Journal of Chemical Health Risks

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JCHR (2026) 16(2), 4663-4670 | ISSN:2251-6727

Evaluation of Correlation Between Eruption Status of Primary Teeth and Body Mass Index (BMI) in Children aged 6 month to 3 years.

Dr. Rehan Khan[1], Dr. Samiksha Kubade[2], Dr. Dinesh Khandare[3], Dr. Khyati Dodia[4]

[1]HOD and professor, Department of Pediatric and Preventive Dentistry, Saraswati Dhanwantari Dental College and Hospital, Parbhani, Maharashtra

[2]PG student, Department of Pediatric and Preventive Dentistry, Saraswati Dhanwantari Dental College and Hospital, Parbhani, Maharashtra

[3] Senior lecture, Department of Pediatric and Preventive Dentistry, Saraswati Dhanwantari Dental College and Hospital, Parbhani, Maharashtra

(Received: 16 February 2026 Revised: 14 March 2026 Accepted: 25 April 2026)

KEYWORDS

Height, Weight, Deciduous teeth, Eruption pattern, Body mass index.

ABSTRACT:

Introduction: Tooth eruption is a continuous biological process by which developing teeth emerge through the jaws and the overlying mucosa to enter into the oral cavity. Tooth eruption time and sequence are important factors in dental treatment planning, particularly in Pediatric dentistry to estimate age of a child. It is influenced by many factors. Few studies have indicated relationship between the eruption times with the weight and height of the children. Children who are below average weight and height have been shown to have a delayed eruption time than those who are within the standard range.

Objectives: To evaluate the correlation between eruption status of deciduous teeth with Body Mass Index (BMI) in children aged 6 months to 3 years.

Methods: Total 85 children were examined after obtaining consent from parents and after getting necessary clearance from institutional ethical committee. Dental examination was performed by single examiner. The weight was determined by weighing a child in kilograms using a digital weighing scale after removal of shoes. The height was measured from the heel to the uppermost part of the head using a wall mounted tape measure. Height was measured in meters.

Result: Among 85 children, 15.5% were underweight ,41.7% were overweight and 42.9% were normal correlation of BMI and number of erupted teeth at different age groups found that strong significant positive (direct) correlation was observed between BMI and number of erupted teeth at three different age groups i.e. 13-18 months, 25-30 months and 31-36 months on using Pearson 'r' correlation test.

Conclusion: It was observed that there was significant influence on the eruption of deciduous teeth and nutritional factors played important role. Children having normal weight and height children showed normal eruption pattern, whereas overweight and over height children showed early eruption of deciduous teeth and underweight and under height children showed delayed eruption of deciduous teeth.

1. INTRODUCTION

The eruption of primary teeth is a crucial developmental milestone during early childhood. It is essential for proper mastication, phonation and guiding the eruption of permanent successors. [1,2] Tooth eruption is a continuous biological process by which developing teeth emerge through the jaws and the overlying mucosa to enter into the oral cavity and contact the teeth of the opposing arch.[3]Normally, the primary dentition begins to erupt around 6 months of age and is usually completed by approximately 30 to 36 months.[1]Tooth eruption time and sequence are important factors in dental treatment planning, particularly in Pediatric dentistry to estimate age of a child.

Tooth eruption is influence by multiple factors, like genetics, gender, diet, preterm birth, socioeconomic

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conditions, height and weight, craniofacial morphology, hormonal factors and systemic disorders, which influence the eruption of teeth in the oral cavity throughout a wide age range.[4,5] Emergence of teeth is positively correlated with an individual's somatic growth (weight and height). Nutrition is thought to have a beneficial effect on accelerating up tooth eruption out of all the variables that affect it. Many researchers from all over the world have also noted that inadequate nutrition during the growing years can have a negative impact on dental development, leading to congenital dental abnormalities, delayed eruption of both permanent and deciduous teeth and poor oral health.[6,7]

The Body Mass Index is one of the most widely used metrics for comparing and determining somatic growth in large populations, particularly children. It is also among the most widely used and straightforward techniques for determining a person's nutritional status. Body mass index is calculated by dividing a person's weight in kilograms by the square of their height in meters. It is sometimes referred to as the Quetelet index.[8,9]

It is usually calculated using the formula:

$$\text{BMI} = \frac{\text{Weight (kg)}}{\text{Height (m}^2\text{)}}$$

Assessments for children and teenagers include gender and growth-specific variations, in contrast to BMI measurements for adults. For children, the Centers for Disease Control and Prevention (CDC) refer to certain BMI values as "BMI for age."[9,10] Literature evidence show that children with lesser height and weight for their age have delayed the eruption of teeth than their normal counterparts.[11] Several studies have demonstrated a positive association between higher BMI and accelerated dental development or earlier tooth eruption. Must et al. (2012)[12] reported that overweight and obese children had a significantly earlier eruption of both primary and permanent teeth compared to normal-weight peers. Similarly, Traver-Ferrando et al. (2022) [13]observed advanced dental age and early eruption among overweight children.

