

# Effect of Body Mass Index on Eruption Time of Permanent First Molars and Incisors among a Group of 6 – 8 Year Old Iraqi School Children

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**Abstract:** *Tooth Eruption is the process that involves the movement or change of position of the tooth from the deeper portion of the jaws into the oral cavity until it achieves occlusal contact with adjacent and opposing teeth. Many factors that affect the eruption time of the teeth. Nutrition is the science of food and its relationship to health. The aims of the study were to count the number of teeth erupted in 6 - 8 years old children and see the effect of BMI on the eruption time and level of eruption in those children. Body mass index is an index which its use as growth indicator is also controversial but it has been widely used in the field of dentistry, especially in studies about obesity and dental caries. It's used to classify children into healthy, underweight and overweight. The total sample consisted of 50 primary school children between 6 - 8 years old girls and boys. The erupted permanent incisors and first molars were recorded and their level of eruption was also recorded. Nutritional status of each child was assessed by measuring height and weight to calculate body mass index according to formula recorded by Worlds Health Organization, 2000. The higher number of erupted permanent teeth was seen in girls of 6 - 7 and 7 - 8 years old. Girls 7 - 8 years old show highest weight values. The number of erupted teeth in healthy children was higher than other children. There was a significant difference in the number of erupted permanent teeth between the healthy and the overweight children. The highest stage of eruption (stage 4) was seen for the mandibular central incisors, the maxillary and mandibular first molars. It can be concluded that BMI affected the eruption time of permanent first molars and incisors which was seen mostly in girls.*

**Keywords:** BMI, eruption time, stage of eruption, first permanent molars

## 1. Introduction

Tooth Eruption can be defined as the movement or change of position of the tooth from the deeper portion of the jaws into the oral cavity until it reaches occlusal contact with opposing and adjacent teeth. Once the crown of the tooth is completely formed the tooth begins its movement. It takes about 5 years from crown completion to complete eruption of an individual tooth [1].

There is a specific sequence of eruption of both primary and permanent dentition in each arch that is favorable for maintaining the length of the arches during the transitional dentition. This sequence is important in maintaining adequate arch length and in preventing lingual tipping of the incisors, which not only causes a loss of arch length but also allows an increased overbite to develop [2].

The nutritional status of the body is reflected by the status of the oral cavity. The relationship among oral health condition, nutritional status and general health is complex with many interrelating factors. Many factors have been related to the eruption of teeth. These factors include elongation of the root, forces exerted by the vascular tissues around and beneath the root, growth of the alveolar bone, growth of dentin, growth and pull of the periodontal membrane, hormonal influences, presence of a viable dental follicle, pressure from the muscular action, and resorption of the alveolar crest [3].

Delayed tooth eruption can be defined as the emergence of a tooth into the oral cavity at a time that deviates significantly from norms established for different races, ethnicities, and sexes, may be due to systemic or local causes. Some of the factors that affect the eruption of the teeth and may cause delaying in eruption are gender, genetic factor, nutrition, socioeconomic status and others [2].

Nutrition can be defined as substances that are obtained from food and are used by the body to promote growth, maintenance, and repair. An assessment of nutritional status can be carried out by various anthropometric measurements to provide information on growth and body composition. Obtaining such data is important for evaluating underweight, stunting, wasting or overweight associated with increased risk for adverse health outcomes [4]. Body mass index is an index which its use as growth indicator is also controversial but it has been widely used in the field of dentistry, especially in studies about obesity and dental caries [5, 6]. It can be calculated by the ratio of an individual's weight to height squared ( $\text{Kg/m}^2$ ), and it is used to estimate a person's risk of weight related health problems [7]. It's commonly used to classify underweight, normal weight and overweight [8, 9].

The aims of this study were to count the number of teeth erupted in 6 - 8 years old children and to evaluate the effect of BMI on the eruption time and level of eruption of permanent first molars in those children.

