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Assessment of the Eruption Stages of Permanent First Molars According to Body Mass İndex in A Six-Year-Old Child Population Living in Afyonkarahisar, Turkey

Afyonkarahisar'da Yaşayan Altı Yaş Çocuk Popülasyonunda Daimi Birinci Büyük Azı Dişlerinin Sürme Evrelerinin Vücut Kitle Indeksine Göre Değerlendirilmesi

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ABSTRACT

Objective: This study aimed to evaluate the eruption stages of permanent first molars (PFMs) and their association with body mass index (BMI) in a 6-year-old child population living in Afyonkarahisar, Turkey. The H0 (null) hypothesis was established as "There is no difference between the eruption stages of PFMs in children with different BMI".

Materials and Methods: The study was a cross-sectional study of 700 systemically healthy, six-year-old Turkish children (311 females, 389 males) living in Afyonkarahisar. The children were divided into three groups (underweight, normal weight, overweight/obese) according to individual BMI values by age. The eruption stages of PFMs were recorded. The comparison of the mean number of teeth at each stage according to gender and BMI was evaluated. Statistical analysis was performed using SPSS. Comparisons were done by Mann-Whitney U and Kruskal-Wallis tests.

Results: The mean number of fully erupted PFMs was 1.4±1.65, partially erupted PFMs was 0.9±1.17, and unerupted PFMs was1.7±1.87 per individual. The mean number of fully erupted PFMs was 2.4±1.53 in females and 0.6±1.23 in males. Females had more fully erupted PFMs than males, significantly (p=0.000). Overweight children had more mean erupted PFMs than normal weight children (p=0.000), and normal weight children had more mean erupted PFMs than underweight children (p=0.000). Overweight children had no unerupted PFMs.

Conclusion: It was found that there was a difference between the eruption stages of PFMs according to the BMI of a group of children. Preventive dental procedures may need to be performed at earlier chronologic ages, in overweight/obese children.

Keywords: *Body mass index, Obesity, Permanent teeth, Tooth eruption.*

ÖZET

Amaç: Bu çalışmanın amacı Afyonkarahisar'da yaşayan 6 yaş çocuk popülasyonunda daimi birinci azı dişlerin (DBA) sürme aşamalarını ve bunların vücut kitle indeksi (VKİ) ile ilişkisini değerlendirmektir. H0 (başlangıç) hipotezi "Farklı VKİ'ye sahip çocuklarda DBA'ların sürme evreleri arasında fark yoktur" şeklinde kurulmuştur.

Gereç ve Yöntem: Çalışma, sistemik olarak sağlıklı, altı yaşında, Afyonkarahisar'da yaşayan 700 Türk çocuğu (311 kadın, 389 erkek) üzerinde yapılan kesitsel bir çalışmadır. Yaşa göre bireysel VKİ değerlerine göre çocuklar üç gruba ayrılmıştır (Zayıf, normal kilolu, fazla kilolu/obez). Daimi birinci molar dişlerin sürme aşamaları kaydedilmiştir. Her aşamadaki ortalama diş sayısının cinsiyet ve VKİ'ye göre karşılaştırılması değerlendirilmiştir. İstatistiksel analiz SPSS kullanılarak yapıldı. Karşılaştırmalar Mann-Whitney U ve Kruskal-Wallis testleri ile yapıldı.

Bulgular: Kişi başına ortalama tam sürmüş DBA sayısı 1,4±1,65, kısmi sürmüş DBA sayısı 0,9±1,17, sürmemiş DBA sayısı 1,7±1,87 idi. Ortalama tam sürmüş DBA sayısı kadınlarda 2,4±1,53 iken erkeklerde 0,6±1,23'tür. Kadınlarda erkeklere kıyasla daha fazla tam sürmüş DBA bulunmaktadır (p=0.000). Aşırı kilolu çocukların normal kilolu çocuklara göre (p=0.000) ve normal kilolu çocukların zayıf çocuklara göre (p=0.000) daha fazla ortalama sürmüş DBA vardı. Aşırı kilolu çocuklarda hiç sürmemiş DBA yoktu.

