

Research article

The Influence of Socio-demographic Factors on the Prevalence of Dental Caries among 12-Year-Old Children, Narathiwat Province

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Abstract

Keywords

tooth decay;
permanent teeth;
socioeconomic factor;
Thailand's southernmost provinces;
young children

Dental caries is the most prevalent oral health issue among school-aged children. If not detected and treated promptly, this leads to severe pain and infection, tooth loss, and more complicated and expensive treatments. This study aimed to determine the prevalence and risk factors associated with dental caries among 12-year-old children in Narathiwat Province. The outcome of the study was dental caries in 12-year-old children's permanent teeth. Frequency and percentage were used to describe the preliminary data analysis. Chi-squared test was used for univariate analysis. Logistic regression was used to investigate the association between factors and dental caries. Permanent teeth in 9,216 children were affected by dental caries at the rate of 37.7%. Gender, religion, residence, medical treatment rights, father's age, father and mother's occupation, father and mother's educational level, and children's periodontal condition were associated with dental caries. The performance of the model was acceptable according to the area under a receiver operating characteristic curve at 72.3%. Therefore, children should be required to participate in preventive measures such as health education regarding oral hygiene, dietary habits, and dental visits.

1. Introduction

The most common oral health problem among school-aged children is dental caries [1]. According to the World Health Organization (WHO) in 2013, 60-90% of schoolchildren worldwide, primarily in developing countries, are affected by dental caries. Although dental caries is generally well controlled in developed nations, its prevalence is increasing in low and middle-income

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countries [2]. To encourage children to develop healthy dental habits that persist into adulthood, several factors such as behavior, attitude, and environment must be considered [1]. However, socioeconomic factors can potentially influence the prevalence of dental caries in children. Parental knowledge and attitudes about oral health, along with access to health care, can significantly impact the oral health behaviors of children [3]. Some studies have reported that dental caries in children was influenced by factors such as the children's age and gender, as well as their parents' education, occupation, and place of residence [1, 4-8].

Dental caries can result in severe pain, infection, tooth loss, and the need for more complex and costly treatments if not promptly detected and treated [9]. Children afflicted with dental caries often suffer from pain, which can result in challenges related to eating, sleeping, and communication, which in turn have repercussions on their ability to concentrate in school and can negatively influence their educational development [10]. Moreover, the high cost of treatment places a significant burden on both the national healthcare system and individual households. To maintain optimal oral health, families often opt to directly pay for dental care. In developed nations, oral health treatment typically accounts for 5-10% of health expenditures. Oral health treatment is either unavailable or highly limited in many underdeveloped nations. Damaged teeth in these regions are often simply extracted or left untreated, despite being a primary source of pain [11].

Dental caries is an acquired disease that cannot be reversed, so preventing caries is the most effective method of treatment. Children aged 12 are of particular significance, as this is typically the age at which they complete primary school. In many nations, this marks the final age at which a reliable sample can be easily collected through the school system. Additionally, by this age, it is probable that all permanent teeth, with the exception of the third molars, will have emerged. For these reasons, 12-year-old children have been selected as the global indicator age group for international comparisons and surveillance of disease trends [12]. In Thailand, the 8th National Oral Health Survey in 2017 showed that 52.0% of 12-year-old Thai children had at least one permanent tooth with dental caries [13]. The percentages of dental caries for 12-year-olds in Thailand in the years 2017, 2018, and 2019 were 39.35, 30.18, and 30.00, respectively [14].

In Narathiwat Province, the prevalence of dental caries surpasses the national average. Notably, among 12-year-old primary school children, the incidence was 76.8% in 2014 and 50.9% in 2018 [14]. The dietary habits of these children tend to favor extremely sweet, fatty, and crunchy snacks, as well as soft drinks, with insufficient attention to proper oral health care to prevent tooth decay. An unfortunate consequence of tooth decay is the potential impact on the slow development of the brain and learning abilities, subsequently affecting a child's intelligence or IQ [15]. Consequently, this study aimed to investigate the prevalence and factors associated with dental caries among 12-year-old children in Narathiwat Province.

