Khalaf et al. Scr Med. 2024 Mar-Apr;55(2):165-71. DOI:10.5937/scriptamed55-49053

ORIGINAL ARTICLE

Eruption of First Permanent Molar Among a Group of Iraqi Children in Relation to Nutritional Status

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Abstract

Background/Aim: The timing of a tooth's eruption can be affected by a variety of factors. The nutritional status has an impact on the development of a child's body. The purpose of the study was to analyse the number of children aged 6 to 9 in an Iraqi Arab population who had erupted permanent first molars and to examine how nutritional status affected the timing and level of emergence.

Methods: A total of 330 boys and girls, in first grade elementary school, made up the sample. First molars that had erupted were noted, along with the level of the eruption. Each child's nutritional status was evaluated by recording their height and weight and body mass index (BMI) value was compared to the 2007 WHO reference.

Results: Girls had higher number of erupted molars than boys did and a correlation between the number of erupted teeth and nutritional condition existed, with a higher mean number of erupted molars in obese children.

Conclusion: BMI had an impact on the timing of the eruption of permanent first molars, a result that was primarily observed in females.

Key words: Body mass index; Eruption time; Stage of eruption; First permanent molars.

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Citation:
Khalaf MS, Abdul-Wadood MO, Khammas AM. Eruption of first permanent molar among a group of Iraqi children in relation to nutritional status. Scr Med. 2024 Mar-Apr;55(2):165-71.

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Received: 2 February 2024
Revision received: 3 March 2024
Accepted: 3 March 2024

Introduction

Tooth eruption refers to the movement or change in the position of the tooth from the depth of the alveolar bone until it reaches occlusal contact with an opposing and adjoining tooth. When the crown of a tooth has formed completely the tooth will the start its eruptive movement. The eruption of a tooth is completed after about five years from the time the crown formation is completed.[1]

The nutritional status of an individual can be reflected by the status of the oral cavity. Many factors that relate oral health conditions, nutritional status and the general well-being have been found. These include forces exerted by the vascular tissues surrounding and beneath the root, hormonal influences, the presence of a healthy dental follicle, pressure from muscular action, resorption of the alveolar crest, growth and development of the alveolar bone and growth and development of the periodontal membrane.[2]

Delay tooth eruption is applied when the appearance of a tooth in the oral cavity at a time that differs from norms set for various races, ethnicities and sexes. It could be caused by local factors or other factors. Gender, genetics, nutrition, socioeconomic situation and others are a few of the factors that might also delay or impact the eruption of teeth.[3]

Nutrition refers to nutrients that the body utilises to continue in development, maintenance and repair. These substances are provided from food. Anthropometric measurements include many

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methods that have been used to evaluate nutritional status and provide knowledge on growth and body composition. For the estimation of underweight, stunting, wasting, or overweight associated with a higher likelihood of having adverse health effects, it is crucial to collect such information.[4] Body mass index (BMI) is a metric that has been utilised in dentistry, particularly in research on the relation of obesity to dental caries. It can be calculated counting the square root of a person's weight to height.[5]

Several studies were conducted in Iraq investigating the nutritional status in relation to various variable.[6-10] Few were found that investigated the teeth eruption status. In 2008, Gatta et al clarified that tooth emergence is a process of growth and therefore is related with other body processes, especially child's weight and height.[11] In 2013, Hanoon et al discovered that malnourished children had less permanent teeth erupted in the oral cavity than children, who by height and weight, were defined as well nourished.[12] In 2016, Ahmed and Al-Dahan[13] indicated that Iraqi children showed differences in permanent tooth eruption in comparison with studies carried previous to their study. They stated that the malnutrition children and adolescents showed late eruption of teeth while in 2023, Hassan et al[14] described different results in that the timing if eruption was not related to the feeding pattern nor the level of growth hormone in saliva. Although their study was on primary teeth eruption. Also, results seen by Salim et al[15] revealed that obese individuals and overweight individuals showed eruption of permanent teeth to be delayed in comparison to normal weighing individuals.

These differences in results of previous studies, especially those carried out in Iraqi populations, have provoked the purpose of this study to count the number of permanent first molar teeth that had erupted in a sample of Iraqi children aged 6 to 9 and to assess the impact of nutritional status on the timing and level of those teeth's eruptions.