Sonuç: Bir grup çocuğun VKİ'sine göre DBA'ların erüpsiyon aşamaları arasında fark olduğu bulunmuştur. Aşırı kilolu/obez çocuklarda koruyucu dental prosedürlerin daha erken kronolojik yaşlarda uygulanması gerekebilir.

Anahtar Kelimeler: *Vücut kitle indeksi, Obezite, Daimi dişler, Diş sürmesi.*

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Introduction

Tooth eruption is the emergence of a tooth from within its follicle in the alveolar process of the jaws into the oral cavity and the eruption process continues until the tooth has contact with the antagonistic teeth.[1] The eruption order of permanent dentition may differ between the upper and lower jaw. However, permanent teeth eruption usually starts with permanent first molars (PFMs) at about the 6th year of age.[1,2]

The emergence of PFMs is an essential developmental milestone with crucial implications for the development of functional occlusion, and the timing of orthodontic and preventive treatments.[3] Also, a systematic review reported that eruption times of permanent teeth were a predictor for caries development, and they emphasized that PFMs being at higher risk of occlusal caries within the first year of the eruption.[4] Although there may be variations in the age range in different populations, it was found that the first emergence of the PFM is between the ages of 5.9 and 6.9 among children living in different regions of Turkey.[5-7]

The eruption of teeth in the oral cavity occurs over a wide chronological age range and is influenced by a number of factors, including nutritional status.[8-11] Body mass index (BMI) is one of the most common and simplest methods to assess an individual's nutrition status.[12] For children, BMI is age and sex-specific because the amount of body fat changes with age and differs between boys and girls. The Centers for Disease Control and Prevention (CDC) provides growth charts and calculators that take these factors into account. In the literature, the relationship between tooth eruption and BMI was evaluated in different populations.[10,13-18] In a study in India, the authors found that overweight children had earlier eruption ages than those with lower BMI.[16] In the study by Must et al, the authors found that permanent teeth in obese children tended to erupt earlier than in non-obese children, with an average of 1.44 more teeth erupting than in non-obese children.[10] In addition, a longitudinal study showed that 11-year-old overweight children had five more teeth than lean children.[15] Lailasari et al. found a significant association between the number of permanent teeth erupted and the nutritional status of six-seven year old children in Indonesia.[13] However, Khan found no significant association between BMI and dental eruption in Pakistani children.[14] In the study of Anu et al., they found that there is a statistically significant association between BMI and central incisor teeth eruption status but, there is no association between BMI and molar teeth eruption status.[18] In the available literature, there are a limited number of studies evaluating the relationship between BMI and oral health in Turkish children,[19-22] but no study was found that examined the relationship between BMI and the eruption time of PFMs.

This study aimed to evaluate the eruption stages of PFMs according to BMI in a six-year-old child population living in Afyonkarahisar, Turkey. For the purposes of the study, the H_0 (null) hypothesis was established as "There is no difference between the eruption stages of PFMs in children with different BMI".

Materials and Methods

This study was approved by the Local Ethics Committee of Medicine Faculty (No: 2019.247). Informed written consent was obtained from the parents, and age-appropriate assent documents were used for all children.

The study was designed as a cross-sectional study. Children who lived in Afyonkarahisar and were referred to the pediatric dentistry department of the university hospital from August 2019 to December 2020 were evaluated. A detailed medical and drug history was taken.

The sample size was estimated using the G Power software program (version 3.1.9.6, HHU, Dusseldorf, Germany). Since there is no similar study in the literature analyzing BMI and eruption of PFMs among six years old children, the sample size was calculated based on the total number of erupted teeth between six-year-old obese and non-obese children in the study of Must et al.[10] The sample size estimation was performed based on a type I error (α) of 0.05 and power of the study at 90%, which indicated that a total of 658 patients was required for a two-tailed hypothesis (Effect size:0.369). Based on this result, 700 participants were selected for the study, allowing for loss due to incomplete examination.

