization. The acidic environment in plaque persists for a while, requiring about 30-60 minutes to revert to a normal pH level around seven. Sucrose, being the most commonly ingested sugar, is thus identified as a primary contributor to cavity development (Santacroce et al., 2023).

d. Time

According to Newburn, time relates both to the rate of cavity formation and to how long and how often the substrate remains attached to the tooth surface. Cavities constitute a chronic condition where the damage develops progressively over months or even years (He et al., 2022).

3. Tooth Loss

Tooth loss is a condition where one or more of a person's teeth fall out of their sockets or are placed in the oral cavity. The need to replace missing teeth is very necessary for patients who experience edentulous in the anterior part, but it is just as important with tooth loss in the posterior part because the teeth are a dynamic unit and support each other. When teeth are lost, the structural integrity of the dental arch will be disrupted and the alignment of the teeth will be readjusted to achieve balance (Albertsson et al., 2021).

Tooth loss is the primary reason for diminished chewing function. It also impacts the health of the oral cavity and overall well-being, consequently influencing an individual's quality of life. Various factors lead to tooth loss, with trauma and the effects of inadequate oral hygiene being the most prevalent. Specifically, caries and periodontal disease are the most common culprits behind tooth loss (Bianco et al., 2021).

Tooth loss can lead to diminished dental function, contribute to systemic diseases, and significantly affect a person’s emotional well-being. A reduction in functional teeth can impair chewing and alter eating habits, which may disrupt nutritional balance. Systemic effects of tooth loss include nutritional deficiencies and conditions like osteoporosis, often due to poor dental health and altered dietary patterns, including insufficient intake of calcium and vitamin D (Kudsi et al., 2020). Emotionally, tooth loss can affect an individual by changing facial structure, reducing facial height, and altering vertical dimensions, which can result in feelings of sadness,

depression, loss of self-confidence, and a sense of premature aging (Uwitonze et al., 2020).

Tooth loss that is left for too long and left without replacement will cause tooth migration and rotation, excessive eruption, decreased masticatory efficiency, disorders of the temporomandibular joint, excessive load on supporting tissues, speech disorders, worsening of appearance, impaired oral hygiene, attrition; and effects on oral soft tissue. The occurrence of tooth loss can affect orofacial structures, such as bone tissue, innervation, and muscles, and reduce orofacial function. Apart from that, the oral mucosa will experience changes in the structure, function, and elasticity of the oral mucosal tissue (Li et al., 2021). If tooth loss is not addressed promptly, it can lead to pathological migration of the remaining teeth, a reduction in alveolar bone density in the edentulous areas, diminished masticatory function, and potentially speech impairments. It may also impact the temporomandibular joint. Optimal occlusion should enable the mandible to move freely without resistance from occlusal contacts during functional movements, particularly in the posterior segment, ensuring more even distribution of load (Tsuchida & Nakayama, 2023).

Imbalance in the dental arch can lead to shifting, tilting, or rotation of the teeth, as well as damage to the periodontal structure. When teeth migrate and rotate, they lose contact with adjacent teeth and opposing teeth in the bite. This misalignment and the formation of spaces allow food to become easily trapped, compromising oral hygiene and potentially increasing the risk of caries. Losing quite a lot of teeth in the back causes chewing efficiency to decrease. Poor chewing habits, over-closure, and eccentric jaw relationship due to tooth loss can disrupt the jaw joint structure (Watted et al., 2024).

C. METHOD

The research design employed aims to objectively describe a specific situation to address or resolve the issues at hand. The population refers to a broad category of objects or subjects possessing particular qualities and characteristics defined by the researchers for study, from which conclusions are subsequently drawn. In this study, the population consists of students from State High Schools in Tangerang. A saturated sampling technique is utilized, where all members of the identified population are included as samples. The criteria for selecting samples include respondents who are registered as students in the specified classes.

D. RESULT AND DISCUSSION

1. Average Number of Cavities

Based on the results of the DMF-T index examination, the average number of Decay components is obtained in the table below:

Table 1. Average Number of Respondents' Teeth with Cavities (Decay)

Number of Respondents	Number of Decay Components	Average	Percentage (%)
33	63	1.90	5.75%

Table 1 shows that of the 33 respondents, 63 had cavities with an average of 1.90 cavities, or in other words, the average respondent had 1 to 2 cavities.

2. Average Number of Missing Teeth

The results of the examination showed that the average number of missing teeth is in the table below:

Table 2. Average Number of Respondents' Missing Teeth

Number of Respondents	Number of Missing Components	Average	Percentage (%)
33	7	0.21	0.63%

Table 2 shows that out of 33 respondents, 7 teeth were missing with an average of 0.21 missing teeth, or in other words, the average respondent had 0 to 1 missing tooth.

3. Average Number of Respondents' Teeth That Have Been Filled

The results of the examination showed that the average number of teeth that had been filled is in the table below:

Table 3. Average Number of Respondents' Teeth That Have Been Filled

Number of Respondents	Number of Fillings	Average	Percentage (%)
33	7	0.21	0.63%

Table 3 shows that out of 33 respondents, 7 teeth were found to have been filled with an average of 0.21 filled teeth, or in other words, the average respondent had 0 to 1 teeth that had been filled.