Methods

The sample size was calculated to be 330 children (164 females and 166 males) using G power 3.0.10. The participating children ranged in age from 6 to 9, Iraqi Arabs and resided in Baghdad. The Scientific Committee and the Central Ethical Committee of the College of Dentistry at the University gave approval for this study. Parents of the children accepted to participate in this study were informed and provided their written consent.

Examination of teeth

The examination was started by recording the determined permanent teeth erupted in the oral cavity. Then the level of eruption of permanent first molars was evaluated while children were standing and under the natural sunlight. Examination of teeth was carried out by the use of a disposable dental mirror. The level of the eruption was measured according to the criteria presented by Carvalho et al.[16]

Criteria for the stage of a permanent first molar's eruption: Stage 0: Not erupted; Stage 1: Partially erupted occlusal surface; Stage 2: Fully erupted occlusal surface with less than 1/2 of crown erupted; Stage 3: Fully erupted occlusal surface with more than 1/2 of crown erupted; Stage 4: Full occlusion.

Measurement of BMI

A computerised weighing scale was used to determine the child's weight. A regular measuring tape that was mounted on the wall was used to measure height. After taking off their shoes, the youngster was instructed to stand up against the measuring tape with their feet parallel to one another. The BMI was calculated as individual's weight in kg divided by the square of their height in m.

The height-for-age (HAZ), weight-for-height (WHZ) and BMI indicator's value was compared to the 2007 WHO reference, chart for ages 5-18 years (z-scores). Four categories were defined: underweight (thinness and severe thinness were appointed to this category), normal weight, overweight and obese.[17]

Statistical analysis

Data were entered into Microsoft Excel and IBM SPSS Statistics version 26 was used for analysis. Normality was assessed using the Shapiro-Wilk test and significant differences were found if $p < 0.05$ between BMI groups.

Results

A total of 164 girls and 166 boys (aged 6-9 years) were recruited in this study. Among the 330 children assessed, 22 (6.67 %) were underweight, 230 (69.69 %) were normal weight, 60 (18.18 %) were overweight and 18 (5.45 %) were obese. The association between gender and BMI was significantly different ($p < 0.05$). Girls were more often overweight and obese (38 and 10, respectively) while boys were more often underweight and normal weight (16 and 120, respectively) as seen in Figure 1.

Girls showed higher mean values (2.45 ± 0.963) for the molar eruption stage than boys (2.18 ± 1.174) and a t-test ($t = 2.223$) revealed that this difference was statistically significant ($p = 0.027$). Using Spearman correlation test, weak positive ($p = 0.002$) correlation was found between the stage of tooth eruption and the nutritional status.

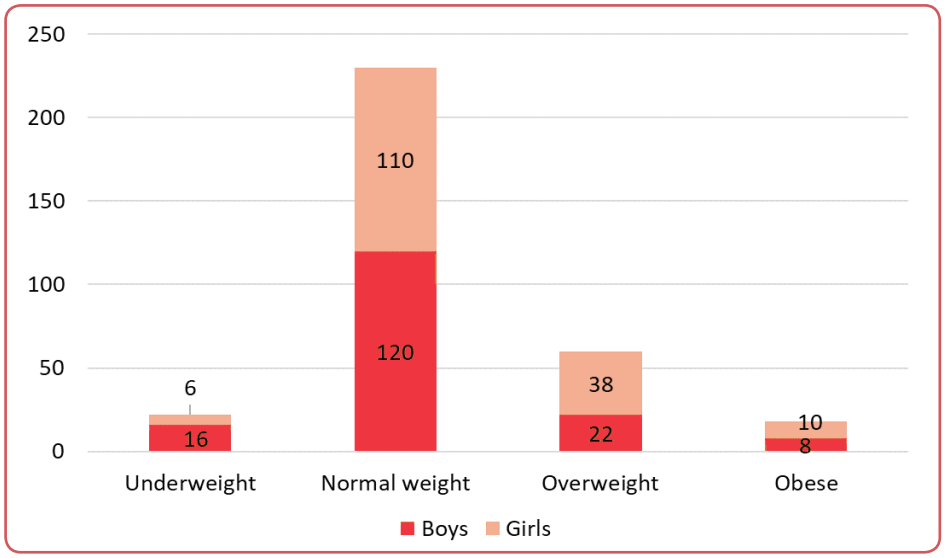

Figure 1: Distribution of the sample according to body mass index (BMI) and gender

A significant difference was found when comparing the number of erupted teeth to the BMI categories using the independent-samples Kruskal-Wallis test ($p = 0.044$). Using pairwise tests the difference was found between the normal and the obese as seen in Table 1 with the highest mean of the erupted molar in obese children.

