



IMPACT OF EARLY ORTHODONTIC INTERVENTION ON DIETARY CHOICES, BMI, AND ORAL HEALTH IN CHILDREN

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Abstract

Introduction: Malocclusion is a common pediatric oral health issue affecting facial aesthetics, dental alignment, and masticatory function. Misaligned teeth can impair chewing efficiency, limit dietary variety, and contribute to plaque accumulation, caries, and gingival inflammation. Early orthodontic intervention aims to correct developing malocclusions, improve oral function, and potentially influence nutritional habits and body mass index (BMI). In Bangladesh, studies exploring the impact of early orthodontic treatment on children's dietary behavior, BMI, and oral health are limited. **Methods:** A cross-sectional study was conducted at the Department of Orthodontics, Sodesh Hospital Pvt. Ltd, Mymensingh, Bangladesh, from January to December 2024. Ninety-two children aged 6–12 years (51 females, 41 males) presenting with dental complaints were included. Oral and periodontal examinations were performed to record erupting teeth, dental lesions, plaque, calculus, and extractions. BMI was calculated, and parents completed structured questionnaires on oral hygiene practices and dietary habits. Data analysis involved descriptive statistics and Spearman correlations to assess relationships among BMI, age, tooth eruption, dental lesions, and dietary patterns.

Results: Participants had a mean age of 9.33 ± 3.52 years and mean BMI of 18.25 ± 3.34 . Higher BMI was significantly associated with age ($p = 0.69$, $p < 0.0001$), calculus presence ($p = 0.40$, $p = 0.0002$), snack consumption, and accelerated tooth eruption ($p = 0.65$, $p = 0.043$). Food intake in the later part of the day correlated with dental lesions ($p = 0.005$). No significant correlations were observed between BMI and systemic conditions or between general health status and dental lesions.

Conclusion: Early orthodontic assessment reveals a significant relationship between BMI, dietary habits, and tooth eruption in children. Obesity is associated with accelerated dental development and may influence oral health outcomes, including lesion prevalence. These findings highlight the importance of integrating nutritional and oral health monitoring in pediatric orthodontic care

Keywords: Over-the-counter medications, KAP study, urban health, self-medication, drug safety,

public awareness

INTRODUCTION

Malocclusion is one of the most common oral health problems in children, which affecting not only face aesthetic and dental alignment but also chewing function. Children with misaligned teeth often show impaired masticatory performance, which reduced bite force, altered jaw movements, and lower chewing efficiency compared to those with normal occlusion. [1] Malocclusion is considered the third most common oral health condition, following dental caries and periodontal disease.[2]

In case of functional and nutritional considerations, malocclusion can influence oral health outcomes. Crowding or misaligned teeth create areas which are difficult to clean, result of increasing the risk of plaque accumulation, dental caries, and gingival inflammation. Early orthodontic treatment can improve alignment, facilitate better oral hygiene, and reduce the risk of secondary oral health problems. [3] Impaired mastication can limit the ability to effectively process tougher, fibrous foods like raw vegetables and fruits, potentially narrowing food variety and favoring softer, less nutrient-dense food choices. [4]

Orthodontic or interceptive interventions implemented during this developmental window — often termed “early orthodontic intervention” — aim to correct or mitigate developing malocclusions, guide skeletal growth, improve dental arch relationships, and restore functional occlusion. [5] The rationale for such treatment extends beyond alignment alone: by correcting skeletal or dental discrepancies early, the severity of malocclusion may be reduced, less invasive treatment later may be required, and improvement of oral function (e.g., mastication, bite force) may be realized. [6]

Childhood is critical for growth, making diet quality and nutrient intake essential. BMI reflects nutritional status, and oral function–related dietary habits may influence BMI in children.[7] Body mass index (BMI) reflects growth and nutritional status in children. Malocclusion can reduce chewing efficiency, limiting dietary variety and affecting BMI, while higher BMI may influence craniofacial development and occlusion, showing a bidirectional relationship between body composition and dental alignment.[8]

Global studies suggest that early orthodontic intervention can influence children’s dietary habits and oral health, though its impact on BMI is generally modest. Orthodontic appliances often lead children to prefer softer foods, temporarily altering diet without significantly affecting nutrition [9]. BMI changes during treatment are usually minor, while higher BMI has been associated with altered craniofacial development and occlusion, indicating a bidirectional relationship between body composition and dental alignment.[10] Dietary modifications during treatment may also affect oral health outcomes, such as plaque accumulation and gingival inflammation, though evidence is limited [11]. Overall, early orthodontic treatment appears to positively influence dietary behavior and oral health, but further longitudinal studies are needed to clarify its full effects on BMI and overall pediatric health.