Inclusion criteria were as follows: children aged 6 years without genetic disorders or developmental delay, systemically healthy, cooperative during clinical examination, and willing to participate in the study. Children with Frankl scale 123 (definitely negative), history of facial trauma, premature birth, previous or current orthodontic appliance, restricted mouth opening, oral cleft, genetic/acquired teeth anomalies, and systemic/genetic disorders were

excluded.

The age of the children was calculated by subtracting the date of birth from the examination date, and children aged 72-84 months were included in the study. The anthropometric measurements were done on participants who were in lightweight clothes and without shoes. The children's height was measured using a calibrated tape attached to a wall, with the subjects' backs and knees straight and feet together. Weight was calculated for each child using a digital weighing machine. Height was determined as meters; weight was determined in kilograms. A single researcher collected all anthropometric measures and performed twice consecutively, and the mean value was used for analysis.

The BMI (kg/m^2) was determined for each child from the collected data on body height and weight. Among children, take the growth- and gender-specific differences into account. Specific BMI values are referred to as "BMI for age," as given by the Centers for Disease Control and Prevention (2021).[24]

Based on individual BMI for age values, the children were divided into three groups, which were:

- Underweight (BMI for age <5th percentile)
- Normal-weight (BMI for age 5th–85th percentile)
- Overweight/obese (BMI for age >85th percentile)

An intraoral examination was conducted after the anthropometric assessment. The intraoral examination was performed on a dental unit with a standard white light, using a sterile mouth glass and probe, starting from the posterior right side of the maxilla and ending on the right side of the mandible.

The criteria of Ekstrand et al.[25], which were used to record the eruption stages of each PFMs were:

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

In cases of doubt about stages two and three, a thin sheet of paper was held in place by the occlusion. For analysis, stages one and two were recorded as partially erupted and stage three as fully erupted.

After cleaning and drying the teeth, a single calibrated examiner recorded the caries lesions. Clinical assessment of dental caries (dft: decayed, filled teeth for deciduous dentition) was done according to World Health Organization guidelines.[26] Caries status of PFM was coded as 1 = caries present and 0 = caries absent. No radiographs were used for ethical reasons.

Statistical analysis was performed using the Statistical Package for Social Sciences Program (SPSS® Inc., Version 26, Chicago, IL, USA). Categorical variables were presented as percentages and numbers (n). The Chi-square test of association was used to compare proportions. Normality was assessed using a graphical method and confirmed using the Kolmogorov–Smirnov test. Numerical data were presented as mean with standard deviations (Std), median, minimum (Min) and maximum (Max) values. The comparison of the mean number of erupted PFMs according to gender was done using the Mann-Whitney U test. The comparison of the mean number of erupted PFMs according to BMI was done using the Kruskal-Wallis test. For intra-examiner calibration, 5% of total children were reassessed one day after the first examination. The intra-examiner Cohen's kappa value was found as 0.92 for evaluating the eruption stages. The level of significance was set at $p<0.05$.

Results

There was no patient loss at the end of the study and post-hoc analysis showed that the study was completed with a power value of 0.986 (Degree of freedom:518, Effect size:0.369). A total of 700 patients who met the inclusion criteria were included in the study, divided by gender into 311 (44.4%) females and 389 (55.6%) males. The mean age of the children was 77.74±3.19 months. There were 283 children (40.4%) in the normal weight group, 180 children (25.7%) in the underweight group and 237 children (33.9%) in the overweight/obese group. The distribution of the groups according to gender was found to be statistically significant and was shown in Table 1 (p=0.000).