There was no distinction between the left and right sides. Children who were underweight were shown to have a first molar eruption that was later than the other. The average age and median age at which mandibular and maxillary first molars erupted by BMI categories is shown in Table 2.

Statistically, no significant difference was found in the eruption age between the mandibular and maxillary molar ($t = -0.228$, $p = 0.819$) using t-test. According to the age of the child, underweight

Table 1: Pairwise comparison of the number of erupted teeth and body mass index (BMI) groups

BMI groups	X^2	SE	p-value
Normal-Underweight	14.563	15.360	0.343
Normal-Overweight	-15.151	9.978	0.129
Normal-Obese	-42.017	16.846	0.013*
Underweight-Overweight	-0.588	17.155	0.973
Underweight-Obese	-27.455	21.875	0.209
Overweight-Obese	-26.867	18.497	0.146

**Significant at $p < 0.05$; X^2 = Kruskal-Wallis test; SE: standard error;*

Table 2: Mean age of eruption of molars between body mass index (BMI) groups

BMI groups	Maxillary permanent first molar (Age)		Mandibular permanent first molar (Age)	
	Mean ± SD	Median (IQR)	Mean ± SD	Median (IQR)
Underweight	7.9 ± 1.26	9.0 (2.0)	8.3 ± 0.96	9.0 (2.0)
Normal	7.3 ± 0.96	7.1 (1.3)	7.3 ± 0.96	7.1 (1.3)
Overweight	7.3 ± 1.00	7.1 (1.2)	7.3 ± 0.96	7.1 (1.2)
Obese	6.7 ± 0.36	7.0 (0.4)	6.7 ± 0.36	7.0 (0.4)

SD: standard deviation; IQR: interquartile range;

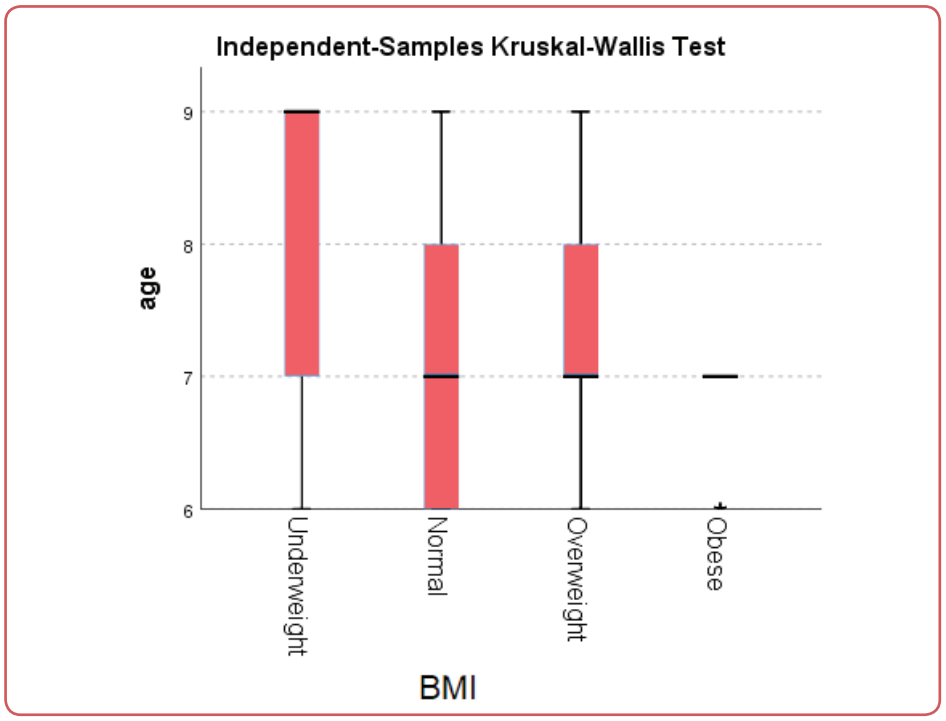

Figure 2: Distribution of the sample according to body mass index (BMI) groups and age

