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The age of eruption of the first and second permanent molar in Cameroon

L'âge d'éruption de la première et deuxième molaire permanente au Cameroun

Moneboulou Mengong HP[1], Lowe M[1], Ekobena JM[1], Yufenyuy Wirnkar, Kattié Louka Aka, Bengondo Messanga C[1]

Article original

[1] Faculty of Medicine and Biomedical Sciences, University of Yaoundé 1, Cameroon

Auteur correspondant :
Mengong Hortense Perpétue epse Moneboulou, Faculty of Medicine and Biomedical Sciences, University of Yaoundé1, Cameroon, **Tel:** +237 699912842, **Email:** hpmengong@yahoo.fr

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RESUME

Background: The age of tooth eruption varies from one region to another and determines the efficient care of children. However, the data used in Cameroon are those of European countries. In seemed useful to us to determine the age of eruption of the second permanent molars in Cameroun.
Materials and methods: We conducted a cross-sectional study on 644 children aged 3 to 15 years. They were classified in Five body mass index groups. Their weights and Height were measured. The intraoral examination was made. The independent t-test allowed the comparison between dental eruption ages averages
Results: The minimum eruption age for the boys was 3 years old, the age maximum 15 years old with average age of (M=5.75±1.212) for the first molar, M=12.30±0.921 for the second molar. The minimum and maximum age for girls was respectively 3 and 14 years with an average age of eruption and SD (standard deviation) M = 6.08 ± 0.973 for the first molar and M=12.18±0.804 for the second molar. The average ages were 5.6 years for the first permanent molar and 11.9 years for the second permanent molar with an interval of 95% confidence. The average ages of the first and second permanent molars have was statistically significant (p=0.00) with body mass index
Conclusion: The mean age of eruption was 5.6years for the first permanent molars and 11.9 years for the second. Body mass indices influenced eruption ages of the sequences.

ABSTRACT

Introduction : L'âge d'éruption dentaire varie d'une région à l'autre. Le but de cette étude était de déterminer l'âge d'éruption des premières et deuxièmes molaires permanentes au Cameroun.
Matériel et méthodes : Nous avons mené une étude transversale sur 644 enfants âgés de 3 à 15 ans. Ils ont été classés en cinq groupes d'indice de masse corporelle. Leur poids et leur taille ont été mesurés. L'examen intrabuccal a été réalisé. Le test t indépendant a permis la comparaison entre les moyennes d'âges d'éruption dentaire.
Résultats : L'âge minimum d'éruption chez les garçons était de 3 ans, l'âge maximum de 15 ans avec un âge moyen de 5,75±1,212 ans pour la première molaire, et 12,30±0,921 ans pour la deuxième molaire. L'âge minimum et maximum chez les filles était respectivement de 3 et 14 ans avec un âge moyen d'éruption de 6,08 ± 0,973 ans pour la première molaire et de 12,18±0,804 ans pour la deuxième molaire. Les âges moyens étaient de 5,6 ans pour la première molaire permanente et de 11,9 ans pour la deuxième molaire permanente. L'âge moyen des premières et deuxièmes molaires permanentes était statistiquement significatif (p = 0,00) avec l'indice de masse corporelle.
Conclusion : L'âge moyen d'éruption était de 5,6 ans pour les premières molaires permanentes et de 11,9 ans pour les deuxièmes. Les indices de masse corporelle ont influencé les âges d'éruption des séquences.

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Introduction

Tooth eruption is a developmental process starts from the initiation of tooth bud formation from the embryonic cells and continues till complete root development. We can correlate the chronology of teeth eruption with the age of human being and it is an important tool for determining the biological age of human beings in forensic needs when the birth date is not known [1]. Knowledge about the timing of tooth eruption is essential to plan diagnostic, preventive and therapeutic measures [2,3]. Teeth have varied time and sequence of eruption, in clinical studies allover hospitals in Yaoundé, reference values attributed to teeth are based on those obtained from foreign population Studying permanent first and second molars eruption. These is equally important because these teeth determine the occlusal table and affect the position and health of other permanent teeth [3]. Authors suggest in literature writings that, the norms for teeth emergence should come from the population on which the study is to be carried out, as there are variations from one region of the world to another in factors influencing teeth eruption [4]. This is in accordance with studies carried on WAC(Gambian) of age range 4.5years to 14years [4,5].