2. Materials and Methods

2.1 Data and variables

This study used secondary data obtained from the Health Data Center of Narathiwat Provincial Public Health Office. The samples included 12-year-old school children from all schools across the 13 districts of Narathiwat Province during the period from October 1st, 2019 to September 30th, 2020. This study specifically addressed dental caries in the permanent teeth of 12-year-old children, amounting to a total of 9,216 samples. The dental caries study employed a binary outcome, classified as either yes or no. The determinant variables represented the characteristics of the 12-year-old children, which were gender, religion, residence, school type, medical treatment rights, father's and mother's age, father's and mother's occupation, father's and mother's educational level, and

periodontal condition. Some variables, including the father's and mother's age, occupation, and educational level, had a significant number of missing values; therefore, those values were classified as undefined. All determinants were categorical variables.

The gender of the 12-year-old children consisted of male and female. Among the religions were Islam, and Buddhism and others. The children lived in 13 districts: Mueang Narathiwat, Tak Bai, Bacho, Yi-ngo, Ra-ngae, Rueso, Si Sakhon, Waeng, Sukhirin, Su-ngai Kolok, Su-ngai Padi, Chanae, and Cho-airong. The types of schools were categorized into two categories: government and private schools. There were two separate categories of medical treatment rights: the first category was the universal coverage scheme, and the second category was government official and other schemes. The ages of fathers and mothers were categorized into three slots: less than 40 years, 40-50 years, and more than 50 years. The educational levels of fathers and mothers were classified into primary school or lower, high school or diploma, and undergrad or higher. The types of father's and mother's occupations were divided into five categories: regular salary, labor, own business, agriculture, and no income. Normal gums, gingivitis, and other non-applicable conditions comprised the periodontal conditions of 12-year-old children.

This study was ethically approved by the research committee of Prince of Songkla University ID: psu.pn.1-006/65.

2.2 Statistical analysis

Frequency and percentage were used to explore information about the children and their parents. In univariate analysis, a chi-squared test was used. The adjusted prevalence percentage was estimated using multiple logistic regression with weights of some contrasts (see more details in [16]). The logistic regression with logit transformation was performed as below:

$$\text{logit}(p) = a + \sum_{i=1}^k b_i x_i \quad (1)$$

$$\ln\left(\frac{p}{1-p}\right) = a + \sum_{i=1}^k b_i x_i \quad (2)$$

$$p = \frac{1}{1 + e^{-(a + \sum_{i=1}^k b_i x_i)}} \quad (3)$$

where p is the probability of dental caries behavior, a is an intercept, b is a coefficient, x is a determinant, and k is the number of determinants. A 95% confidence interval was used to present the effect of each group determinant on the dental caries in the model.

A receiver operating characteristic (ROC) curve was used to assess how well the model fitted the data. The R program generated all of the analysis and graphs.

3. Results and Discussion

A descriptive and univariate analysis is shown in Table 1. There were 9,261 children in total, with a slight difference in the number of males and females, which were 50.0% and 49.9%, respectively.

The majority of children (94.1%) were Muslims, and the district that had the largest number of children was Mueang Narathiwat (16.7%). The majority of them (95.2%) were from government school. Without accounting for the undefined group, their father's age was between 40 and 50 years (22.8%), his educational level was primary school or lower (26.8%), and his occupation was labor (31.6%). Their mother was less than 40 years old (34.9%), had a primary school education or less (26.9%), and worked as labor (27.4%). The universal coverage scheme provided treatment to 91.4% of the children. Besides oral hygiene, the results revealed that periodontal conditions (68.7%) were generally normal.

The prevalence of dental caries among children in the current study was 37.7%. There was a significant association between dental caries in children and all socio-demographic factors. When comparing the groups of each demographic characteristic to the status of dental caries, we found that females had a higher prevalence of dental caries (38.9%) compared to males (36.5%). The prevalence of dental caries was greater among Muslims (38.7%) compared to Buddhists and other religions (22.7%). Children attending private schools had a greater percentage of dental caries (43.1%) compared to those attending public or government schools (37.5%). The prevalence of dental caries among children from the districts of Si Sakhon, Rueso, and Cho-Airong exceeded 50%, with rates of 60.8%, 57.1%, and 51.7%, respectively.

