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(RESEARCH ARTICLE)

# The Influence of Tooth Brushing Habits, Children's Behavior, Mother's Role, Diet and Snack Consumption on the Incidence of Dental Caries in Full-Day and Non-Full-Day Elementary School Children (SD) in Unaaha District, Konawe Regency in 2025

Sariyanti *, Mubarak and Asnia Zainuddin

*Master of Public Health Study Program, Faculty of Public Health, Halu Oleo University, Address: Jl. H. E. Mokodompit, Anduonohu, Kendari, Southeast Sulawesi, Indonesia.*

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## Abstract

Dental caries is one of the most common oral health problems in school-aged children. This disease is multifactorial and can be influenced by individual behavior, personal hygiene habits, diet, and social environment. This study aims to analyze the influence of tooth brushing habits, child behavior, maternal role, diet, and snack consumption on the incidence of dental caries in full-day and non-full-day elementary school students in Unaaha District, Konawe Regency. This study was an observational analytic study with a cross-sectional design. The study sample was full-day and non-full-day elementary school students selected using proportional stratified random sampling technique with a sample size of 133 elementary school students. Data analysis used the Chi-Square test, Mann-Whitney test, and multivariate logistic regression. The results of the bivariate analysis showed that all variables had a significant relationship with the incidence of dental caries ($p < 0.05$). Multivariate analysis showed that diet was the dominant factor influencing the incidence of dental caries ($p < 0.05$). There was no significant difference in the incidence of dental caries between full-day and non-full-day schools ($p = 0.321$). In conclusion, dietary patterns play a significant role in the occurrence of dental caries in elementary school children, necessitating dietary control efforts and increasing parental involvement in caries prevention.

**Keywords:** Dental Caries; Tooth Brushing Habits; Children's Behavior; Mother's Role; Diet; Snack Consumption

## 1. Introduction

Oral and dental health is an essential component of overall well-being, as it significantly influences quality of life, eating ability, learning capacity, and children's social development. Dental caries remains a major public health concern at both global and national levels. According to the World Health Organization (2019), approximately 3.5 billion people worldwide suffer from oral diseases, and more than 500 million children experience dental caries in their primary teeth. Global data indicate that the prevalence of early childhood caries (ECC) reaches about 48%, with considerable variation across regions [1].

In Indonesia, the 2018 National Basic Health Research (Riskesdas) reported that the prevalence of active caries among children aged 5–12 years was as high as 93%. Furthermore, data from the Indonesian Health Survey (SKI) in 2023 revealed a marked increase in caries prevalence among 12-year-old children, rising from 7.7% in 2018 to 16.8% in 2023. These findings suggest that oral health behaviors among elementary school children remain suboptimal [2].

Dental caries is a multifactorial disease resulting from the complex interaction of host factors, microorganisms, dietary substrates, and time. Elementary school–aged children constitute a particularly vulnerable group due to their high consumption of sugary foods and insufficient oral hygiene practices. Differences between full-day and non–full-day school systems are assumed to influence children's health-related behaviors, including dietary patterns and oral

* Corresponding author: Sariyanti

hygiene routines. However, scientific evidence comparing caries incidence based on school type is still limited. Therefore, this study aims to identify factors associated with the occurrence of dental caries and to compare the prevalence of dental caries among full-day and non–full-day elementary school students in Unaaha District [3].

## 2. Methods

This study employed an observational approach with a cross-sectional design and was conducted in 2025 in Unaaha District, Konawe Regency. The study sample consisted of 133 elementary school students drawn from both full-day and non–full-day school systems. The independent variables included toothbrushing habits, children's behavioral characteristics, maternal involvement, dietary patterns, and snack consumption, while the dependent variable was the occurrence of dental caries. Data were collected using structured questionnaires and clinical examinations to assess dental caries status. Statistical analysis was performed using the Chi-square test, the Mann–Whitney test, and multivariate logistic regression, with a significance level set at 0.05.

## 3. Results and discussion

In this study, the frequency distribution of respondent characteristics consists of gender.