Studies suggest that Caucasians have a delayed time of eruption. In addition, Negroes have earlier eruption than Caucasians. Since the end of the nineteenth century, a trend toward earlier eruption of permanent teeth has been reported in industrialized countries. For Almonaitiene *et al.* African children have early eruption of permanent teeth. Literature accords on the fact that girls have an early tooth eruption when compared to boys [6]. Several factors have been proven to influence tooth eruption in children. According to AAPCN, “obesity is the most prevalent chronic health condition in the pediatric population.” Obesity is then defined as a BMI greater than or equal to the 95th percentile [6]. We have also, geographical, climatic, racial, gender and ethnic differences, as well as economic status, fluoride, season of birth, temporal variations, and growth parameters together with infrequent general pathological conditions. In Cameroon, studies have been carried to determine ages of first primary and permanent teeth eruption and none of these evaluated the influence of BMI. Therefore, the aim is to determine the ages of permanent first and second molar eruption among children in selected schools in Yaoundé and evaluate the influence of BMI on tooth eruption.

Material and methods

A descriptive cross-sectional study was carried out in Four school in Yaoundé: Government Elementtary nursery and primary school GENPS Etoug-Ebe, governement public school (*GPS) Nkolbisson, Champions Secondary and High School(CSHS) Obili, Governement bilingualhigh school (GBHS) Etoug-Ebe,* for a duration of eigth months. The following material was used to carry out our work: Individual report sheet, Consultation trays (Mirror, Probe and Tweezers), latex gloves, surgical masks disinfecting solution, liquid soap, sodium hypochloride solution, protective glasses, alcoholic solution, Weight scale, standiometer. Throughout our study, we recruited children whose 1/3 or 2/3 of the crown was visible and/or whose crown was fully visible in the oral cavity. Children whose parents have approved and the children themselves have accepted to participate in the study. Children with chronic systemic pathologies were non-inclued. The Sample Size is calculated using Lorentz formula to estimate the minimum size of the population [7]. Therefore, N = (1.96)2 x0.15 (1-0.15)/ (0.05)2=196. Implying a minimum of 196 participants will be required for our study. Absolute precision considered as 5% or 0.05. The identification of children and collection of demographic data of each child and doubted we calculated the BMI using Quetelet’s formula: weight/height^2 and expressed in kg/m^2 to the nearest one decimal place [7]. Participant’s weight was measured in a standing position. It was expressed to the nearest 0.1Kg. Participant’s height was measured using a standard graduated stadiometer in centimeters.

The values obtained were compared to those stated on the CDC growth chart for children aged 2-19 yrs, and these values permitted us to evaluate the nutritional status of the children and be able to say with certitude if the child is underweight, normal or overweight. The CDC defines BMI categories as follows: underweight, BMI less than 5th percentile; normal (average), 5th percentile to less than 85th percentile; overweight, 85th percentile to less than 95th percentile; and obese, 95th percentile or greater. The patients were grouped into either underweight/average or overweight/obese pairings to create a more definitive classification system.

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Chronologic age was calculated from each child's birth date, and the sex of each patient was also recorded. An intra-oral examination was done for all the children and all consultations were done using one mouth mirror per child under daylight. The teeth present in the mouth on the day of consultation were noted on the report sheet using the IDF or FDI. A permanent tooth was considered erupted, if part of the crown has emerged out of the oral mucosa into the oral cavity. The administrative bodies of the selected institutions and pupils/students were first sensitized on necessity and proper oral hygiene practices, then explained our objectives for the study before data collection. Consent formulation forms were distributed to teachers to seek their parental approval and it is with the approval of the parents and teachers that an appointment was taken for data collection.