For data of father and mother over the age of 50, a prevalence of around 45% for childhood dental caries was indicated. Over 40% of father and mother had a primary school education or less. In the no income category, the prevalence of dental caries was greater than 45%, while it was greater than 50% in the agriculture category.

With respect to children's access to dental treatment coverage, children covered under government officer, and other schemes had a prevalence of 42.0%, and those covered under a universal coverage scheme had a prevalence of 37.3%. When compared to others, the periodontal condition of children with gingivitis had the highest prevalence of caries, at 43.0%, as shown in Table 1.

The results of dental caries analyzed from logistic regression are shown in Figures 1 and 2. A 95% confidence interval of the prevalence shows that all determinants, except the mother's age were statistically significant with dental caries (p -value<0.05). When compared to the overall prevalence, females had a higher prevalence (38.9, a 95% CI of 37.8-40.0) than males, who had a lower prevalence (36.6, a 95% CI of 35.6-37.7) than the overall prevalence. Buddhists had a lower prevalence (24.0, 95% CI: 20.4-28.0) than the overall prevalence, while Muslims had the same prevalence as the overall prevalence. Mueang Narathiwat (50.9, 95% CI: 48.3-53.5), Bacho (48.1, 95% CI: 43.8-52.5), Rueso (53.5, 95% CI: 49.0-57.9), Si Sakhon (53.3, 95% CI: 48.5-58.1), and Cho Airong (43.4, 95% CI: 39.4-47.5) were among the five districts with higher prevalences than the overall prevalence. The values of crude and adjusted prevalences appeared to be quite different in the districts of Cho Airong and Si Sakorn. Tak Bai (17.5, a 95%CI of 14.8-20.4), Yingo (27.8, a 95%CI of 22.9-33.3), Rangae (32.1, a 95%CI of 28.8-35.5), Waeng (12.6, a 95%CI of 10.3-15.3), and Sungai Kolok (31.5, a 95%CI of 28.3-34.9) were the five districts with lower rates than the overall prevalence. Among all children, children in Waeng had the lowest prevalence of dental caries.

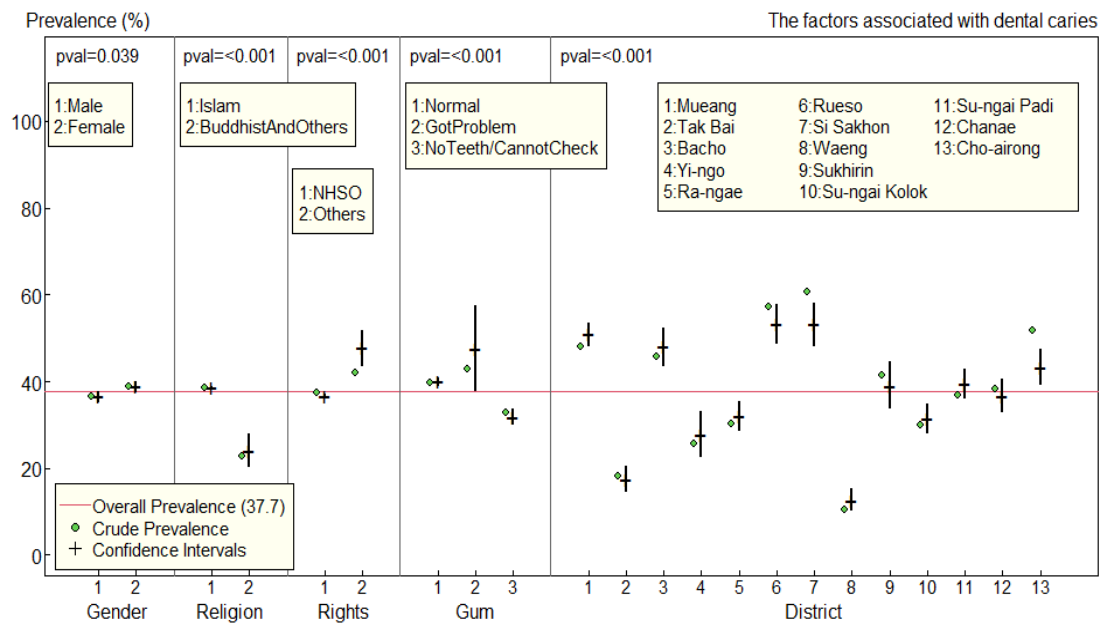
When compared to the overall prevalence of medical treatment rights, children covered in a government officer and other schemes had a higher prevalence of caries (47.8, 95% CI of 43.8-51.9) than the overall prevalence, whereas children covered in the universal coverage scheme had a rate that was similar to the overall prevalence. In terms of periodontal conditions, the prevalence of caries was higher in the group with normal gums (40.1, a 95%CI of 39.2-41.0) and gingivitis (47.65, a 95%CI of 37.9-57.6) than in the overall prevalence, while it was lower in the not applicable group (31.9, a 95%CI of 30.2-33.7).