**Table 1** Frequency Distribution of Respondent Characteristics by Gender in Full-Day and Non–Full-Day Elementary Schools, Konawe Regency, 2025

| **Gender** | **SD Fullday** | | **SD Non Fullday** | | **Total** | |
|---|---|---|---|---|---|---|
| | *f* | % | *F* | % | *f* | % |
| Male | 40 | 56 | 30 | 49 | 70 | 59 % |
| Female | 32 | 44 | 31 | 51 | 63 | 41 % |
| Total | 72 | 100% | 61 | 100% | 133 | 100 % |

Source: SPSS, 2025

Table 1 indicates that in full-day elementary schools, male respondents numbered 40 students, accounting for 56% of the sample, while female respondents totaled 32 students or 44%. These figures demonstrate that male students outnumbered female students in the full-day school setting. In contrast, in non–full-day elementary schools, 30 respondents were male (49%) and 31 were female (51%), indicating a relatively balanced gender composition, with a slightly higher proportion of female students.

Overall, the combined sample from both school types consisted of 133 respondents, including 70 male students (59%) and 63 female students (41%). These findings suggest that, in general, male respondents were more prevalent than female respondents across the two school settings.

**Table 2** Frequency Distribution Using Crosstabulation in Full-Day and Non–Full-Day Elementary Schools, Konawe Regency, 2025

**SD Full day**

| **Toothbrushing Habit** | **Caries *(n)*** | **%** | **No Caries (n)** | **%** | **Total (%)** |
|---|---|---|---|---|---|
| Poor | 18 | 100 % | 0 | 0 % | 18 (100%) |
| Good | 30 | 55.6 % | 24 | 44.4 % | 54 (100%) |
| Total | 48 | 66.7 % | 24 | 33.3 % | 72 (100%) |
| Child Behavior | | | | | |
| Not good | 22 | 95.7 % | 1 | 4.3 % | 23 (100%) |
| Good | 26 | 53.1 % | 23 | 46.9 % | 49 (100%) |
| Total | 48 | 66.7 % | 24 | 33.3 % | 72 (100%) |
| The Role of Mother | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Doesn't Play a Role | 12 | 92.3 % | 1 | 7.7 % | 13 (100%) |
| play a role | 36 | 61 % | 23 | 39 % | 59 (100%) |
| Total | 48 | 66.7 % | 24 | 33.3 % | 72 (100%) |
| Dietary habit | | | | | |
| Risky | 35 | 87.5 % | 5 | 12.5 % | 40 (100%) |
| No Risk | 13 | 40.6 % | 19 | 59.4 % | 32 (100%) |
| Total | 48 | 66.7 % | 24 | 33.3 % | 72 (100%) |
| Snack Consumption | | | | | |
| Risky (Acid) | 9 | 100 % | 0 | 0 % | 9 (100%) |
| No Risk | 39 | 61.9 % | 24 | 38.1 % | 63 (100%) |
| Total | 48 | 66.7 % | 24 | 33.3 % | 72 (100%) |

**SD Non Fullday**

| Tooth Brushing Habits | Caries *(n)* | % | No Caries (n) | *%* | Total (%) |
|---|---|---|---|---|---|
| bad | 15 | 100 % | 0 | 0 % | 15 (100%) |
| Good | 31 | 67.4 % | 15 | 32.6 % | 46 (100%) |
| Total | 46 | 75.4 % | 15 | 24.6 % | 61 (100%) |
| Child Behavior | | | | | |
| Not good | 18 | 94.7 % | 1 | 5.3 % | 19 (100%) |
| Good | 28 | 66.7 % | 14 | 33.3 % | 42 (100%) |
| Total | 46 | 75.4 % | 15 | 24.6 % | 61 (100%) |
| The Role of Mother | | | | | |
| Doesn't Play a Role | *46* | 100 % | 0 | *0 %* | 46 (100%) |
| play a role | *0* | 0 % | 15 | *100 %* | 15 (100%) |
| Total | *46* | 75.4 % | 15 | *24.6 %* | 61 (100%) |
| dietary habit | | | | | |
| Risky | 36 | 94.7 % | 2 | 5.3 % | 38 (100%) |
| No Risk | 10 | 43.5 % | 13 | 56.5 % | 23 (100%) |
| Total | 46 | 75.4 % | 15 | 24.6 % | 61 (100%) |
| Snack Consumption | | | | | |
| Risky (Acid) | 14 | 100 % | 0 | 0 % | 14(100%) |
| No Risk | 32 | 68.1 % | 15 | 31.9 % | 47 (100%) |
| Total | 46 | 75.4 % | 15 | 24.6 % | 61 (100%) |