Before carrying out our study, we beseeched an institutional ethical clearance from the ethical committee of FMBS. We also obtained demand for authorization of research from the selected school administrations where the study was to be carried out. The age of the participants was determined using their date of births as recorded in school documents and in accordance with those giving by the parents. Sex and place of birth was determined by looking into his school records. After a thorough and scrupulous intra-oral examination, the permanent first and second molars were registered into our report sheet. Para-functional exam was evaluated by direct and individual inquiry from the participants. Statistical analysis was done using the statistical package for social sciences (SPSS) version 26.0 and Microsoft excel version 2013. Frequencies and prevalence were expressed in percentages. The level of statistical significance was set at a p-value less than 0.05 and cross tabulations were used to draw tables to compare the variables. The independent t-test was used to compare quantitative and qualitative variables.

Results

This study consisted of 647 students followed in four schools in Yaoundé in the district of Biyem - Assi. Therefore, the parents refused to give their informed consent, 644 agreed to participate in the study, 2 students were excluded from the study because of the incorrectly completed questionnaire, 644 were finally retained. This study was carried out in four selected schools in Yaoundé of which GENPS Etoug-Ebe had the highest population (n=221, 34.3%); *GPS Nkolbisson (n=198, 30.7%), CSHS Obili (n=119, 18.6%), GBHS Etoug-Ebe (n=106, 16.4%)*. The study was constituted of 644 participants of which 55.4% were females with a sex-ratio of 0.8 in favor of females. The females mean age was 11.19 ± 1.272 years. The mean age of males was 9.14±3.134 years with a confidence interval of 95%.

Table I: *demographic characteristic*

Demographic characteristic	Frequency (N=644)	Percentage (%)
Sex		
Males	287	44,6
Females	357	55,4
Place of birth		
Urban	641	99,5
Rural	3	0,5

Age of eruption of permanent first molar in quadrant one

Of the 644 participants in this study, 8% of the participants had their first molars by the age of 6 in the first quadrant. 16% of the participants had their first molars already before the age of six and 61% of the participants have their first molar after the age of six in the first quadrant. The earliest age was three years' old.

Age of eruption of permanent first molar in quadrant two

In quadrant two, 8% of the participants had their first molars erupted by the age of six.

Age of eruption of permanent first molar in quadrant three

In quadrant three, 9 % of the participants had their first molars erupted at the age of six. 10% of the participants had their first molars already before the age of six and 69% of the participants have their first molar after the age of six in the quadrant three.

Age of eruption of permanent first molar in quadrant four

In quadrant four, 10% of our participants had their first molars erupted by the age of seven.

Age and percentage of detection of second molar

From the 644 participants, by the age of twelve 12% of the participants had their second molars erupted in quadrant one. Of all the participants in this study, 8% of the participants had their second molar

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erupted by the age of twelve in quadrant two. 11% of the participants had their second molar erupted before the age of twelve in quadrant two. And 11% of the participants had their second molars erupted after age of twelve in quadrant two. 78% of the participants not had their second molars erupted by the age of twelve in quadrant two.

Age of eruption of permanent second molar in quadrant three

Of all the participants, 13% had their second molars erupted by the age of twelve in quadrant three. 10% of all participants had their second molars erupted before the age of twelve in quadrant three. 12% of all the participants their second molars erupted after the age of twelve in quadrant three.

Age of eruption of permanent second molar in quadrant four

From this study, by the age of twelve, all 10% of the participants had their second molars erupted already in quadrant four. Of all the participants, 10% had their second molars erupted after the age of twelve in quadrant four.

Association between permanent first and second molar eruption and BMI

An independent sample t test reported a significant difference in BMI of present and absent for quadrant one molar one, t (326.534) = 12.699, p<0.00, 95% *C.I.* [1.98837 – 2.71737]. Participants with first molars present were averagely higher (M = 16.3503, SD = 2.58240) as compared to those with first molars absent (M = 13.9975, SD = 1.70845). In this study, the mean age of eruption and SD of permanent first molars eruption was 5.74±1.195 for molar one in quadrant four for males and 5.87±1.073 for molar two in quadrant two in females. The mean age of eruption for molar two and SD in males was 12.04±1.017 in female's quadrant four and 12.07±0.825 for females in quadrant three. Globally in these study mean age of eruption and SD are earlier than in the other study. This study reported 255(39.6%) with permanent first molars erupted in quadrant four within the BMI group 15.1 – 19Kg/m^2 and 57(8.85%) of the participants had second permanent molars erupted in quadrant two within the BMI group 19.1 – 23Kg/m^2.