Table 1. Descriptive analysis and results from the Chi-squared test

| Determinant | Total 9,216 (%) | Dental caries | | χ^2 | df | P-value |
|----------------------------|--------------------|------------------------|-------------------------|----------|----|---------|
| | | No (62.3) 5,738 (%) | Yes (37.7) 3,478 (%) | | | |
| Gender | | | | 5.69 | 1 | 0.017 |
| Male | 4,612 (50.0) | 2,927 (63.5) | 1,685 (36.5) | | | |
| Female | 4,604 (49.9) | 2,811 (61.1) | 1,793 (38.9) | | | |
| Religions | | | | 56.20 | 1 | <0.001 |
| Islam | 8,669 (94.1) | 5,315 (61.3) | 3,354 (38.7) | | | |
| Buddhism and others | 547 (5.9) | 423 (77.3) | 124 (22.7) | | | |
| School type | | | | 5.73 | 1 | 0.017 |
| Government | 8,773 (95.2) | 5,486 (62.5) | 3,287 (37.5) | | | |
| Private | 443 (4.8) | 252 (56.9) | 191 (43.1) | | | |
| District of residence | | | | 748.01 | 12 | <0.001 |
| Mueang Narathiwat | 1,538 (16.7) | 797 (51.8) | 741 (48.2) | | | |
| Tak Bai | 708 (7.7) | 580 (81.9) | 128 (18.1) | | | |
| Bacho | 541 (5.9) | 293 (54.2) | 248 (45.8) | | | |
| Yi-ngo | 322 (3.5) | 239 (74.2) | 83 (25.8) | | | |
| Ra-ngae | 892 (9.7) | 623 (69.8) | 269 (30.2) | | | |
| Rueso | 522 (5.7) | 224 (42.9) | 298 (57.1) | | | |
| Si Sakhon | 474 (5.1) | 186 (39.2) | 288 (60.7) | | | |
| Waeng | 750 (8.1) | 671 (89.5) | 79 (10.5) | | | |
| Sukhirin | 388 (4.2) | 227 (58.5) | 161 (41.5) | | | |
| Su-ngai Kolok | 830 (9.0) | 581 (70.0) | 249 (30.0) | | | |
| Su-ngai Padi | 901 (9.8) | 570 (63.3) | 331 (36.7) | | | |
| Chanae | 708 (7.7) | 437 (61.7) | 271 (38.3) | | | |
| Cho-airong | 642 (7.0) | 310 (48.3) | 332 (51.7) | | | |
| Father's age (years) | | | | 32.70 | 3 | <0.001 |
| Less than 40 | 1,559 (16.9) | 974 (62.5) | 585 (37.5) | | | |
| 40–50 | 2,099 (22.8) | 1,326 (63.2) | 773 (36.8) | | | |
| More than 50 | 1,360 (14.8) | 754 (55.4) | 606 (44.6) | | | |
| Undefined | 4,198 (45.6) | 2,684 (63.9) | 1,514 (36.1) | | | |
| Father's educational level | | | | 50.00 | 3 | <0.001 |
| Primary school or lower | 2,465 (26.8) | 1,415 (57.4) | 1,050 (42.6) | | | |
| High school or diploma | 1,322 (14.3) | 871 (65.9) | 451 (34.1) | | | |
| Undergrad or higher | 164 (1.8) | 127 (77.4) | 37 (22.6) | | | |
| Undefined | 5,265 (57.1) | 3,325 (63.2) | 1,940 (36.9) | | | |
| Father's occupation | | | | 255.28 | 5 | <0.001 |
| Regular salary | 237 (2.6) | 175 (73.8) | 62 (26.2) | | | |
| Labor | 2,914 (31.6) | 1999 (68.6) | 915 (31.4) | | | |
| Own business | 198 (2.2) | 133 (67.2) | 65 (32.8) | | | |
| Agriculture | 1,316 (14.3) | 594 (45.1) | 722 (54.9) | | | |
| No income | 809 (8.8) | 441 (54.5) | 368 (45.5) | | | |
| Undefined | 3,742 (40.6) | 2,396 (64.0) | 1,346 (36.0) | | | |
| Mother's age (years) | | | | 39.99 | 3 | <0.001 |
| Less than 40 | 3,215 (34.9) | 1,943 (60.4) | 1,272 (39.6) | | | |
| 40–50 | 2,037 (22.1) | 1,237 (60.7) | 800 (39.3) | | | |
| More than 50 | 531 (5.8) | 291 (54.8) | 240 (45.2) | | | |
| Undefined | 3,433 (37.3) | 2,267 (66.0) | 1,166 (34.0) | | | |