2. Materials and Method

This study was conducted on 50 children of primary school of age (6 - 8) years old in Baghdad - city attending Baghdad Teaching Hospital. Consent forms that explained the purpose of the study were sent to the families of the children to be signed for their permission to examine their children's teeth. After that, examinations were carried out. The weight measurement was done using the weighting device while the child stood up in upright position and was looking forward without touching anything. The height measurement was done by using the self - retracting tape while the child stood up in upright position and was looking straight forward This index is a number calculated from child's weight and height, according to this formula:

$$BMI = \frac{Weight (Kg)}{Height^2 (m^2)} \text{ (WHO, 2000)}$$

The value of indicator was compared with the international reference values, for this purpose it was recommended to use the reference population defined by the National Center for Health Statistics in collaboration with National Center Chronic Disease Prevention and Health Promotion and using CDC growth charts. Body mass index is used differently for children. The body mass index percentile allows comparison with children of same gender and age. Children with body mass index that is less than the 5<sup>th</sup> percentile were considered malnourished while children with body mass index that is between the 5<sup>th</sup> and 85<sup>th</sup> percentile were considered well - nourished (CDC, 2000). Examination was started by recording the permanent teeth erupted in the oral cavity. Then the level of eruption of permanent incisors and first molar was evaluated while children were standing and under the natural sun light. Examination of teeth was carried out by the use of disposable dental mirror. The level of eruption was measured

according to the criteria presented by Carvalho et al [10] (Table 1).

**Table 1:** Criteria for determining the stage of eruption of permanent incisors and first molar

|         |  |
|---------|--|
| Stage 0 | Not erupted  |
| Stage 1 | Partially erupted occlusal surface                               |
| Stage 2 | Fully erupted occlusal surface with less than ½ of crown erupted |
| Stage 3 | Fully erupted occlusal surface with more than ½ of crown erupted |
| Stage 4 | Full occlusion   |

The data was analyzed using the statistical program, Statistical Package for Social Sciences (SPSS) package version 20. The tests carried out were description statistics, ANOVA and LSD.

3. Results

Table 2 describes the sample according to the age of the children and their gender. The highest number of erupted permanent teeth was seen in girls of 7 - 8 years of age (n=157). While the lowest number of erupted permanent teeth was seen in boys 6 - 7 years of age (n=55). Girls 7 - 8 years old also showed highest weight values (weight = 29, BMI=17.9). Boys in the 6 - 7 years age group had higher weight values than those of 7 - 8 year olds (weight=26.1, BMI= 17.1; weight=25.3, BMI=16.2 respectively).

Most of the children had a healthy BMI (n=38). While only two children were underweighted. It was also found that the number of erupted permanent teeth in healthy children was higher than the other children (n=282).

**Table 2:** Mean values for the Description of the sample

| Age         | gender   | Height | Weight | BMI  | No. of erupted teeth (total) | No. of erupted teeth in uwc | No. of erupted teeth in hwc | No. of erupted teeth in ovc | Total sample |
|-------------|----------|--------|--------|------|------------------------------|-----------------------------|-----------------------------|-----------------------------|--------------|
| 6 - 7 years | Girls 13 | 1.19   | 23.8   | 16.6 | 74                           | 22                          | 282                         | 105                         | 50 children  |
|             | Boys 9   | 1.22   | 26.1   | 17.1 | 55                           |                             |                             |                             |              |
| 7 - 8 years | Girls 14 | 1.24   | 29     | 17.9 | 157                          | No. of children=2           | No. of children=38          | No. of children=10          |              |
|             | Boys 14  | 1.24   | 25.3   | 16.2 | 135                          |                             |                             |                             |              |

Uwc: under weighted children, hwc: healthy weighted children, ovc: over weighted children

An ANOVA test was carried out to examine the difference in the number of erupted teeth between the groups of different BMI. No significance was observed between the groups at the level 0.05 (Table 3). When an LSD test was done (Table 4) it was seen that there was a significant difference in the number of erupted permanent teeth between the healthy and the over weighted children (p=0.027).

**Table 3:** Anova test to examine the difference in the number of erupted teeth between the groups of different BMI in children

|                | Df | F     | Sig.  |
|----------------|----|-------|-------|
| Between Groups | 2  | 3.167 | .051* |
| Within Groups  | 47 |       |       |
| Total          | 49 |       |       |

\*The mean difference was not significant at the 0.05 level

**Table 4:** LSD test for determining the difference in the number of erupted permanent teeth between the healthy, under and over weighted groups

| Weight status |                | Mean Difference | P - value |
|---------------|----------------|-----------------|-----------|
| Under weight  | Healthy weight | 3.57895         | .201      |
|               | Over Weight    | .50000          | .866      |
| Over weight   | Under weight   | -.50000 -       | .866      |
|               | Healthy        | 3.07895         | .027*     |

\*The mean difference was significant at the 0.05 level

Table 5 shows the stage of emergence of the maxillary and mandibular incisors and first molars. The highest stage of eruption (stage 4) was seen for the mandibular central incisors (n=29). While only one maxillary right lateral incisor was seen at this level. The maxillary lateral incisors were the least seen erupted (n=32, 34 at stage 0). The maxillary and mandibular first molars were mostly seen at stage 4 of eruption.