children mostly were at nine years old children (n = 12) while the normal category was mainly 6-7 years old children (n = 78 and 76, respectively). The overweight and obese categories were at seven years old (n = 26 and 14, respectively) as seen in Figure 2. When comparing the nutritional status between the age groups significant difference was found (p = 0.011). Using pairwise tests the differences were found between the underweight and the other categories (Table 3).

Table 3: Comparison of age differences in body mass index (BMI) groups

BMI groups	X^2	SE	p-value
Obese-Normal	23.197	22.307	0.298
Obese-Overweight	38.100	24.493	0.120
Obese-Underweight	83.576	28.966	0.004*
Normal-Overweight	-14.903	13.212	0.259
Normal-Underweight	60.379	20.339	0.003*
Overweight-Underweight	45.476	22.716	0.045*

*SD: standard deviation; IQR: interquartile range; *Significant at p < 0.05; X^2 = Kruskal-Wallis test; SE: standard error;*

According to height for age z-score, children were mostly in normal category and only 9 children were in moderate stunting (3 girls, 6 boys). Significant positive correlation (r = 0.4) between z score for height and the stage of the erupted molar (p < 0.001) was found.

Discussion

BMI has been long utilised and depended on to compare the anthropometric values of adults and children. However, it refers to body fatness in children.[18] Due to its effect, studied previously, on child's intelligence, occlusion of primary and permanent teeth, caries risk and the timing of preventative and orthodontic intervention, permanent teeth erupt might be affected by nutritional status.[11, 19, 20] These dental conditions put a heavy financial strain on the medical system. Therefore, research to study the variables affecting the period of permanent tooth eruption is very important for clinical personnel and public health strategies.

There was significant difference in the number of erupted permanent first molars between BMI groups, with a higher mean among obese children. These results support the earlier article of Wong et al.[21] As evident from the results, significant sex differences were seen for BMI status in the total sample. The higher number of overweight or obese children was in girls. This was in contrast to Talwar and Airi,[22] who stated in their research that the malnourished were more in girls than boys. However, their investigation was carried out in areas where malnutrition in children is a problem.

Girls had more erupted first permanent molars than boys. Teeth have been seen to emerge a little earlier in girls than boys.[23] The reason for the earlier eruption is unclear. Although it is thought to be related to the difference in sexual maturation of each sex at a specific age. This difference in this study may be due to the finding that malnutrition was more among boys. This result agreed with that of the study done by Ahmed and Al-Dahan[13] and Laith and Al-Rawi.[24] It disagreed with Reis et al[25] study which stated that girls are more prone to delayed teeth eruption compared to boys.

In this study, the mean age of eruption of first molars was found to have a statistically significant difference between underweight, normal, overweight and obese children who were categorised according to BMI status. This finding agreed with Esan and Schepartz.[26] The result of this study showed children in the underweight category showed delayed eruption patterns while obese children had earlier eruption ages compared with those with lower BMI status. Similar observations were made by Reis et al[25] who demonstrated that underweight children had more than 4 times higher chance of presenting delayed teeth eruption. Lack of important nutrients and reduced growth hormones may have been the factor that caused tooth eruption delay in underweight children attributed to altered tooth formation.[27] Since the regulation of the hormones and metabolic processes happens in adipose tissue. Accumulation of adipose tissue leads to hormonal changes in obese individuals, which in turn accelerates the release of growth hormones leading to the eruption of teeth acceleration.[21] A past study revealed dental development was weakly related to nutritional status and maturational status of children when compared to genetic correlates. Genetic correlates are of a reasonable order of magnitude and when studied on monozygotic twin pairs, it was about as high as theory would allow.[28]

The likelihood of developing dental cavities, has also had clinical significance. A tooth that has erupted early will be in the oral cavity and exposed to cariogenic substances for a longer period at a particular age. This in turn will increase the susceptibility of the tooth to develop carious lesions.[29] In order to organise programs that effectively prevent childhood caries, it is important to consider the early tooth eruption in obese children. On the other hand, this was conflicting with Raghavan et al[18] who stated obese children experienced delayed eruption and that the mean age of eruption increased with increasing BMI.