Table 1. Descriptive analysis and results from the Chi-squared test (continued)

| Determinant | Total 9,216 (%) | Dental caries | | χ^2 | df | P-value |
|--------------------------------------|--------------------|------------------------|-------------------------|----------|----|---------|
| | | No (62.3) 5,738 (%) | Yes (37.7) 3,478 (%) | | | |
| Mother's educational level | | | | 131.63 | 3 | <0.001 |
| Primary school or lower | 2,476 (26.9) | 1,326 (53.6) | 1,150 (46.5) | | | |
| High school or diploma | 2,052 (22.3) | 1,301 (63.4) | 751 (36.6) | | | |
| Undergrad or higher | 274 (3.0) | 214 (78.1) | 60 (21.9) | | | |
| Undefined | 4,414 (47.9) | 2,897 (65.6) | 1,517 (34.4) | | | |
| Mother's occupation | | | | 310.41 | 5 | <0.001 |
| Regular salary | 201 (2.2) | 159 (79.1) | 42 (20.9) | | | |
| Labor | 2,527 (27.4) | 1,751 (69.3) | 776 (30.7) | | | |
| Own business | 266 (2.9) | 182 (68.4) | 84 (31.6) | | | |
| Agriculture | 1,190 (12.9) | 595 (50.0) | 595 (50.0) | | | |
| None income | 1,975 (21.4) | 994 (50.3) | 981 (49.7) | | | |
| Undefined | 3,057 (33.2) | 2,057 (67.3) | 1,000 (32.7) | | | |
| Medical treatment rights | | | | 6.68 | 1 | 0.010 |
| Universal coverage scheme | 8,423 (91.4) | 5,278 (62.7) | 3,145 (37.3) | | | |
| Government officer scheme and others | 793 (8.6) | 460 (58.0) | 333 (42.0) | | | |
| Periodontal condition | | | | 40.42 | 2 | <0.001 |
| Normal gums | 6,328 (68.7) | 3,812 (60.2) | 2,516 (39.8) | | | |
| Gingivitis | 128 (1.4) | 73 (57.0) | 55 (43.0) | | | |
| Not applicable | 2,760 (23.0) | 1,853 (67.1) | 907 (32.9) | | | |