Bangladesh, studies on early orthodontic intervention are limited, focusing mainly on malocclusion prevalence. There is no research examining its effects on dietary choices, BMI, or oral health in children, highlighting a significant gap for future investigation.[12]

The aim of this study is to evaluate the impact of early orthodontic intervention on dietary choices, body mass index (BMI), and oral health outcomes in children, to determine whether timely orthodontic treatment can improve nutrition, growth, and overall oral health.

METHODOLOGY

Study Design and Setting

This cross-sectional study was conducted in the Department of Orthodontics, Sodesh Hospital Pvt. Ltd, Mymensingh, Bangladesh, from January 2024 to December 2024. The study aimed to evaluate the relationship between children's oral health parameters, nutritional habits, and body mass index (BMI).

Study Population

A total of 92 pediatric patients aged 6 to 12 years were included in the study. Among them, 51 were female and 41 were male. All participants presented with various dental complaints and were examined for oral and periodontal health. Children with systemic conditions such as diabetes, respiratory disorders, anemia, or vitamin D deficiency were not excluded, as the study also aimed to explore potential associations between systemic and oral parameters.

Sampling Technique and Sample Size

A convenience sampling method was used, enrolling all eligible children who attended the dental clinic during the study period and met the inclusion criteria. The final sample size was 92 participants, which was deemed adequate for correlation analyses among the study variables.

Data Collection Tools and Procedure

Each participant underwent a detailed oral and periodontal examination. The number of teeth in the process of eruption, presence of carious lesions, debris, dental plaque, calculus, and any extracted teeth were recorded. Body Mass Index (BMI) was calculated by dividing the child's weight (in kilograms) by the square of their height (in meters).

A structured questionnaire was administered to parents or guardians to gather information about the child's oral hygiene practices, dietary patterns, and systemic health status. Dietary behavior was categorized based on the frequency of consumption of fruits, vegetables, cereals, milk and dairy products, meat, and sweets (1 = daily, 2 = at least twice per week, 3 = occasional). Additional variables included:

- Food rhythm (1 = higher intake in the first part of the day; 2 = higher intake in the second part of the day)
- Number of meals per day (1, 2, or 3)
- Snack consumption between meals (yes/no)
- Tooth brushing frequency (0, 1, 2, or 3 times per day)
- Presence of dental calculus

Data Analysis

Data were analyzed using GraphPad Prism version 10.6.1 (GraphPad Software). Continuous variables were summarized as mean $\pm$ standard deviation (SD) and median with interquartile range (IQR), while categorical variables were presented as frequencies and percentages. Normality of distribution was tested using the Kolmogorov–Smirnov test.

Spearman's correlation coefficient was applied to assess relationships between continuous variables such as BMI, age, number of erupting teeth, and number of dental lesions. A two-tailed p-value of less than 0.05 was considered statistically significant.

RESULT

The participants had an average age of 9.33 ± 3.52 years, with females comprising 55.4% and males 44.6% of the study population. Most of the children resided in urban areas. The mean body weight was 36.64 ± 14.20 kg, and the average BMI was 18.25 ± 3.34 .

Eating behaviors, particularly the intake of fruits, vegetables, and snacks between meals, were notable among the participants included in this study (Table 1).

Table 1. Demographic, clinical and nutritional-related pattern characteristics in patients.

Characteristics	Total (n=92)
Age, years Mean±SD	9.33±2.52
Median, SQRT	9 (6-12)
Gender, n (%)	
Female	51 (55.4%)
Male	41 (44.6%)
Environment, n (%) Urban	72 (82.6%)
Rural	20 (17.4%)
Weight, kg	
Median±SD	36.64±14.20
Median, SQRT	35.6 (25-44)
Hight, cm Median±SD	138.5± 15.58
Median, SQRT	140.5 (125.3-150.8)
BMI	
Median±SD Median, SQRT	18.25± 3.34 18.10 (16.7-19.98)
Brushing	
0	3 (3.3%)
1	44 (47.8%)
2	37 (40.2%)
3	8 (8.7%)
Calculus	74 (80.4%)
Intake of food	
Fruits	1=39 (42.4%), 2=44 (47.8%), 3=9 (9.8%)
Vegetables	1=38 (41.3%), 2=41 (44.6%), 3=13 (14.1%)
Cereals	1=23 (25%), 2=40 (41.5%), 3=29 (31.5%)
Milk	1=29 (31.5%), 2=47 (51.1%), 3=15 (16.3%)
Meat	1=44 (47.8%), 2=40 (43.5%), 3=7 (7.6%)
Sweats	1=41 (44.6%), 2=31 (33.7%), 3=12 (13%)
Food rhythm 1, yes	42 (45.7%)
Food rhythm 2, yes	50 (54.3%)
Meals number per day 1	6 (6.5%)
2	39 (42.4%)
3	47 (51.1%)
Snacks, yes	63 (68.5%)
Eruptions	0.96± 1.22
Systemic diseases	23(25%)
Diabetes	1(1.08%)

There was a strong, statistically significant positive correlation between BMI and age ($\rho = 0.69$, $p < 0.0001$), and a moderate, significant correlation with calculus accumulation ($\rho = 0.40$, $p = 0.0002$).