**Table 5:** Stage of eruption of permanent teeth in both arches of total sample

| Tooth            |                        | Level of eruption |   |   |    |    |
|------------------|------------------------|-------------------|---|---|----|----|
|                  |                        | 0                 | 1 | 2 | 3  | 4  |
| Maxillary left   | Central incisor        | 14                | 2 | 2 | 17 | 16 |
|                  | Lateral incisor        | 32                | 5 | 5 | 5  | 3  |
|                  | 1 <sup>st</sup> molars | 17                | 0 | 1 | 12 | 20 |
| Maxillary right  | Central incisor        | 15                | 1 | 6 | 13 | 15 |
|                  | Lateral incisor        | 34                | 2 | 7 | 6  | 1  |
|                  | 1 <sup>st</sup> molars | 13                | 0 | 3 | 8  | 26 |
| Mandibular left  | Central incisor        | 4                 | 1 | 3 | 13 | 29 |
|                  | Lateral incisor        | 18                | 2 | 7 | 11 | 12 |
|                  | 1 <sup>st</sup> molars | 13                | 2 | 5 | 9  | 21 |
| Mandibular right | Central incisor        | 4                 | 0 | 4 | 14 | 29 |
|                  | Lateral incisor        | 18                | 1 | 7 | 12 | 12 |
|                  | 1 <sup>st</sup> molars | 11                | 4 | 4 | 9  | 22 |

#### 4. Discussion

The sample consisted of 50 children from first and second grade primary school in Baghdad city with an age ranged from 6 - 8 years old. The sample was divided according to gender into girls and boys and then divided according to nutritional status into healthy, underweight and overweight. The higher number of erupted permanent teeth was seen in girls of 6 - 7 and 7 - 8 years old. It was observed that the teeth of girls erupt slightly earlier than those of boys [11]. The reason for the earlier eruption in girls is poorly understood. It is assumed that the earlier onset of the permanent dentition is part of the different sexual maturity of both genders at a given age. Development of girls is about 3% ahead that of boys [12, 13]. Girls 7 - 8 years old show highest weight values. This finding disagreed with Talwar and Airi [14] who concluded in their study that girls were more undernourished than boys. Their study was conducted in areas known for malnutrition in children. While it agreed with Basterfield et al [15]. They found that boys showed higher MVPA (moderate to vigorous intensity physical activity) per day. Boys of 6 - 7 years old showed highest weight values when compared with boys of 7 - 8 years old. The reason may be the same; their movement and playing activities may be less. The number of erupted teeth in healthy children was higher than other children. This was also seen in other studies. Although data on nutrition influence on permanent teeth emergence is scarce, there is evidence that chronic malnutrition extending beyond the early childhood is correlated with delayed teeth eruption [16].

The results of the ANOVA test revealed that the effect of the weight and height status on the number of erupted teeth was not significant at level 0.05. But when an LSD test was done there was a significant difference in the number of erupted permanent teeth between the healthy and the over weighted children. A positive correlation between body height and weight and teeth emergence has been established in the earlier studies [17, 18]. The taller and heavier children are slightly advanced dentally while it is apparent that stunting (retarded linear growth) is more strongly associated with delayed tooth eruption. Obese children had less number of erupted teeth in this study. This disagreed with a study carried out by Hilgers et al [19]. In their research on children obesity and dental development, their results showed a positive correlation: obese children mature earlier and teeth tend to erupt on average 1.2 to 1.5 year earlier as compared to children with normal body mass index.

The highest stage of eruption (stage 4) was seen for the mandibular central incisors, the maxillary and mandibular first molars. The reason for this high level of eruption may be because these teeth are the first or second tooth to form and erupt so they have the higher stage of eruption at these ages. It can also be explained that the mandibular incisors erupt lingual to their predecessors, not affected with the time required for their predecessor to exfoliate, as required for the maxillary incisors. In addition to that the first molars erupt in the oral cavity directly without a predecessor so they reach the late stage of eruption earlier. Maxillary lateral incisors were the least teeth erupted. This may be due to their late formation and the late exfoliation of the primary lateral incisors [20].

#### 5. Conclusion

It can be concluded that BMI affected the eruption time of permanent first molars and incisors which was seen mostly in girls.

#### Ethical approval

The scientific committee of the Pedodontics and Preventive Dentistry Department of the College of Dentistry at the University of Baghdad, Iraq gave approval for this study

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