Table II: *association between permanent first and second molar eruption and BMI*

Quadrant	Molar			Mean	SD	P value	T value	df	CI
Q1	M1	BMI	Present	16.3503	2.58240	**0.000**	12.699	326.534	1.98837/2.71737
			Absent	13.9975	1.70845				
	M2	BMI	Present	17.8881	2.46673	**0.000**	14.883	337.334	2.58197/3.36839
			Absent	14.9129	2.08529				
Q2	M1	BMI	Present	16.3461	2.59797	**0.000**	12.703	343.392	1.95758 /2.67487
			Absent	14.0299	1.66246				
	M2	BMI	Present	17.9164	2.46448	**0.000**	15.062	333.565	2.61655/3.40265
			Absent	14.9068	2.07374				
Q3	M1	BMI	Present	16.2774	2.57515	**0.000**	12.230	247.843	1.99128/2.75575
			Absent	13.9038	1.71299				
	M2	BMI	Present	17.7695	2.42542	**0.000**	15.595	400.522	2.58965/3.33675
			Absent	14.8063	2.05223				
Q4	M1	BMI	Present	16.2451	2.58242	**0.000**	11.852	226.454	1.94724/2.72381
			Absent	13.9095	1.70217				
	M2	BMI	Present	17.6607	2.40427	**0.000**	12.379	642	2.13271/2.93689
			Absent	15.1259	2.31917				

Mean age of eruption of permanent first and second molars

In this study, the mean age of eruption of permanent first molars eruption was 5.74±1.195 years for molar one in quadrant four for males and 5.87±1.073 years for molar two in quadrant two in females. The mean age of eruption for molar two in males was 12.04±1.017 years in female's quadrant four and 12.07±0.825 years for females in quadrant three.

Comparison between mean age of eruption

Globally in these study mean age of eruption and SD are earlier than in the other study.

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Table III: *mean age of eruption of permanent first and second molars*

Quadrant/molar	Males	Female
	Mean and SD	Mean and SD
Q1M1	5.75±1.212	6.08±0.973
Q1M2	12.30±0.921	12.18±0.804
Q2M1	5.79±1.200	6.07±0.980
Q2M2	12.27±0.931	12.17±0.807
Q3M1	5.74±1.215	5.96±0.999
Q3M2	12.20±0.936	12.07±0.825
Q4M1	5.74±1.195	5.87±1.073
Q4M2	12.04±1.017	12.07±0.838

Table IV: comparison between eruption and SD of the present study and that of other study

Quadrant/Molar	Male		Female	
	Mean and SD	**Present study**	**Mean SD**	**Present study**
Q1M1	7.3±4.7	5.75±1.212	7.3±4.6	6.08±0.973
Q1M2	13.4±3.7	12.30±0.921	13.4±3.6	12.18±0.804
Q2M1	7.4±5.7	5.79±1.200	7.3±5.7	6.07±0.980
Q2M2	13.4±3.7	12.27±0.931	13.4±3.7	12.17±0.807
Q3M1	6.9±5.1	5.74±1.215	6.9±5.1	5.96±0.999
Q3M2	12.8±4.2	12.20±0.936	12.8±3.9	12.07±0.825
Q4M1	7.0±5.4	5.74±1.195	7.0±5.2	5.87±1.073
Q4M2	12.9±3.8	12.04±1.017	12.8±3.8	12.07±0.838

Table V: *frequency of permanent first and second molar eruption with BMI*

BMI (kg/m^2)	Q1M1	Q2M1	Q3M1	Q4M1	Q1M2	Q2M2	Q3M2	Q4M2
8-11	1	2	2	2	1	1	1	0
11.1-15	189	186	201	206	24	23	28	27
15.1-19	245	246	253	255	118	117	137	112
19.1-23	64	64	64	64	56	57	56	41
>23	7	7	7	7	3	3	4	3

Permanent first and second molars with corresponding BMI groups

This study reported 255(39.6%) with permanent first molars erupted in quadrant four within the BMI group 15.1 – 19Kg/m^2 and 57(8.85%) of the participants had second permanent molars erupted in quadrant two within the BMI group 19.1 – 23Kg/m^2.