Additionally, BMI showed a moderate and significant association with snack consumption and tooth eruption ($\rho = 0.65$, $p = 0.043$), as well as a weak but significant correlation with dental lesions ($\rho = 0.27$, $p = 0.007$). A notable association was also found between BMI and food rhythm type 2 ($p = 0.043$), and between food rhythm type 2 and dental lesions ($p = 0.005$).

The general health status showed no significant correlation with either the number of tooth eruptions ($\rho = -0.102$, $p = 0.335$) or the number of dental lesions ($\rho = -0.091$, $p = 0.331$).

These findings are presented in Tables 2 and 3. A significant association was observed between the presence of dental calculus and both age ($p = 0.42$, $p = 0.002$) and BMI. However, no correlation could be established between BMI and the presence of systemic diseases.

Table 2. Correlations coefficients between the parameters analyzed

	Age	BMI	Brushing	Debris	Calculus	Fruits	Vegetables	Cereals	Milk	Meat	Sweats	Meals	Snacks	Eruptions	Lesions
Age	1.00	0.69	0.15	0.05	0.42	-0.01	0.03	-0.17	0.11	-0.25	-0.03	0.21	-0.16	0.03	0.22
BMI	0.69	1.00	0.09	0.16	0.40	0.16	0.17	0.02	0.14	-0.21	-0.12	0.28	0.41	0.65	0.27
Brushing	0.15	0.09	1.00	-0.63	-0.08	-0.19	-0.10	-0.15	-0.01	-0.05	0.01	0.02	0.03	0.03	-0.33
Debris	0.05	0.16	-0.63	1.00	0.28	0.17	0.17	0.12	0.01	0.04	0.09	0.05	-0.10	0.11	0.53
Calculus	0.42	0.40	-0.08	0.28	1.00	0.20	0.22	-0.01	0.03	-0.07	-0.02	0.06	-0.11	0.14	0.12
Fruits	-0.01	0.16	-0.19	0.17	0.20	1.00	0.41	0.27	-0.01	0.04	-0.18	0.01	0.09	0.04	0.18
Vegetables	0.03	0.17	-0.10	0.17	0.22	0.41	1.00	0.24	0.10	-0.13	-0.20	0.05	0.14	-0.04	0.13
Cereals	-0.17	0.02	-0.15	0.12	-0.01	0.27	0.24	1.00	0.00	0.03	-0.30	-0.02	-0.13	-0.01	0.02
Milk	0.11	0.14	-0.01	0.01	0.03	-0.01	0.10	0.00	1.00	-0.10	-0.09	-0.04	-0.05	-0.11	0.23
Meat	-0.25	-0.21	-0.05	0.04	-0.07	0.04	-0.13	0.03	-0.10	1.00	0.14	0.01	-0.03	-0.07	-0.14
Sweats	-0.03	-0.12	0.01	0.09	-0.02	-0.18	-0.20	-0.30	-0.09	0.14	1.00	-0.02	-0.04	0.03	-0.23
Meals	0.21	0.28	0.02	0.05	0.06	0.01	0.05	-0.02	-0.04	0.01	-0.02	1.00	-0.27	0.06	0.05
Snacks	-0.16	0.41	0.03	-0.10	-0.11	0.09	0.14	-0.13	-0.05	-0.03	-0.04	-0.27	1.00	-0.16	-0.06
Eruptions	0.03	0.65	0.03	0.11	0.14	0.04	-0.04	-0.01	-0.11	-0.07	0.03	0.06	-0.16	1.00	0.03
Lesions	0.22	0.27	-0.33	0.53	0.12	0.18	0.13	0.02	0.23	-0.14	-0.23	0.05	-0.06	0.03	1.00

Table 3. Significances of correlations (*= $p < 0.05$ statistically significant)

Characteristics	BMI correlations	p -value
Age	0.69	<0.0001*
Brushing	0.09	0.03*
Debris	0.16	0.179
Calculus	0.40	0.0002*
Fruits	0.16	0.038*
Vegetables	0.17	0.13
Cereals	0.02	0.09
Milk	0.14	0.87
Meat	-0.21	0.19
Sweats	0.12	0.04
Meals	0.28	0.26
Snacks	0.41	0.043*
Eruptions	0.65	0.043*
Lesions	0.27	0.007*
Food rhythm1	0.247	0.431
Food rhythm2	0.653	0.043*

The correlation matrix illustrating the relationships between eruptions, lesions and general status of the participants is shown in Figure 1. Positive and negative associations are depicted using a color gradient, where blue indicates strong positive correlations ($r = 1.0$) and red represents strong negative correlations ($r = -1.0$).