**Figure 1.** A 95% CI of dental caries prevalence from logistic regression

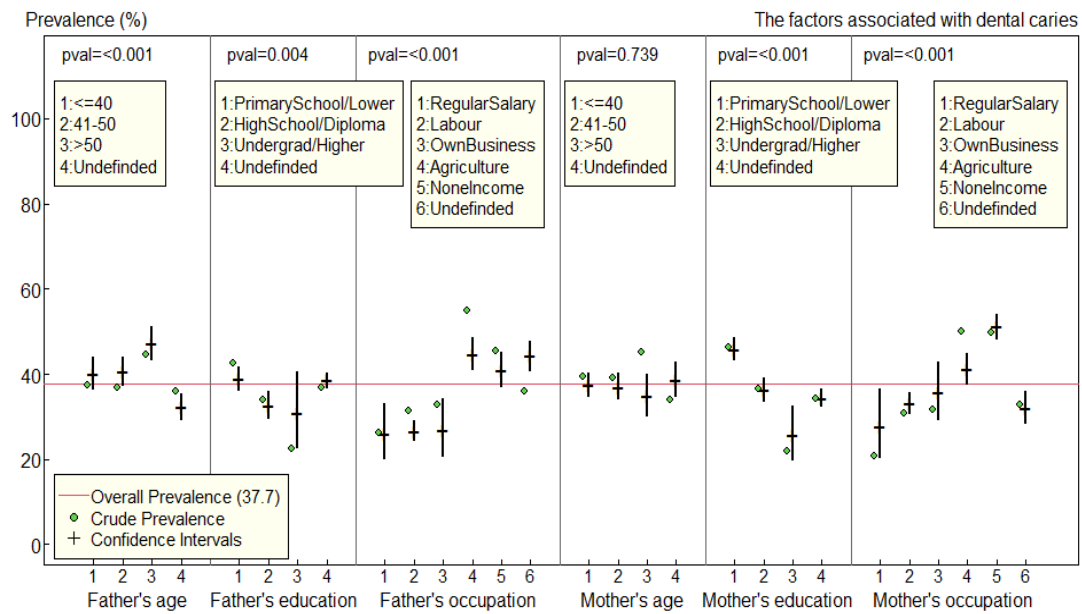


Figure 2. A 95% CI of dental caries prevalence from logistic regression

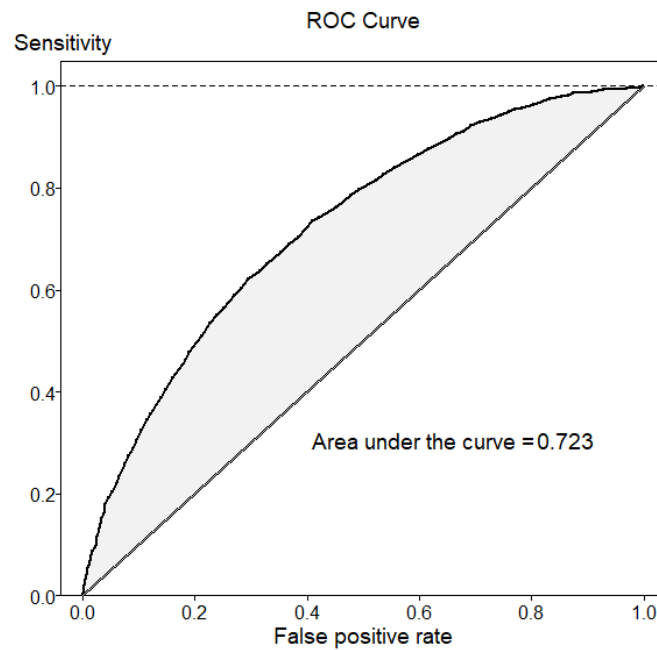


Figure 3. A ROC curve of the logistic regression modelling

Children with fathers who were over 50 years old (47.3, 95% CI=43.3-51.3) and worked in agriculture (44.8, 95% CI=41.1-48.5) had a higher prevalence of dental caries than the overall prevalence. On the other hand, the father's education level of all groups correlated with a rate of children caries than the overall prevalence, except for the fathers who had graduated with a high school diploma, who showed a prevalence (32.80, a 95%CI=29.7-36.0) less than the overall. The children of fathers with a regular salary (26.2, 95% CI=20.4-33.1), who worked as labor (26.80, 95% CI=24.5-29.2), and who owned business (26.9, 95% CI=20.7- 34.2) had a lower rate of children dental caries than the overall prevalence. The children whose fathers worked in agriculture (44.8, 95% CI=41.1-48.5) and undefined occupations (44.4, 95% CI=40.9-47.9) had a higher rate of dental caries than the overall prevalence. The prevalence of caries in children whose fathers had no income was similar to the overall prevalence.