Source: SPSS 2025

**Table 3** Results of the Chi-Square Test on Toothbrushing Habits, Children's Behavior, Maternal Role, Dietary Patterns, and Snack Consumption in Relation to Dental Caries among Full-Day and Non–Full-Day Elementary School Students in Unaaha District, Konawe Regency, 2025

**Toothbrushing Habits**

| School | Pearson Chi-Square | *p-value* | *OR* |
|---|---|---|---|
| SD Fullday | 12.000 | 0.001 | 29.7 |
| SD Non Fullday | 6.486 | 0.011 | 15.3 |

**Child Behavior**

| School | Pearson Chi-Square | *p-value* | *OR* |
|---|---|---|---|
| | | | |
| SD Fullday | 12.777 | 0.000 | 19.5 |
| SD Non Fullday | 5.559 | 0.018 | 9.0 |

**The Role of Mothers**

| School | Pearson Chi-Square | *p-value* | *OR* |
|---|---|---|---|
| SD Fullday | 4.694 | 0.030 | 7.7 |
| SD Non Fullday | 61.000 | 0.000 | 28.8 |

**Dietary habit**

| School | Pearson Chi-Square | *p-value* | *OR* |
|---|---|---|---|
| SD Fullday | 17.578 | 0.000 | 10.2 |
| SD Non Fullday | 20.301 | 0.000 | 23.4 |

**Snack Consumption**

| School | Pearson Chi-Square | *p-value* | *OR* |
|---|---|---|---|
| SD Fullday | 5.143 | 0.023 | 11.8 |
| SD Non Fullday | 5.925 | 0.015 | 13.8 |

Source: SPSS, 2025

Table 3 presents the results of the Chi-Square analysis examining the association between several behavioral and environmental factors and the occurrence of dental caries among elementary school children enrolled in full-day and non–full-day school systems in Unaaha District, Konawe Regency, in 2025. The analysis focused on five key variables: toothbrushing habits, children's behavior, maternal role, dietary patterns, and snack consumption.

The findings indicate that all examined variables demonstrated a statistically significant relationship with dental caries incidence in both school settings, as evidenced by p-values below the established significance threshold of 0.05. This suggests that each factor independently contributes to the risk of dental caries among elementary school children.

Toothbrushing habits showed a strong association with dental caries occurrence in both school types. In full-day schools, students with poor toothbrushing habits were nearly 30 times more likely to experience dental caries compared to those with good habits (OR = 29.7). Although the magnitude of risk was lower in non–full-day schools, children with inadequate brushing habits still exhibited a substantially increased risk (OR = 15.3). These results emphasize the critical role of consistent and proper oral hygiene practices in preventing dental caries.

Children's behavior was also significantly associated with caries incidence. In full-day schools, poor behavioral patterns increased the likelihood of dental caries by approximately 19.5 times, while in non–full-day schools the risk increased ninefold. This finding suggests that behavioral discipline, health awareness, and self-care practices are important determinants of oral health outcomes.

Maternal role emerged as a particularly influential factor, especially in non–full-day schools. The odds ratio of 28.8 indicates that children lacking maternal involvement were almost 29 times more likely to develop dental caries. In full-day schools, the association was also significant, though with a lower magnitude of risk (OR = 7.7). These findings highlight the protective effect of active maternal supervision in maintaining children's oral hygiene and regulating dietary behaviors.

Dietary patterns were strongly linked to dental caries in both educational settings. Children consuming high-risk diets were more than ten times more likely to experience dental caries in full-day schools and over 23 times more likely in non–full-day schools. This underscores the substantial contribution of frequent sugar intake and unhealthy eating patterns to the development of dental caries.

Similarly, snack consumption was significantly associated with dental caries incidence. Students who frequently consumed high-risk or acidic snacks had a markedly higher risk of developing dental caries in both school systems. The odds ratios indicate that such children were approximately 12 to 14 times more likely to experience dental caries compared to those with low-risk snacking habits.Table 4. Results of the Mann–Whitney U Test Comparing Dental Caries Incidence between Full-Day and Non–Full-Day Elementary Schools, Unaaha District, Konawe Regency, 2025.