Table 1. The distribution of the BMI percentile of participants according to gender

Groups according to BMI percentile	Female %(n)	Male %(n)	Total %(n)	p value
Underweight	2.9% (9)	44% (171)	25.7% (180)	p=0.000
Normal weight	Male	0.50	0.00*	
Overweight	67.8% (211)	6.7% (26)	33.9% (237)	

*Pearson Chi-square test, BMI: Body mass index

The mean number of fully erupted PFMs was 1.4±1.65, partially erupted PFMs were 0.9±1.17, and unerupted PFMs were 1.7±1.87 per individual. According to gender, the mean number of fully erupted PFMs was 2.4±1.53 in females and 0.6±1.23 in males. Females had more fully erupted PFMs than males, significantly (p=0.000), (Table 2).

The distribution of the mean number of PFMs according to BMI is shown in Table 3. Overweight children had more mean erupted PFMs than normal weight children (p=0.000), and normal-weight children had more mean erupted PFMs than underweight children (p=0.000). Overweight children had no un-erupted PFM.

Table 2. The distribution of the eruption stages of PFMs according to gender

Eruption stages	Gender	Mean±Std	Median (Min-Max)/ Mean rank	Test statistics	p value
Fully erupted PFM	FEMALE (n=311)	2.4±1.53	3 (0-4)/478.12	-16.114	p=0.000
	MALE (n=389)	0.6±1.23	0 (0-4)/248.47		
Partially erupted PFM	FEMALE (n=311)	1.3±1.36	1 (0-4)/416.16	-8.672	p=0.000
	MALE (n=389)	0.5±0.83	0 (0-3)/298		
Un-erupted PFM	FEMALE (n=311)	0.3±0.94	0 (0-4)/211.08	18.037	p=0.000
	MALE (n=389)	2.9±1.62	4 (0-4)/461.97		

*Mann-Whitney U test, Std:Standard deviation, Min:Minimum, Max:Maximum, PFM: Permanent first molar

Table 3. The distribution of the eruption stages of PFMs according to BMI

Eruption stages	BMI percentile	Mean±Std	Median (Min-Max)	Test statistics	p value
Fully erupted PFM	Underweight (n=180)	0.1±0.22a	0 (0-1)	456.618	p=0.000
	Normal weight (n=283)	0.7±1.25b	0 (0-4)		
	Overweight (n=237)	3.2±0.97c	4 (1-4)		
Partially erupted PFM	Underweight (n=180)	0.2±0.87A	0 (0-4)	119.634	p=0.000
	Normal weight (n=283)	1.3±1.27B	1 (0-3)		
	Overweight (n=237)	0.8±0.97C	0 (0-3)		
Un-erupted PFM	Underweight (n=180)	3.8±0.89x	4 (0-4)	416.540	p=0.000
	Normal weight (n=283)	1.9±1.27y	2 (0-4)		
	Overweight (n=237)	0z	0 (0-0)		

*Kruskal-Wallis test, Std=Standard deviation, Min=Minimum, Max=Maximum, PFM: Permanent first molar, BMI: Body mass index, Each subscript letter (a-c, A-C, x-z), denotes a subset of group categories whose column properties differ significantly from each other at the 0.05 level.

The mean number of fully erupted PFMs was 0.8±0.92 in the maxilla and 0.8±0.88 in the mandible. The mean number of fully erupted PFMs was found to be statistically different between the BMI groups in both the mandible and maxilla (p=0.000), (Table 4). The mean number of fully erupted right PFMs was 0.7±0.89, and the mean number of fully erupted left PFMs was 0.7±0.84.

The children's mean dft score of the children was 5.16 ±6.452. Of the partially erupted PFMs (n=601), 0.7% had caries; of the fully erupted PFMs (n=972), 4.8% had caries.

Table 4. The distribution of the fully erupted maxillary and mandibular PFMs according to BMI.

Eruption stages	BMI percentile	Mean±Std	Median (Min-Max)	Test statistics	p value
Fully erupted maxillary PFM	Underweight (n=180)	0.1±0.22a	0 (0-1)	466.04	p=0.000
	Normal weight (n=283)	0.4±0.68b	0 (0-2)		
	Overweight (n=237)	1.8±0.42c	2 (1-2)		
Fully erupted mandibular PFM	Underweight (n=180)	0A	0 (0-0)	277.815	p=0.000
	Normal weight (n=283)	0.7±0.94B	0 (0-2)		
	Overweight (n=237)	1.5±0.73C	2 (0-2)		

*Kruskal-Wallis test, PFM: Permanent first molar, Each subscript letter (a-c, A-C), denotes a subset of group categories whose column properties differ significantly from each other at the 0.05 level.