Conversely, chronic undernutrition or growth faltering has been linked to delayed dental eruption. Prijatmoko et al. (2022)[14] found that stunted toddlers had fewer erupted primary teeth than age-matched non-stunted children. Such findings suggest that inadequate nutrition during the critical growth period may delay the maturation of dental follicles and the resorption of overlying bone and soft tissue, thereby postponing tooth emergence. However, some studies have failed to find a strong association between malnutrition and delayed dental development (Elamin et al., 2013)[15] highlighting the need for further investigation.

Most existing studies examining the link between nutritional status and dental eruption have focused on older children or the mixed/permanent dentition stage. There is a scarcity of data on this relationship during the critical early years when primary dentition emerges (6 months to 3 years). Understanding how BMI correlates with primary tooth eruption during this period could provide valuable insights into the interplay between general health and oral development and may aid in early detection of growth-related disorders.

Therefore, the present study aims to evaluate the correlation between eruption status of primary teeth and BMI in children aged 6 months to 3 years.

2. OBJECTIVES

- To evaluate the correlation between eruption status primary teeth and Body Mass Index (BMI) in children aged 6 months to 3 years.
- To compare eruption status of primary teeth among different BMI categories.
- To evaluate whether nutritional status (as reflected by BMI) influences early or delayed tooth eruption.

3. METHODS

A cross-sectional study involved a convenient sampling of 85 children ranging in the age group from 6–36 month old. This study was performed in Department of Pediatric and Preventive Dentistry after getting approval from institutional ethical committee. The sample was selected from group of children attending Specialist Health Center and children of Nursery after taking written informed consent from parents.

INCLUSION CRITERIA:

- Apparently, children with good health.

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- Age of children from 6 to 36 months.
- Both genders enrolled.

EXCLUSION CRITERIA

- Parents refuse to participate.
- Systemic disease or any congenital deformity that could affect teeth emergence.

Samples were divided according to age into 5 groups: Group I - 6-12 month

Group II - 13 -18 month

Group III - 19 -24 month

Group IV -25 -30 month Group V - 31-36 month

Dental examination was done using a mouth mirror and probe with adequate natural illumination (Type III examination). Height of the children was measured using a calibrated tape attached to a wall, with the subjects back and knees straight and feet together. Weight was calculated for each child using a digital weighing machine. With the obtained values of height and weight, body mass index was calculated for all children with the formula:

$$\text{BMI} = \frac{\text{Weight (kg)}}{\text{Height (m}^2\text{)}}$$

According to the WHO parameters and the International Obesity Task Force (IOTF) classified the values as:[16]

- UNDERWEIGHT (BMI < 18.5)
- NORMAL WEIGHT (BMI 18.5–24.9)
- OVERWEIGHT (BMI 25–29.9)

Each tooth was also examined for their clinical stage of eruption in the oral cavity and noted according to the criteria given by Pahkala et al.[17] as:

- Stage 0—the teeth is not visible in the oral cavity.
- Stage 1—at least one cusp is visible in the oral cavity.
- Stage 2—the entire occlusal surface visible but not reached the occlusal level.
- Stage 3—the tooth in occlusion or at the level of the occlusal plane if the antagonistic tooth was not fully erupted.

Fig 1. Height measurement

Fig 2. Weight measurement

For the purpose of analysis, the stages of eruption were dichotomized, i.e., teeth which were noted stage 0, 1 were considered to be unerupted and teeth which were noted stage 2 and 3 considered to be erupted.

Data were recorded and tabulated in excel sheet in MS Excel. Statistical analysis was performed using Statistical Product and Service Solution (SPSS) version 21 for

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Windows (SPSSInc, Chicago, IL). Correlation between eruption status and BMI was done using Pearson or Spearman 'r' correlation coefficient test. Association between eruption status and BMI was be done using Chi square test.

4. RESULTS

A total of 85 children aged between 6 and 36 months were assessed. Among these 15.5% were underweight ,41.7% were overweight and 42.9% were normal (Fig 3).