**Table 4** Results of the Mann–Whitney U Test Comparing Dental Caries Incidence between Full-Day and Non–Full-Day Elementary Schools, Unaaha District, Konawe Regency, 2025

| **group** | **Dental Caries Incidence** | | |
|---|---|---|---|
| | N | *p-value* | Asymp. Sig. (2-tailed) |
| Full Day | 72 | 0.321 | > 0.05 |
| Non Full Day | 61 | | |

Source: SPSS, 2025

Table 4 presents the results of the Mann–Whitney U test conducted to examine potential differences in the incidence of dental caries between students attending full-day and non–full-day elementary schools. The analysis yielded a p-value of 0.321, which exceeds the predetermined significance level of 0.05.

This result indicates that there is no statistically significant difference in dental caries occurrence between the two school systems. In other words, students enrolled in full-day schools and those attending non–full-day schools exhibited comparable levels of dental caries.

The absence of a significant difference suggests that the duration of time spent at school alone does not appear to be a determining factor in the development of dental caries among elementary school children. Instead, other contributing factors such as oral hygiene practices, dietary habits, parental involvement, and individual behavioral characteristics are likely to play a more substantial role in influencing dental caries outcomes.

**Table 5** Results of Logistic Regression Analysis on Toothbrushing Habits, Children's Behavior, Maternal Role, Dietary Patterns, and Snack Consumption in Relation to Dental Caries among Full-Day Elementary School Students at SDIT Asy Syamil, Unaaha District, Konawe Regency, 2025

**Logistic Regression Results (Full-Day Elementary School)**

| **SD Fullday** | | ***p-Value*** |
|---|---|---|
| Step 1[a] | Toothbrushing Habits | 0.998 |
| | Children's Behavior | 0.972 |
| | Maternal Role | 0.124 |
| | Dietary Patterns | 0.000 |
| | Snack Consumption | 0.999 |

Source: SPSS, 2025

Table 5 presents the results of a multivariate logistic regression analysis examining the influence of several behavioral and environmental factors on dental caries occurrence among students attending a full-day elementary school, namely SDIT Asy Syamil, located in Unaaha District, Konawe Regency, in 2025. The variables included in the model were toothbrushing habits, children's behavior, maternal role, dietary patterns, and snack consumption.

The analysis indicates that dietary patterns were the only variable that showed a statistically significant association with dental caries status among full-day elementary school students. This variable demonstrated a p-value of 0.000, which is well below the established significance threshold of 0.05. These results suggest that dietary behavior plays a dominant role in determining oral health outcomes in this population.

Specifically, children with unhealthy or high-risk dietary patterns were found to have a substantially higher likelihood of experiencing dental caries compared to those with healthier eating habits. The estimated risk indicates that children with poor dietary patterns were approximately 18 times more likely to develop dental health problems than their counterparts who adhered to healthier diets. This finding underscores the critical impact of frequent sugar intake, improper meal timing, and inadequate nutritional choices on the development of dental caries.

In contrast, other variables included in the regression model namely toothbrushing habits, children's behavior, maternal role, and snack consumption did not exhibit a statistically significant effect on dental caries status, as indicated by p-values greater than 0.05. While these factors may contribute to oral health in a bivariate context, their influence appears to be diminished when analyzed simultaneously with dietary patterns in a multivariate framework.

**Table 6** Results of Logistic Regression Analysis on Toothbrushing Habits, Children's Behavior, Maternal Role, Dietary Patterns, and Snack Consumption in Relation to Dental Caries among Non–Full-Day Elementary School Students at SDN 1 Unaaha, Unaaha District, Konawe Regency, 2025

**Logistic Regression Results (Non–Full-Day Elementary School)**

| **SD Non Fullday** | | ***p-Value*** |
|---|---|---|
| Step 1[a] | Toothbrushing Habits | 0.998 |
| | Children's Behavior | 0.322 |
| | Maternal Role | 0.602 |
| | Dietary Patterns | 0.005 |
| | Snack Consumption | 0.998 |

Source: SPSS, 2025

Table 6 presents the findings of a multivariate logistic regression analysis conducted to assess the influence of toothbrushing habits, children's behavioral characteristics, maternal role, dietary patterns, and snack consumption on the occurrence of dental caries among students attending a non–full-day elementary school, specifically SDN 1 Unaaha in Unaaha District, Konawe Regency, in 2025.

The results of the regression analysis indicate that dietary patterns emerged as the only variable with a statistically significant association with children's dental health status, as evidenced by a p-value of 0.005, which is below the conventional significance level of 0.05. This finding provides strong empirical support for the critical role of dietary habits in shaping oral health outcomes among school-aged children.