The study was only carried out in a small area of the country. As a result, the results of the current study cannot be extended to the population of Iraq. Further study on nutritional condition and its major impact on delayed tooth eruption is suggested by these findings.

Conclusion

BMI had an impact on the timing of the eruption of permanent first molars, a result that was primarily observed in females.

Ethics

The scientific committee of the Pedodontics and Preventive Dentistry Department and the Central Ethical Committee of the College of Dentistry at the University of Baghdad, Iraq gave approval for this study (Project No 769323, dated 19 January 2023).

Acknowledgement

None.

Conflicts of interest

The authors declare that there is no conflict of interest.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Data access

The data that support the findings of this study are available from the corresponding author upon reasonable individual request.

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References

1. Demirjian A, Levesque G-Y. Sexual differences in dental development and prediction of emergence. J Dent Res. 1980 Jul;59(7):1110-22. doi: 10.1177/00220345800590070301.
2. Wise G. Cellular and molecular basis of tooth eruption. Orthod Craniofac Res. 2009 May;12(2):67-73. doi: 10.1111/j.1601-6343.2009.01439.x.
3. Suri L, Gagari E, Vastardis H. Delayed tooth eruption: pathogenesis, diagnosis, and treatment. A literature review. Am J Orthod Dentofacial Orthop. 2004 Oct;126(4):432-45. doi: 10.1016/j.ajodo.2003.10.031.
4. World Health Organization. Diet, nutrition, and the prevention of chronic diseases: report of a joint WHO/FAO expert consultation: World Health Organization; 2003. World Health Organ Tech Rep Ser. 2003;916:i-viii, 1-149, backcover. PMID: 12768890.
5. WHO Expert Consultation. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. Lancet. 2004 Jan 10;363(9403):157-63. doi: 10.1016/S0140-6736(03)15268-3.
6. Al-Ghalebi, S. Oral health status and treatment needs in relation to nutritional status among 9-10 year- old school children in Nassiryia City/Iraq. Master thesis, College of Dentistry, University of Baghdad, 2011.
7. Hasan DM, Hussien BH. Oral health status in relation to nutritional status among kindergarten children aged (4-5) years old in Karbala city / Iraq. Mustansiria Dent J. 2019;14(1):72-9. doi: 10.32828/mdj.v14i1.762.
8. Al-Awadi ZA, Hussien BH. Oral health status in relation to nutritional status among 9 years old school children in Dewanyiah City/Iraq. Mustansiria Dent J. 2017;14(1):80-6. doi: 10.32828/mdj.v14i1.763.
9. AL-Nassary HT, Mohammed AT. Dental caries and treatment needs in relation to nutritional status among kindergartens children in Tikrit City, Iraq. Indian J Public Health Res Dev. 2019 Oct 1;10(10). doi: 10.5958/0976-5506.2019.03095.X.
10. AL Khafaji SY, Al Rawi NA. Oral health in relation to nutritional status among 10 years old primary school children in Al-Hillah city/ Iraq. J Bagh Coll Dent. 2019;31(4):46-50. doi: https://doi.org/10.26477/jbcd.v31i4.2720.
11. Gatta EA, Al-Alousi WS, Diab BS. Primary teeth emergence in relation to nutritional status among 4-48 months old children in Baghdad City. Mustansiria Dent J. 2008;5(1):62-70. doi: doi.org/10.32828/mdj.v5i1.507.
12. Hanoon SA. Effect of protein-energy malnutrition through body mass index on eruption time condition among 6 and 9 years old in primary school children at Sammawa City. J Babylon Univ Appl Sci. 2013;21(06):1-9.
13. Ahmed HS, Al-Dahan ZA. Time of emergence of permanent teeth and impact of nutritional status among 4-15 years old children and teenagers in Bashar City, Iraq. J Baghdad Coll Dent. 2016;325:1-7. doi: 10.12816/0033224.
14. Hassan DHM, Al-Joranii SM. Effect of feeding pattern and salivary level of growth hormone on the stage of primary tooth eruption: an analytical cross-sectional study. Dent Hypotheses. 2023;14:52-4. doi: 10.4103/denthyp.denthyp43_23.
15. Salim Younis M, Ahmed K, Mand W, Hameed Fatah S. The correlation between BMI and dental caries/tooth eruption among 12 years old school children in both private and governmental in Erbil City. Eurasian J Sci Eng. 2023;9(2):1-11. doi: 10.23918/eajse.v9i2p1.
16. Carvalho JC, Ekstrand KR, Thylstrup A. Dental plaque and caries on occlusal surfaces of first permanent molars in relation to stage of eruption. J Dent Res. 1989;68:773-9. doi: 10.1177/00220345890680050401.
17. de Onis M, Onyango AW, Borghi E, Siyam A, Nishida C, Siekmann J. Development of a WHO growth reference for school-aged children and adolescents. Bull World Health Organ. 2007 Sep;85(9):660-7. doi: 10.2471/blt.07.043497.
18. Raghavan A, Srinivasan N, Sherif AS, Somasundaram N, Govindhan M, Diwakar MKP. 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. J Oral Health Comm Dent. 2019;13:40. doi: 10.5005/jp-journals-10062-0047.