Discussion

We set out to determine the eruption ages of permanent first and second molars and evaluate the influence of BMI on the eruption of these teeth. The results showed that from the point of view of socio-demographic characteristics, 55.4% of the participants were females, and 99.5% of the participants were born and reside in an urban environment. Our participants ages ranged from 3 to 15years, from which they were grouped in different age groups. This age groups permitted us to evaluate the phenomenon of precocious and retarded eruptions. These age groups were found close to those of Nassif *et al*. [8]. Who conducted a cross-sectional study on timing of eruption of permanent teeth and the clinical emergence. Data were collected for Lebanese children aged between 5.5 years and 13 years from different socioeconomic groups in rural and urban communities spread over different regions in Lebanon [8]. Equally this age group was found close

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to that of Billewicz *et al*. who conducted a similar study on West African (Gambian) children with an age range of 4.5 to 14years [9]**.** We found molar one eruption in quadrant one earlier in males than in females with mean age and SD (M=5.74±1.195) in quadrant while females had an earlier molar two eruptions than males in quadrant three (M=12.07± 0.825) which could be explained by early onset of puberty in children which results high metabolic activities resulting in precocious dental maturation. This is opposed by data obtained from the International Journal of Clinical and Pediatric Dentistry 2020[10]. The 82.9% of our participants had first molar erupted in quadrant four, with the minimum age of 3years for males. The female mean ages of eruption were *M=6.08±0.973* for molar one in quadrant one. Studies have been conducted in many parts of the world to determine ages of permanent first molar eruption. In our study, the first molar was observed within the age group 3 – 7years which was contrary to study conducted by Paolo Frazao *et al*. in 2011 whose lowest age group for first molar emergence was 5.5 – 6years [2].

Our study showed 10% of the participants had all their first molars erupted by the age of seven. However, 0.93% of our participants had first molars erupted by the age 3years which is opposed Nassif *et al*.2020 who suggest that permanent first permanent molar appear around the age of 5 to 6 years [8]**.** This was equally opposed by Jin Yan *et al*. 2021 who suggested that first molar eruption age ranges from 3.5 to 6years [3]. Our chronology for first molar eruption showed that mandibular molars erupted earlier that maxillary first molars which in line with studies conducted by Hassanali *et al.* in Nairobi, Kenya who reported mandibular teeth to erupted earlier than the maxillary ones in both races [11]**.** The present study reported mean age and SD to be *M*=5.62±1.108 with a modal age of 7years. This was opposed by Nassif *et al* 2020[8] whose mean age of eruption and standard deviation for first permanent molar was *M*=6.39±9.69. There was a significantly difference between female mean age of eruptions and SD when compared to male counterparts and when compared to males and females of other studies conducted in other parts of the world. The mean age and SD for females was *M*=5.87±1.073 which was opposed by that of Penmatsa et al 2018 (*M*=6.9±5.1) [12].

Of all our participants, 35.1% had permanent second molar erupted in quadrant three. The mean ages of eruption of permanent second molars for boys were *M=12.30±0.921* for molar two in quadrant one, *M=12.27±0.931* for molar two in quadrant two, *M=12.20±0.936* for molar two in quadrant three and *M=12.04±1.017* for molar two in quadrant four. For females, the mean ages of eruption were, *M=12.18±0.804* for molar two in quadrant one, *M=12.17±0.807* for molar two in quadrant two, *M=12.07±0825* for molar two in quadrant three, and *M=12.07±0.838* Studies have been conducted on the ages of eruption permanent second molars. This is in line with studies conducted by Ambika *et al*. on Indian school children where 52.56% of the participants were girls with second molars within the range 12 to 13years [13]**.** Our study revealed that at the age of 12years, 13% of the participant had their second molars in quadrant three. However, 0.78% of our participants had their second molars erupted by the age of 10years which is opposed by Jim Fuller *at al*. who suggest permanent second molars eruption by the age of 12years [12]**.**