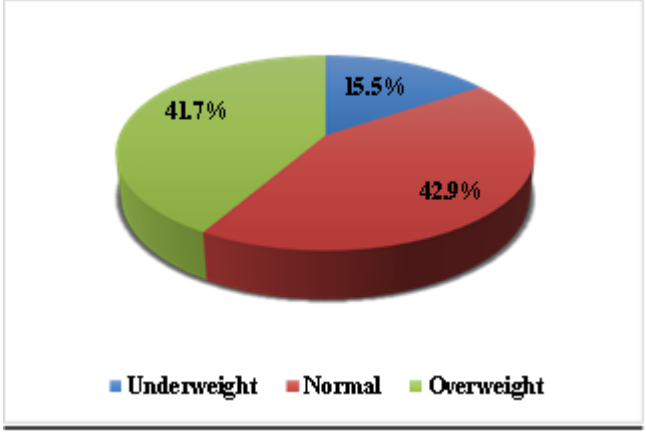

Fig 3. BMI distribution

Correlation of BMI and number of erupted teeth at different age groups found that strong significant positive (direct) correlation was observed between BMI and number of erupted teeth at three different age groups

i.e. 13-18 months, 25-30 months and 31-36 months on using Pearson 'r' correlation test. Weak positive (direct) correlation was observed between BMI and number of erupted teeth at three different age groups

i.e. 6-12 months, 19-24 months on using Pearson 'r' correlation test (Fig

4).

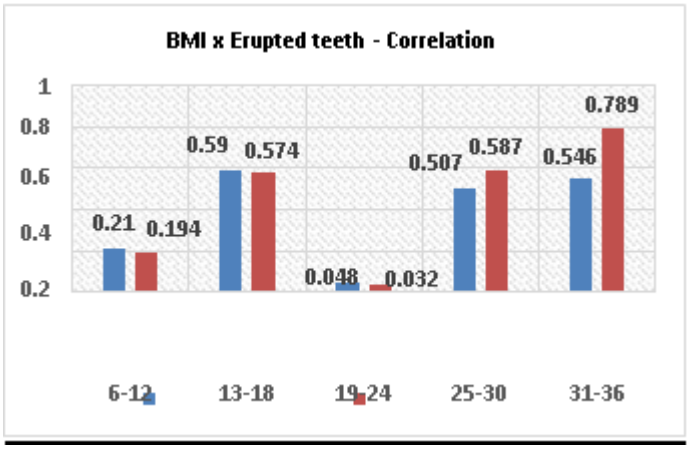

Fig 4. Correlation of BMI and number of erupted teeth at different age groups

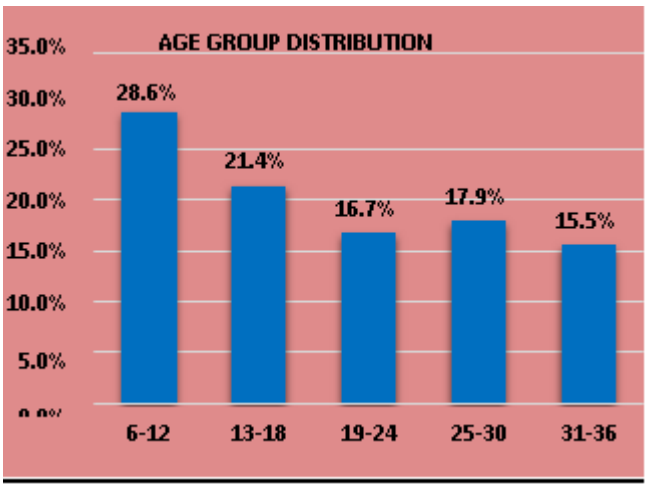

Fig 5. Age group distribution

On association of BMI category with number of erupted maxillary teeth using Chi square test, it was observed that statistical significant ($p<0.05$) association was observed between increase in BMI with increase in number of erupted teeth on using Chi square test (Table 1).

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Maxilla	0 teeth N (%)	1 erupted teeth N (%)	2 erupted teeth N (%)	3 erupted teeth N (%)	4 erupted teeth N(%)	5 erupted teeth N (%)
Underweight (n=13)	5 (38.5%)	2 (15.4%)	0 (0%)	2 (15.4%)	4 (30.8%)	0 (0%)
Normal (n=36)	10 (27.8%)	1 (2.8%)	3 (8.3%)	8 (22.2%)	10 (27.8%)	4 (11.1%)
Overweight (n=35)	4 (11.4%)	1 (2.9%)	4 (11.4%)	7 (20%)	14 (40%)	5 -14.30%
	Chi square test = 16.98, p=0.021* (statistical significant association)					

Table 1: Association of BMI category with number of erupted maxillary teeth using Chi square test

On association of BMI category with number of erupted mandibular teeth using Chi square test, it was observed that statistical significant association ($p<0.05$) was observed between increase in BMI with increase in number of erupted teeth on using Chi square test (Table 2).