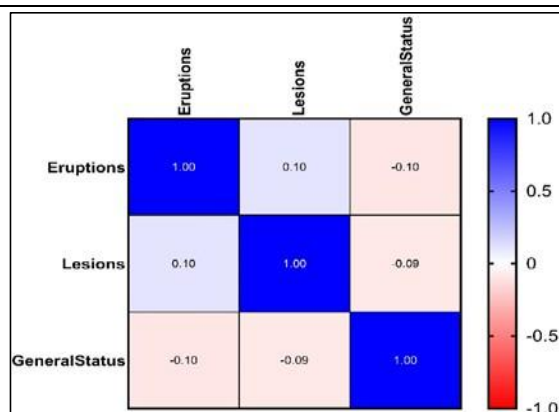


Figure 1. Heatmap of the correlation matrix between general status of patients and the number of dental lesions and eruptions

DISCUSSION

In this study, no significant correlations were found between the evaluated parameters and systemic diseases, despite 25% of participants presenting with some form of systemic condition. Only one child in the sample was diagnosed with diabetes, although diabetes is among the most commonly recognized comorbidities associated with obesity, as well as oral and periodontal alterations [13].

Lalla et al. (2007) investigated the relationship between diabetes mellitus and periodontal attachment and bone loss, reporting higher plaque indices and a greater percentage of plaque sites in diabetic patients compared to non-diabetic counterparts [14]. Moreover, the number of affected teeth was notably greater among diabetic children than in healthy controls, in both younger (<12 years) and older (>12 years) subgroups. Children with poor glycemic control also exhibited a higher prevalence, while BMI-for-age was similar across groups; however, older diabetic children demonstrated significantly higher BMI values than younger ones [15].

A weak but notable link has also been observed between accelerated tooth eruption and elevated BMI percentiles among diabetic children [16]. Consistent with these findings, our study identified similar trends among systemically healthy children showing significant correlations between BMI, tooth eruption, and dietary rhythm, and a highly significant relationship between age and BMI, irrespective of systemic diagnosis. A previous study conducted in 2012 also explored this relationship, revealing a connection between the number of permanent teeth erupted and weight status across three groups of children: normal weight, overweight, and obese.

Obesity status, female gender, and age were all significantly associated with the number of erupting permanent teeth. After adjusting for age, sex, and race/ethnicity, obese children were found to have an average of 1.44 more erupted teeth than their non-obese counterparts [17]. This supports evidence that higher BMI is linked to accelerated dental development, with obese children exhibiting a greater number of erupted permanent teeth by around 12 years of age [18].

A longitudinal three-year study using digital panoramic radiographs of children aged 6–12 years revealed that those with at least one dental anomaly were significantly older (mean age 7.90 years) than those without anomalies. The prevalence of anomalies was substantially higher in permanent teeth (60.5%) than in primary teeth (3.3%) [19]. Similarly, Wong et al. (2017) reported that 20% of the examined children were overweight according to WHO BMI-for-age criteria, finding strong correlations between the number of erupted permanent teeth and multiple anthropometric measures, including BMI [20]. Our findings align with this, indicating that children with higher BMI exhibited faster tooth eruption.

Previous studies have also shown a significant association between obesity and the frequency of dental caries, emphasizing that obesity should be recognized not only as a risk factor for systemic conditions but also for oral health issues such as carious lesions [21]. In our study, poor oral hygiene evidenced by debris and calculus deposits—was significantly linked to the presence of dental lesions.

Obesity has been associated with accelerated physical maturation, leading to earlier tooth eruption compared to normal-weight peers of the same age [22]. Conversely, underweight children aged 8–11 years were found to be at risk for delayed tooth eruption [23].

Abdullatif et al. examined dietary behaviors among adolescents and found that unhealthy eating patterns were prevalent: 21.3% did not consume fruits, 19.7% avoided vegetables, and 3.3% reported no dairy intake in the week before the survey. Additionally, 31% consumed carbonated drinks daily, 18.4% skipped breakfast, and 78.9% ate fast food at least once a week [24].

Another study investigating dietary influences on tooth eruption showed that frequent meat consumption was associated with earlier eruption of permanent teeth [25]. In our findings, most children reported eating meat daily, whereas fruits and vegetables were consumed less often typically twice per week. However, no significant correlation was identified between these dietary patterns and any of the evaluated parameters. Notably, 63% of participants reported consuming snacks between meals, and a significant association was observed between food rhythm particularly eating later in the day and the presence of dental lesions.

Ethical Consideration

informed consent was secured from all participants' legal guardians prior to data collection.

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