The rate of caries in children whose mothers had a primary school education or less clearly demonstrated higher rate than the overall prevalence (45.9, a 95% CI of 43.4-48.6). Otherwise, the prevalence of dental caries among children whose mothers had a high school diploma was comparable to the overall prevalence. Mothers with a bachelor's degree or higher (25.7, 95% CI: 19.9-32.5), as well as the undefined group (34.5, 95% CI: 32.5-36.6), were associated with a lower prevalence of children dental caries than the overall prevalence. The children of mother who work in agriculture (41.3, a 95%CI of 37.8-44.9), and who had no income (51.2, a 95%CI of 48.3-54.1) had a higher rate of caries than the overall prevalence. The prevalence in children whose mother ran her own business was similar to the overall prevalence. Children whose mothers were regular salary workers (27.8, 95% CI 20.6-36.5), labor workers (33.2, 95% CI 30.8-35.8), and the undefined group (32.2, 95% CI 28.6-36.0) had a rate of caries that was lower than the overall.

Figure 3 shows that the area under the curve of the logistic model of dental caries was 72.3 %, indicating that the performance of the model was acceptable. In Narathiwat, the prevalence of dental caries among schoolchildren aged 12 was 37.7% in fiscal year 2020. Compared to other Asian countries, the prevalence of dental caries was lower than in Libyan schoolchildren aged 8-12 years in Klang Valley, Malaysia, which was 55.8% [17], 53.0% among children aged 10-12 years in Surabaya, Indonesia [18], and 68.9% of the schoolchildren aged 11-12 years in Vietnam [19]. In comparison to non-Asian countries, the prevalence of dental caries in this study was close to a study conducted in Australia, at 38.8%. [20]. The prevalence was lower than studies conducted in Spain, at 39.6% [21], Sudan, at 47.2% [22], Libya, at 48.2% [23], and in the Eastern Mediterranean region, including Iran, Jordan, Yemen, Libya, the United Arab Emirates, Iraq, Bahrain, and Lebanon, at 61.0% [24, 25]. However, the prevalence was higher than the study conducted in Ethiopia, which was at 36.9% [22].

Sociodemographic factors, including gender, religion, medical rights, periodontal condition, districts, father's age, father's education, father's occupation, mother's education, and mother's occupation, were associated with dental caries. Females were more likely to have dental caries than males. This finding was consistent with research from India [1], Pakistan [5], China [7], Malaysia [17], Indonesia [18], and Libya [23]. In this study, the educational level of the parents was associated with the rate of dental caries of the schoolchildren, an observation that was consistent with the findings in China [4], Vietnam [19], Ethiopia [25], Italy [26], and Saudi Arabia [27]. However, it was in contrast with a study in Iran that demonstrated that there was no significant relationship between the dental caries of children and their parents' levels of education [28]. Furthermore, a study in Malaysia showed that there was no significant relationship between children's caries and maternal level of education [17].

Our studies showed that parental occupation was associated with dental caries of the children. These findings corroborated the findings in Japan [3], Iran [6] and Libya [23] but were in contrast with the findings of a study conducted in Malaysia [17], in which it was concluded that there was no correlation between prevalence of children's dental caries and parental occupations. Moreover, children's dental caries in Mueang Narathiwat were shown to have a higher prevalence

than the overall prevalence, a result that was in agreement with the findings in Spain [21] and China [29].

4. Conclusions

Children who were not covered by the universal coverage scheme and lived in Mueang Narathiwat, Bacho, Rueso, Si Sakhon, and Cho-airong appeared to have a high prevalence of dental caries. Their father's age, occupation as a business owner, their mother's education at the primary school level and below, and their mother's lack of income all contributed to the high prevalence of dental caries. To prevent and control dental caries, children and their parents should receive better health education about oral hygiene, dietary habits, and dental visits. Furthermore, local health policymakers must develop and implement preventive, therapeutic, and educational programs at the individual, family, and school levels to control dental caries.

In this study, only sociodemographic factors were included in the determination of the factors affecting dental caries in school-aged children. The behavior of the children and their parents are interesting factors for further investigation on the intervention parameters. Data related to these variables, however, are not available in the Health Data Center of Narathiwat Provincial Public Health Office database. For future studies, it is recommended to include factors such as oral health care behaviors, accessibility of dental services, and considerations of sociological, psychological, and cultural aspects to gain deeper insights.

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