Mandible	0 teeth N (%)	1 erupted teeth N (%)	2 erupted teeth N (%)	3 erupted teeth N (%)	4 erupted teeth N(%)	5 erupted teeth N (%)
Underweight (n=13)	3 -23.10%	4 -30.80%	1 -7.70%	1 -7.70%	5 -38.50%	0 0%
Normal (n=36)	5 -13.90%	9 -25%	6 -16.70%	6 -16.70%	8 -22.20%	8 -22.20%
Overweight (n=35)	1 -2.90%	7 -20%	5 -14.30%	5 -14.30%	10 -28.60%	12 -34.30%
	Chi square test = 15.13, p=0.023* (statistical significant association)					

Table 2: Association of BMI category with number of erupted mandibular teeth using Chi square test

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5. DISCUSSION

The eruption of primary (deciduous) teeth is a vital developmental milestone in early childhood, reflecting both oral and general health status. It is a complex biological process that occurs following crown formation and involves the tooth penetrating the oral mucosa.[3] Deciduous teeth act as placeholders for permanent dentition and any disruption or delay in their eruption can adversely affect occlusion, masticatory function and overall craniofacial growth.[18] Dental eruption is influenced by a variety of factors including genetic, racial and sex-related determinants; however, the role of physical development, especially nutritional status and Body Mass Index (BMI), has drawn increasing attention.[19]

The present study evaluated the correlation between the eruption status of primary (deciduous) teeth and Body Mass Index (BMI) in children aged 6 months to 3 years. Our findings revealed a positive association between deciduous teeth emergence and BMI in both genders. The mean number of erupted deciduous teeth was found to be higher in children who were overweight compared to those with normal weight and underweight. This agrees with Bagewadi et al.[20] who observed that children classified as underweight showed a delayed eruption pattern, while overweight children exhibited earlier eruption ages.

Similarly, Rafisa et al.[21] reported that underweight children generally experience delayed tooth eruption, whereas children with normal or higher weight demonstrate eruption timing within the normal range. Mennella et al.[22] also suggested that children with higher weight gain show earlier eruption of deciduous teeth which correlates with this study.

Moreover, our results align with findings by Yassin[23], who demonstrated a positive correlation between weight status and the number of erupted deciduous teeth in both genders, indicating that overweight children tend to mature dentally earlier than children with normal BMI. Chohan et al.[24] similarly reported that children with below-average height and weight showed delayed eruption, whereas overweight children exhibited earlier eruption patterns, reinforcing the link between somatic growth (height and weight) and dental development. Almonaitiene et al.[25] also observed a positive correlation between body size and tooth emergence and noted that stunting is strongly associated with delayed tooth eruption. Agarwal et al.[26] supported this by concluding that eruption of teeth is positively related to somatic growth indicators.

However, contrasting findings have been reported by Shaweesh & Al-Batayneh[27]who found no significant correlation between anthropometric measures such as height and weight and the number of erupted primary teeth, with only the extremes of weight and length showing any influence. Similarly, Khan et al.[28] reported that tall children tended to have delayed tooth eruption regardless of their weight, while heavier but shorter children had earlier eruption, suggesting that height and weight may exert opposing effects on eruption timing. Moreover, Sayed HM & Elchaghaby MA[29] observed that birth weight rather than current BMI had a stronger association with eruption status, suggesting that early-life factors may override the influence of later nutritional status.

In summary, within limitation of this study the findings reinforce the association between higher BMI and earlier eruption of primary teeth in young children, highlighting the influence of nutritional and somatic growth status on dental development. Literature regarding the chronology of tooth eruption and its correlation with BMI among children in India is limited. The Indian population differs from Western populations racially, culturally and environmentally; therefore, eruption standards derived from Western cohorts cannot be directly applied to Indian children. Further research among diverse population groups across various states is essential to establish population-specific eruption timelines for Indian children. Ensuring adequate nutrition from birth through early childhood is vital for promoting both optimal growth and timely tooth eruption. Moreover, future longitudinal studies should explore the underlying mechanisms linking birth weight, height and tooth eruption and develop effective interventions to mitigate the adverse effects of poor nutrition on dental and overall health.

6. CONCLUSION

Within the limitations of the present study, we conclude the following:

1. It was observed that there was significant influence on the eruption of deciduous teeth and nutritional factors played important role.

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2. Normal weight children showed normal eruption pattern, whereas overweight children showed early eruption of deciduous teeth and underweight children showed delayed eruption of deciduous teeth.

3. Normal height children showed normal eruption pattern, whereas over height children showed early eruption of deciduous teeth and under height children showed delayed eruption of deciduous teeth.

4. Height and Weight had significant influence on eruption of deciduous teeth.

5. No significant difference was found in the eruption pattern of males and females

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