Discussion

The eruption time of the PFMs, which have a very important place in many areas such as function, supporting facial structure, and occlusion in children, can be affected by many factors. Some of the previous studies have reported that there may be a relationship between the eruption of PFMs and BMI. However, in most of these studies, the results were interpreted based on the total number of erupted permanent teeth, and eruption stages were not included, but only categorized as erupted or unerupted.[10,13]-18 Also, in the accessible literature no study was found to assess the relationship between BMI and eruption time of PFMs among a group of children living in Turkey. In this study, the eruption stages of PFMs in a group of 6-year-old children living in Afyonkarahisar province in Turkey were evaluated according to the BMI of the children and it was found that there was a difference between the eruption stages of PFMs according to the BMI of the children. Thus, the null hypothesis (H0) was rejected.

The eruption times of PFMs were at about the 6th year of age but can be changed in different populations. In Denmark, the eruption of PFM begins at the age of 5.2, while 7.3 in Northern Ireland.[25,27] Studies conducted in Turkey have found that the first emergence of the PFM is between the ages of 5.9 and 6.9.5-7 So, only six-year-old children (72-84 months) were selected for the study to standardize the age factor.

One of the critical factors involved in the timing of tooth eruption is gender.[7,28,29] In the studies carried out in Turkey, the eruption times of the permanent teeth were earlier in females than in males.[6,7] In the present study, females had more fully erupted PFMs than males, similar to previous literature.[3,30]-32 The age of eruption has gender differences potentially caused by hormonal changes, genetics, and diet.[27,28] This study reinforces previous findings that females are more overweight than males, which may contribute to early tooth eruption.[31,32]

The number of fully erupted PFMs was positively associated with BMI in our population. Overweight/obese children had a significantly higher number of fully erupted PFMs compared to normal-weight and underweight children. These findings concur with the previous studies.[3,8,34] Must et al., found that obese children were more likely to have a high number of erupted teeth than non-obese children.[10] In a longitudinal study, it was found that among 110 Mexican children, obese children had more erupted teeth than non-obese children after accounting for gender and age at baseline.[15] Moreover, Eid et al. found no significant correlation between dental maturation and BMI in 6-14 years old Brazilian children.[35] The different results can be attributed to different study methods, ethnicity, or the age of the study population.

Psoter et al. stated that chronic malnutrition extending beyond early childhood is correlated with delayed tooth eruption.[9] In this study, all six-year-old underweight children had almost no fully erupted PFMs. The finding that decreased BMI is associated with delayed emergence is also in agreement with the study of Kjellberg et al.[36]

In the present study, the mean number of fully erupted PFMs was similar among the localization (both mandible, maxilla, and right/left side) of the jaws. But different from the studies that reported that the mandibular teeth erupted earlier.[27,29,37] The different results can be attributed to the method of the study and racial differences.

Nutrition, socioeconomic status, fluoride intake, caries, premature extraction of primary teeth, gender, and environmental factors affect permanent tooth eruption.[34,38] To eliminate significant variables, this study selected children living in the same region.

However, tooth eruption is a complex process, and as such, this study is limited in its ability to exclude the involvement of other potentially contributing factors. Longitudinal studies in large populations, in which all factors are considered, are therefore needed in future studies. It is possible to determine the status of tooth eruption either through clinical observation or radiography. In this cross-sectional study, only a clinical examination was done due to ethical reasons. Therefore, the study is limited as it only evaluates clinical eruption stages and does not include dental development of teeth.