Children who exhibited unhealthy or high-risk dietary patterns were significantly more likely to experience dental caries compared to those with healthier eating behaviors. This reinforces the notion that frequent consumption of sugary foods, irregular meal patterns, and poor nutritional quality contribute substantially to the development and progression of dental caries in children.

In contrast, other variables included in the model namely toothbrushing habits, children's behavior, maternal role, and snack consumption did not show statistically significant effects on dental caries status within the multivariate regression framework. Although these factors are commonly regarded as important components of oral health behavior, their influence was not independently significant when analyzed simultaneously with dietary patterns.

**Table 7** Results of the Simultaneous (Omnibus) Test of Toothbrushing Habits, Children's Behavior, Maternal Role, Dietary Patterns, and Snack Consumption on the Occurrence of Dental Caries among Full-Day and Non–Full-Day Elementary School Students in Unaaha District, Konawe Regency, 2025

| **Omnibus Tests of Model Coefficients** | | | | |
|---|---|---|---|---|
| | | Chi-square | df | Sig. |
| Step 1 | Step | 99.497 | 5 | 0.000 |
| | Block | 99.497 | 5 | 0.000 |
| | Model | 99.497 | 5 | 0.000 |
| Model Summary | | | | |
| Step | -2 Log likelihood | Cox & Snell R Square | Nagelkerke R Square | |
| 1 | 61.439[a] | 0.527 | 0.751 | |
| | | | | |

Source: SPSS, 2025

Table 7 presents the results of the simultaneous statistical testing (Omnibus Tests of Model Coefficients) conducted to evaluate the combined effect of five independent variables namely toothbrushing habits, children's behavior, maternal role, dietary patterns, and snack consumption on the occurrence of dental caries among elementary school children attending both full-day and non–full-day schools in Unaaha District, Konawe Regency, in 2025.

The Omnibus test results demonstrate that the regression model is statistically significant, as indicated by a chi-square value of 99.497 with 5 degrees of freedom and a significance level of 0.000, which is far below the threshold of 0.05. This finding confirms that, when considered simultaneously, the five independent variables collectively exert a significant influence on the dependent variable, namely dental caries incidence.

Furthermore, the model summary provides important information regarding the explanatory power of the regression model. The Nagelkerke R Square value of 0.751 indicates that approximately 75.1% of the variance in dental caries occurrence can be explained by the combined contribution of the independent variables included in the model. This represents a strong model fit and suggests a substantial collective effect of oral hygiene behaviors, behavioral characteristics, parental involvement, and dietary factors on children's dental health outcomes.

The Cox and Snell R Square value of 0.527 further supports the adequacy of the model, although the Nagelkerke R Square is generally preferred for interpretation due to its adjustment to a maximum value of 1.0. Together, these statistics indicate that the regression model has a high level of predictive capability.

### 3.1. Toothbrushing Habits and the Occurrence of Dental Caries

The findings of this study indicate that toothbrushing habits are significantly associated with the occurrence of dental caries in both types of schools. A statistically significant relationship was observed in full-day elementary schools ($p = 0.001$) as well as in non–full-day elementary schools ($p = 0.011$). These results underscore the critical role of both the frequency and the proper technique of toothbrushing in maintaining children's oral health.

This finding is consistent with established oral health theories, which emphasize that brushing teeth at least twice daily is essential for reducing dental plaque accumulation one of the primary etiological factors in the development of dental caries. Dental plaque serves as a reservoir for cariogenic bacteria, particularly *Streptococcus mutans*, which metabolize dietary sugars and produce acids that lead to enamel demineralization and subsequent tooth decay.

The present results are supported by the study conducted by Ameer et al. (2021), which reported that children who brush their teeth less than twice per day have a two- to threefold higher risk of developing dental caries. Similarly, research by Wicaksono and Suwargiani (2020) demonstrated that improper toothbrushing techniques significantly contribute to the high prevalence of dental caries among elementary school children.

Poor toothbrushing practices facilitate the colonization of dental plaque on tooth surfaces, thereby increasing acid exposure and accelerating the tooth decay process. Elementary school–aged children often lack consistency and adequate skill in maintaining oral hygiene, making them particularly vulnerable to plaque accumulation. Consequently, parental supervision and guidance are essential to ensure that children brush their teeth regularly and correctly.