In our study, mandibular permanent second molar showed an early eruption when compared to maxillary permanent second molars. This in line with studies conducted my McGregor *et al*. on Gambian children [14]**.** The mean age of eruption and SD (*M*=11.87±0.87). The mean age of eruption and SD for males was statistically different from those of females counterparts and males of other studies. In the present study, the mean and SD for males (*M*=12.04±1.017) in quadrant three was different from the ones obtained by Penmetsa *et al*. whose mean age of eruption and SD was (*M*=12.8±4.2) in quadrant three [12]. The females on the other hand showed similar differences in terms of mean age of eruption and SD for the male counterparts and females in different parts of the world with mean age of eruption and SD (*M*=12.07±0.825) opposed by studies conducted by Nassif *et al.* whose mean age of eruption and SD was (*M*=10.79±10.9) for second permanent molar in quadrant three [8].

The results of our study showed the difference in the mean eruption age of permanent first and second molars, whereby teeth emergence was more advance in females than in males, in accordance with studies carried out by Gacia *et al*. 2021 who showed an advance age of emergence in females in a study conducted on southeastern Dominican children [15]**.** We observed a significant difference when body mass indices for males were compared

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to those of females whereby, 11.2% of the females had a higher BMI, which could be explained by the fact that females have a high body composition at early puberty when compared to males. However, when body mass indices were compared to the CDC growth chart, 0.4% of males had body mass indices below 5th percentile within BMI group 6-8 Kg/m^2, with a mean age of eruption and SD of 9.14±3.134 for molar one and 11.95±1.105 for molar two, and 0.3% of females of the same age and BMI groups had their body mass indices below 5th percentile with a mean age of eruption and SD of 9.63±2.942 for molar one and 11.19±1.272 for molar two. Of all the males, 11.18% of males were of normal weight and had their body mass indices between 5th percentile and 85th percentile while of all the females, 11% were of normal weight and had BMI values between 5th and 85th percentile. This could be explained by the fact that, most of these pupils and students cover long distances to school on foot and involve greatly in academic activities that help regulate their body composition. Of all our participants, 0.62% had first molar erupted within the age group 3-5years and BMI group 8-11Kg/m^2 while 63.5% of the participants had first molar erupted within the BMI group 15-19Kg/m^2. Moreover, 45% of all the participants had second molar erupted within the age BMI group 15-19years. We observed a correlation with BMI of individuals of opposite sex and same age as most of them fell within optimal BMI range and there was no significant influence on tooth eruption. This was contrary to study conducted by Sharma *et al*. in 2020 who found a correlation between BMI and time of eruption of permanent molars [10]**.** This was equally opposed by Sindelarova *et al.* who conducted a study on the relationship of obesity to the timing of permanent tooth emergence, Mohamedhusein *et al.* whose study was based on association of obesity with the eruption of first and second molars in childrewn and Nagaratna *et al.* 2016 whereby they conducted a cross-sectional to find a comparison of teeth eruption with body mass index among schools' children in Mangalore [16].

Conclusion

Males had a precocious age of eruption of permanent first and second. The ages of eruption of permanent first permanent molar was found to be earlier than the one mentioned in literature. The age of permanent second molar was found earlier than the ages mention in literature. The mean age of permanent first molar was 5.6 years. The mean age of eruption of permanent second molar was 11.9 years. The body mass indices of participants were significant and had influenced eruption ages and sequence of permanent first and second molars.

Conflicts of interest: none

Author's contribution

Moneboulou Mengong Hortense Perpétue: **conception, data collection, writing of the article**, Ekobena Jean Martial: **data collection,** Lowe Michelle: **critical revision of the content,** Yufenyuy Wirnkar: **data collection, writing of the article**, Kattié Louka Aka, Bengono Messanga Charles**: approval of the final version.**

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