Conclusion

Within the limitations of the study, it was found that overweight/obese children included in the study had more fully erupted PFMs than normal-weight children, and fewer PFMs were fully erupted in underweight children than in normal-weight children. The results have important implications for pediatric dentistry, orthodontics, forensic studies, and anthropology. It is essential for a thorough diagnosis, treatment planning, preventive and therapeutic interventions. Preventive dental procedures may sometimes need to occur at earlier chronologic ages, on average, in overweight/obese children than in their normal-weight counterparts.

Conflict of interest

None of the authors of this article has any relationship, connection or financial interest in the subject matter or material discussed in the article.

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References

1. Boucher, C.O. and Zwemer, T.J. Boucher's clinical dental terminology: A glossary of accepted terms in all disciplines of dentistry.3rd edition. St. Louis: Mosby; 1983.

2. Prijatmoko D, Zakiyah, F. Role of body composition on the eruption time of first permanent molars. J Int Dent Med Res. 2019;12:1563-7.

3. Pahel BT, Vann WF, Divaris K, Rozier RG. A contemporary examination of first and second permanent molar emergence. J Dent Res. 2017;96:1115-21.

4. Mejàre I, Axelsson S, Dahlén G, Espelid I, Norlund A. Caries risk assessment: a systematic review. Acta Odontol Scand. 2014;72:81-91.

5. Wedl JS, Schoder V, Blake FAS, Schmelzle R, Friedrich RE. Eruption times of permanent teeth in teenage boys and girls in İzmir (Turkey). J Clin Forensic Med 2004;11:299–02.

6. Oznurhan F, Ekci ES, Ozalp S, Deveci C, Delilbasi AE. Time and sequence of eruption of permanent teeth in Ankara, Turkey. Pediatr Dent J. 2016;26:1-7.

7. Bayrak S, Sen Tunc E, Tuloglu N, Acikgoz A. Timing of permanent teeth eruption in Turkish children. J Clin Pediatr Dent. 2012;37:207-11.

8. Hilgers KK, Akridge M, Scheetz JP, Kinane, DE. Childhood obesity and dental development. Pediatr Dent. 2006;28:18-22.

9. Psoter W, Gebrian B, Prophete S, Reid B, Katz R. Effect of early childhood malnutrition on tooth eruption in Haitian adolescents. Community Dent Oral Epidemiol. 2008;36:179-89.

10. Must A, Phillips SM, Tybor DJ, Lividini K, Hayes C. The association between childhood obesity and tooth eruption. Obes.2012;20:2070-4.

11. Hedayati Z, Khalafinejad F. Relationship between body mass index, skeletal maturation and dental development in 6- to 15-year-old orthodontic patients in a sample of Iranian population. J Dent. (Shiraz).2014;15:180-6

12. Nuttall FQ. Body mass index obesity, BMI, and health: a critical review. Nutr Today.2015;50:117–28.

13. Lailasari D, Zenab Y, Herawati E, Wahyuni IS. Correlation between permanent teeth eruption and nutrition status of 6-7-years-old children. Padjadjaran J Dent. 2018;30:116-23.

14. Khan N. Eruption time of permanent teeth in Pakistani Children. Iran J Public Health. 2011;40:63–73.

15. Sánchez-Pérez L, Irigoyen ME, Marco Z. Dental caries, tooth eruption timing and obesity: a longitudinal study in a group of Mexican schoolchildren. Acta Odontol Scand. 2010;68:57–64.

16. Bagewadi NB, Kumar H, Bagewadi SB, Kumar V, Panchmal GS, Mohnish ZM. Comparison of chronology of teeth eruption with body mass index among school children at Mangalore: A cross-sectional study. J Indian Assoc Public Health Dent. 2016;14:276.

17. Anu V, Brindha JR, Carol PT, Diana PC, Elsy JD, Garima S. Does body mass index affect tooth eruption sequence? A study among 6–7 years old schoolchildren in Chennai, India. Int J Clin Pediatr Dent. 2020;13:261.