19. Mohamedhussein N, Busuttil-Naudi A, Mohammed H, UlHaq A. Association of obesity with the eruption of first and second permanent molars in children: a systematic review. Eur Arch Paediatr Dent. 2020 Feb;21(1):13-23. doi: 10.1007/s40368-019-00452-6.
20. Jafar ZJ. Oral health and nutritional status in relation to intelligence quotient (IQ) of children in Baghdad. J Int Dent Med Res. 2019;12:1487-91.
21. Wong HM, Peng S-M, Yang Y, King NM, McGrath CPJ. Tooth eruption and obesity in 12-year-old children. J Dent Sci. 2017;12:126-32. doi: 10.1016/j.jds.2016.10.004.
22. Talwar I, Airi P. Physical growth and nutritional status of children aged 6-8 years of Panchkula city (Haryana), India. Human Biol Rev. 2015;4:1-26.
23. Kutesa A, Nkamba EM, Muwazi L, Buwembo W, Rwenyonyi CM. Weight, height and eruption times of permanent teeth of children aged 4–15 years in Kampala, Uganda. BMC Oral Health. 2013;13:1-8. doi: 10.1186/1472-6831-13-15.
24. Laith NMH, Al-Rawi NA. Dentition status in relation to nutritional condition among a group of intermediate school students in Al-Najaf city/Iraq. J Baghdad Coll Dent. 2017;29:89-95. doi: 10.12816/0043003.
25. Reis CL, Barbosa MC, Henklein S, Madalena IR, de Lima DC, Oliveira MA, et al. Nutritional status is associated with permanent tooth eruption in a group of Brazilian school children. Glob Pediatr Health. 2021;8:2333794X211034088. doi: 10.1177/2333794X211034088.
26. Esan TA, Schepartz LA. Does nutrition have an effect on the timing of tooth formation? Am J Phys Anthropol. 2020 Mar;171(3):470-80. doi: 10.1002/ajpa.23987.
27. Hegde RJ, Vadgaonkar V, Kamath S. A correlative analysis of dental age, chronological age, and body mass index and its impact on dental development in 6-13 year old children of Navi Mumbai, India. J Indian Soc Pedod Prev Dent. 2018 Oct-Dec;36(4):376-80. doi: 10.4103/JISPPD.JISPPD_189_18.
28. Garn SM, Lewis AB, Kerewsky RS. Genetic, nutritional, and maturational correlates of dental development. J Dent Res. 1965;44:228. doi: 10.1177/00220345650440011901.
29. Peng SM, Wong HM, King NM, McGrath C. Association between dental caries and adiposity status (general, central, and peripheral adiposity) in 12-year-old children. Caries Res. 2014;48(1):32-8. doi: 10.1159/000351690.