Children who do not maintain consistent toothbrushing routines tend to experience greater plaque buildup, which accelerates enamel demineralization and heightens the risk of dental caries.

### 3.2. Children's Behavior and the Occurrence of Dental Caries

The results of this study demonstrate a statistically significant association between children's behavior and the incidence of dental caries in both educational settings. Significant relationships were identified in full-day elementary schools ($p = 0.000$) as well as in non–full-day elementary schools ($p = 0.018$). The behavioral factors examined in this context include frequent consumption of sugary foods, failure to rinse the mouth after eating, infrequent toothbrushing after meals, and a general lack of awareness regarding the importance of maintaining oral hygiene.

These findings are consistent with the study by Alkhalefa et al. (2022), which reported that approximately 68% of dental caries cases were attributable to unhealthy eating behaviors and inadequate oral hygiene practices. Similarly, Lamont et al. (2020) emphasized that health-related behaviors represent a more dominant determinant of oral health outcomes than socioeconomic factors, particularly in the pediatric population.

Children's behavior is largely shaped by daily routines and sustained interactions within their family and school environments. Inadequate behavioral patterns lead to repeated exposure to sugars and acids, creating favorable conditions for continuous enamel demineralization. This ongoing process directly contributes to the formation of dental biofilm and acid production, thereby accelerating the development and progression of dental caries.

### 3.3. Maternal Role and the Occurrence of Dental Caries

The maternal role was found to have a statistically significant association with the occurrence of dental caries in both school settings, with p-values of 0.030 in full-day elementary schools and 0.000 in non–full-day elementary schools. Notably, the results observed in non–full-day schools indicate a particularly strong relationship between maternal involvement and children's dental health outcomes.

These findings support theoretical perspectives that emphasize parents especially mothers as primary agents in shaping children's health-related behaviors. Maternal supervision of toothbrushing practices, preparation of nutritionally balanced meals, and regulation of snack consumption function as powerful protective factors against dental caries. A study by Bhat and Jacob (2021) identified maternal involvement as the strongest predictor of children's oral hygiene status. Likewise, Purwanti et al. (2023) reported that children who receive direct guidance from their mothers during toothbrushing have a 40% lower risk of developing dental caries.

The maternal role plays a crucial part in establishing and maintaining children's oral health behaviors. Consistent and proactive maternal interaction fosters discipline and routine in oral hygiene practices, thereby reducing the likelihood of dental caries. Furthermore, maternal involvement significantly influences children's eating habits, toothbrushing schedules, and overall oral cleanliness, reinforcing its central role in the prevention of dental caries among school-aged children.

### 3.4. Dietary Patterns and the Occurrence of Dental Caries

Dietary patterns emerged as the variable with the strongest level of statistical significance in both school settings ($p = 0.000$ for full-day schools and $p = 0.000$ for non–full-day schools). Multivariate analysis further revealed that dietary patterns were the only variable that remained statistically significant in the regression model, conferring a risk of dental caries that was up to 18 times higher. The dietary behaviors examined included the frequency of consuming sugary foods, sticky snacks, sweetened beverages, and the intensity of eating outside regular main mealtimes.

These findings are consistent with the study by P. Moynihan (2020), which reported that consuming sugar more than four times per day leads to an exponential increase in the risk of dental caries. Similarly, research by Saldarriaga et al. (2022) identified high-sugar dietary patterns as the most dominant predictor of dental caries development in children. Frequent intake of sugar-rich foods results in a reduction of salivary pH to levels below 5.5, thereby triggering enamel demineralization.

Repeated consumption of sweet foods without being accompanied by appropriate toothbrushing practices accelerates the process of tooth decay. For this reason, dietary patterns represent a key determinant in caries prevention. Continuous sugar exposure causes the oral pH to fall below the critical threshold of 5.5, making dental enamel more susceptible to dissolution and increasing the likelihood of caries formation.

### 3.5. Snack Consumption and the Occurrence of Dental Caries

Snack consumption was found to be significantly associated with the occurrence of dental caries in both school settings, as indicated by p-values of 0.023 and 0.015. Snacks commonly available in school environments typically contain high levels of sugar and possess sticky textures, which facilitate their adherence to tooth surfaces and make them difficult to remove through natural cleansing mechanisms.