18. Mohamedhussein N, Busuttil-Naudi A, Mohammed H. Association of obesity with the eruption of first and second permanent molars in children: a systematic review. Eur Arch Paediatr Dent. 2020;21:13–23.

19. Cantekin K, Gurbuz T, Demirbuga S, Demirci T, Duruk G. Dental caries and body mass index in a sample of 12-year-old eastern Turkish children. J Dent Sci. 2012;7:77-80.

20. Kızılcı E, Demiroğlu C, Duman B, Ayhan B. Is body mass index for-age related with dental caries in children? J Pediatr Res. 2022:9:1.

21. Gokkaya B, Kargul B. Assessment of the eating disorders and relationship with dental caries, age, gender, and body mass index in a sample of turkish adolescents aged 9 through 15. Niger J Clin Pract 2022;25:695-701.

22. Cinar AB, Murtomaa H. Interrelation between obesity, oral health and life-style factors among Turkish school children. Clin Oral Invest. 2011;15:177–84.

23. Frankl S, Shiere F, Fogels H. Should the parent remain with the child in the dental operatory. J Dent Child. 1962;29:150-63.

24. About Child and Teen BMI. (2021): [https://www.cdc.gov/ healthyweight/assessing/bmi/childrens_bmi/about_childrens_bmi. html]. Accessed: 25.01.2021

25. Ekstrand KR, Christiansen J, Christiansen MEC. Time and duration of eruption of first and second permanent molars: a longitudinal investigation. Community Dent Oral Epidemiol. 2013;31:344-50.

26. World Health Organization. Oral Health Surveys: Basic Methods. Geneva: World Health Organization,2013.

27. Kochhar R, Richardson A. The chronology and sequence of eruption of human permanent teeth in Northern Ireland. Int J Paediatr Dent. 1998;8:243-52.

28. Diamanti J, Townsend GC. New standards for permanent tooth emergence in Australian children. Austr Dent J. 2003;48:39-42.

29. Moslemi M. An epidemiological survey of the time and sequence of eruption of permanent teeth in 4-15-year-olds in Tehran, Iran. Int J Paediatr Dent. 2004;14:432-38.

30. Lakshmappa A, Guledgud MV, Patil K. Eruption times and patterns of permanent teeth in school children of India. Indian J Dent Res. 2011;22:755-63.

31. Raghavan A, Srinivasan N, Sherif AS, Somasundaram N, Govindhan M. Association between mean age of eruption of the permanent teeth and body mass index among school-going children of 7–17 years of age in Chennai city. JOCHD. 2019;13:40.

32. Almonaitiene R, Balciuniene I, Tutkuviene J. Factors influencing permanent teeth eruption. Part one–general factors. Stomatol. 2010;12:67-72.

33. Sabharwal R, Sengupta S, Sharma B, Singh S, Rastogi V. Correlation of body mass index with eruption time of permanent first molars and incisors and caries occurrence: A cross-sectional study in school children in Uttar Pardesh, India. Eur J Dent.2013;2:114.

34. Shaweesh AI. Timing and sequence of emergence of permanent teeth in the Jordanian population. Arch Oral Biol. 2012;57:122-30.

35. Eid RMR, Simi R, Friggi MNP, Fisberg M. Assessment of dental maturity of Brazilian children aged 6 to 14 years using Demirjian's method. Int J Paediatr Dent. 2002;12:423-8.

36. Kjellberg H, Beiring M, Albertsson Wikland K. Craniofacial morphology, dental occlusion, tooth eruption, and dental maturity in boys of short stature with or without growth hormone deficiency. Eur J Oral Sci. 2000;108:359–67.

37. Leroy R, Bogaerts K, Lesaffre E, Declerck D. The emergence of permanent teeth in Flemish children. Community Dent Oral Epidemiol. 2003;31:30–9.

38. Folayan M, Owotade F, Adejuyigbe E, Sen S, Lawal B. The timing of eruption of the primary dentition in Nigerian children. Am J Phys Anthropol. 2007;134:443-8.