4. Permanent Dental Caries Experience Rate (DMF-T)

The average DMF-T index is the sum of the average Decay, average Missing, and average Filling components. Based on the results of the examination, it was found that the average DMF-T index was 2.32, or in other words, the average number of respondents' tooth decay was 2 teeth/person.

Table 4. Rate of Permanent Dental Caries Experience (DMF-T) of Respondents

No	Number of Respondents	(D) Decay	(M) Missing	(F) Filling	DMF-T
1	33	63	7	7	77
2	Average	1.90	0.21	0.21	2.32

Table 4 shows that the number of respondents of 33 people had 63 cavities (decay) with an average of 1.90, meaning that the average tooth decay for each person was 1 to 2 teeth/per person. The (Missing) component has 7 teeth missing with an average of 0.21 as well and the (Filling) component has 7 teeth that have been filled with an average of 0.21 and the DMF-T index has an average of 2.32. This means that each respondent has 2 to 3 teeth per person.

5. Achievement of Respondents' Performed Treatment Index (PTI).

The respondent's Performed Treatment Index (PTI) is obtained by calculating the F (Filling) index divided by DMF-T multiplied by 100 percent. The results obtained are then grouped into 2 criteria, namely good criteria if ≥ 50% and bad if < 50%. The results of the respondents' achievement of the Performed Treatment Index (PTI) obtained a PTI achievement of 11.11% with the distribution as in the table below;

Table 5. Achievement of Respondents' Performed Treatment Index (PTI).

No	Filling Components	DMF-T	PTI Percentage	Criteria
1	7	2.32	11.11%	Bad

Information: PTI percentage = (7/63) x 100% = 11.11%

So, the percentage of respondents achieving the Performed Treatment Index (PTI) as referred to the WHO target is included in the deficient criteria, namely at 11.11%.

Research regarding the average DMF-T Index and achievement of the Performed Treatment Index (PTI) of class X students at SMAN Tangerang with a sample of 33 people. This research first begins with a dental examination of the respondent, then the data obtained is written on a status sheet, and then the data is processed using computer tools to determine the relevant results. In this research, the DMF-T Index shows the severity of permanent tooth damage. The DMF-T index is the sum of the components D+M+F which is the amount of tooth decay that a person has experienced, namely component D (Decay) is the number of permanent teeth that have caries and have not been filled; component M (Missing) is the number of permanent teeth that have been removed or still have roots remaining, while component F (Filling) is the number of permanent teeth that have been filled. Based on the 2007 Basic Health Research Results (RISKESDAS), the average DMF-T Index for Banten Province was 3.18% with the respective values: D = 0.84% M = 2.37% F= 0.05%; which means tooth decay for the Indonesian population is 320 teeth per 100 people. Meanwhile, the research results obtained from respondents in this study showed an average DMF-T Index of 2.32%, meaning that the average tooth decay for each respondent was 2 to 3 teeth per person, including good criteria in the WHO target of ≤ 3 teeth.

A person's motivation to fill their teeth is an effort to maintain permanent teeth which is described in the Performed Treatment Index (PTI) number, calculated from the number of permanent teeth filled (filling) divided by the total DMF-T index multiplied by 100%. The results of Basic Health Research (RISKESDAS) in 2007 for achieving the Performed Treatment Index (PTI), namely a person's motivation to fill cavities to maintain permanent teeth in Banten province, had a percentage of 1.6%. Meanwhile, the research results showed that the achievement of the Performed Treatment Index (PTI) was 11.11%, which was less than the WHO target of <50%. The results of relevant research conducted by Listrianah showed that the average index of experience of permanent dental caries (DMF - T) in Palembang respondents was classified as moderate with an average of (2.78). Meanwhile, the samples examined were 287 with a total of 800 DMF - T teeth and the achievement of a Performed Treatment Index (PTI) of 2.25 was described, this result was categorized as less than

the WHO target of < 50%. Compared with research conducted in Tangerang, the DMF-T index was 2.33, meaning that each person had 2 cavities, teeth that had been removed or had indications of extraction due to caries and teeth that had been filled. Then the achievement of the Performed Treatment Index (PTI) among respondents was 9%, which is less than the WHO target of <50%.

E. CONCLUSION

This study examined the oral health of Class X students at SMAN Tangerang by analyzing the DMF-T Index, which measures the severity of permanent tooth damage through decayed, missing, and filled teeth, and the Performed Treatment Index (PTI), reflecting the proportion of decay treated with fillings. The research findings indicated an average DMF-T Index of 2.32%, suggesting that on average, each student had about 2 to 3 affected teeth, which falls within the WHO's acceptable range of ≤3 teeth. However, the PTI stood at 11.11%, significantly lower than the WHO's target of less than 50%, indicating a relatively low rate of treated decay among the students. This study underscores the need for enhanced dental health initiatives and possibly greater accessibility to dental care services to improve the PTI, thereby ensuring better oral health outcomes for the students.

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