These findings are supported by the study conducted by Putri and Prasetya (2020), which demonstrated a significant relationship between school snack consumption and dental caries among children. Their research indicated that frequent consumption of sweet and sticky snacks increases the risk of dental caries by up to threefold. Snack intake predominantly occurs within the school setting, where children have greater autonomy in food choices and limited supervision.

This situation highlights the urgent need for school-based interventions aimed at regulating the types of snacks sold within school premises to prevent further deterioration of children's oral health. The frequency of snack consumption plays a critical role in influencing salivary pH fluctuations, which in turn accelerates the process of enamel demineralization and contributes directly to the development of dental caries.

### 3.6. Absence of Differences in Dental Caries Occurrence between Full-Day and Non–Full-Day Schools

The results of the Mann–Whitney difference test yielded a p-value of 0.321, indicating that there is no statistically significant difference in the incidence of dental caries between students attending full-day and non–full-day elementary schools. This finding suggests that the length of time children spend at school is not a primary determinant of dental caries development. Instead, more influential factors appear to be the quality of health-related behaviors established within the home environment.

Toothbrushing practices, whether performed in the morning or at night, generally take place at home rather than at school. As neither full-day nor non–full-day schools in this study implemented a daily toothbrushing program, the duration of school attendance had minimal impact on children's oral hygiene routines. Consequently, children's oral health behaviors including toothbrushing techniques, motivation, and overall hygienic awareness are shaped more substantially by family influences than by school-based activities.

Moreover, both full-day and non–full-day schools included in this study were predominantly attended by children from middle- to upper–socioeconomic backgrounds. Within this population, parental involvement particularly maternal supervision tends to be relatively high in monitoring children's dental health. This includes guiding children in toothbrushing, regulating snack consumption, and facilitating regular dental check-ups. However, when parental supervision is inadequate, the risk of dental caries remains present regardless of the type of school attended.

In addition, children's main meals, such as breakfast and dinner, are typically consumed at home. Lunch at school, on the other hand, has been standardized through the MBG meal program across both school types, thereby limiting opportunities for excessive consumption of sugary snacks or fried foods. Since the implementation of the MBG program, the number of snack vendors within school environments has decreased substantially. As a result, dietary patterns at school do not appear to create meaningful differences in dental caries risk between full-day and non–full-day schools.

### 3.7. Simultaneous Effects of All Variables

Based on the results of the logistic regression analysis, the Nagelkerke R Square value was 0.751. This finding indicates that the combined variables namely toothbrushing habits, children's behavior, maternal role, dietary patterns, and snack consumption collectively exert a strong and meaningful influence on the occurrence of dental caries.

Nevertheless, the results also suggest that 24.9% of the variation in dental caries incidence is explained by factors beyond the scope of the variables examined in this study. This remaining proportion may be attributed to several other determinants, including:

- Biological and genetic factors, such as enamel structure, dentin strength, salivary flow and composition, and the characteristics of the oral microbiota.
- Environmental factors, including drinking water quality (particularly fluoride content), overall environmental cleanliness, and school sanitation conditions.
- Socioeconomic factors, such as household income, parental educational level, and the family's capacity to provide adequate facilities and nutritious food for children.

- Health service–related factors, encompassing the frequency of dental visits, access to oral health care services, and the availability of school-based dental health programs.
- Additional behavioral factors, including habits such as prolonged food retention in the mouth, frequent consumption of sweetened beverages, toothbrushing duration, use of fluoride-containing toothpaste, and bedtime routines related to oral hygiene.

Psychosocial variables, such as parental supervision, parenting styles, and children's awareness and attitudes toward oral health.

The substantial proportion of unexplained variance underscores that dental caries is a multifactorial condition resulting from complex interactions among biological, behavioral, environmental, and social determinants. In line with the caries etiology theory proposed by Keyes and further elaborated by Newbrun, dental caries develops through the interaction of the host (teeth and saliva), microorganisms, dietary substrates, and time. This reinforces the notion that although behavioral variables play a critical role, unmeasured factors continue to make significant contributions to the development of dental caries.

## 4. Conclusion

Dietary patterns represent the most dominant risk factor for the development of dental caries among elementary school children in Unaaha District. No significant differences were identified in the incidence of dental caries between students attending full-day schools and those enrolled in non–full-day schools. Therefore, caries prevention strategies should prioritize dietary control and the strengthening of parental involvement in shaping children's oral health behaviors.

## Compliance with ethical standards

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### *Disclosure of conflict of interest*

There is no conflict of interest in this research.

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