Role of Body Composition on the Eruption Time of First Permanent Molars

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Abstract

Body Composition has been known to have a significant role in the bone maturity process. Heavy children showed to have a more mature phase in the development of their metacarpal bones compared to those of thin children at the same age groups. However, the study on the role of body composition on the eruption times of first permanent molars among children is limited. The aim of this study is to determine the role of body composition on the eruption time of first permanent molars among 6 and 7 years old children living in Jember administration city, Indonesia. Two hundred and thirty four children, age between 6 to 7 years old, were participated in this study. Body composition was assessed by measuring their BMI. The percent total body fat (%TBF) was calculated from BMI using the Deurenberg equation and grouped into thin and fat subgroup using the approach of analytic z score. Oral examinations were conducted to collect the first permanent teeth eruption data. This study found that thin subgroup children showed delayed eruption in all 4 first permanent molars. The fat subgroup showed accelerated eruption in all 4 first permanent molars. This study concluded that the body composition played a significant role in the eruption time of permanent teeth in which fat children experience accelaration of first permanent molars eruption. Chronological age was a weak predictor of first permanent molars eruptive times.

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Introduction

Dental eruption is a unique developmental process and the aetiology of the mechanism is not fully understood yet. The order of permanent dentition eruption is usually different between upper and lower jaw. However, the first permanent dentition to erupt is usually begin by the first molar. There is an agreement among the scientists on acceptable range of eruptive times. However, significant deviation from the norms eruptive times should be put into account when orthodontic treatment is required in the mix dentition period. Number of physiological and pathological factors can influence tooth eruption. Studies on the dental eruptive times were mostly involve in age and gender different, genetic factors, racial and etnicity.[1,2,3] Permanent teeth tend to appear earlier in girls.[1,4,5] Eruptive times of permanent dentition is also influenced by nutritional status.[4] Under nutrition children show to have fewer number of permanent teeth eruption compare to those of normal weight children.[6,7]

Assessment of body composition is an integral part of nutritional status assessment. Body composition have been explored in various normal and pathological condition. The role of body composition in either physiological and pathological processes including in the field of dental caries have been explored [8,9] and studies of the influences of body composition on bone mass have also been widely reported. Body composition per se lean body mass, body fat has been reported as the most significant predictors of bone mass in preadolescent.[10] While Smith RJ (1980) earlier researcher who studied the relation between body composition and bone maturity using the metacarpal radiology found that there is significant role of body composition and bone maturity.[11] However, study on the role of body composition on the eruptive times of first permanent molars is limited,[12] especially within Asian ethnicity. This study is aimed to determine

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the role of body composition on the eruptive times of first permanent molars among children living in Jember admistrative city, East Java, Indonesia.

Conventional of body composition divides body component into Fat Mass (FM) and Fat Free Mass (FFM). Deurenberg et al.[13] has developed body composition equations as to estimate the %FM from Body Mass Index (BMI). For these calculations, age and sex must be included in the equation. Internal and external cross-validation of the prediction formulas showed that Deurenberg equation gave valid estimates of body fat, between sexes at all ages. The most commonly used formula for relationship between BMI and %FM in children is presented by Deurenberg et al. is as follows;

Child body fat (%) = (1.51 × BMI) − (0.70 × Age) − (3.6 × sex) + 1.4.

The purpose of the current study was to perform a cross-sectional analysis of the association between Body composition and first permanent molar eruption in student age 6 and 7 years old living in Jember administration city, Indonesia.

Materials and Methods

This was an analytic observational study with cross sectional approach.This research was conducted on first grade students among the state elementary schools in Jember administration city and within three districts only, which were Kaliwates, Sumbersari and Patrang. Total of 234 male elementary students, age between 72 – 84 months old, were selected using the approach of stratified random sampling.

All anthropometry assessment was performed every day in between 10.00-11.00 am in each selected school. Body weight was assessed using digital weight scale (Camry) and body height was assessed using microsite statue meter. Body composition as percent total fat mass (%FM) was derived from BMI by the use of Deurenberg equation.[13] The population was divided into two age groups which were 6-year-olds group (< 78 months) and 7 years old (> 77 months). Every age group were divided into thin and fat group using the approach of Z score.

Intra oral examination was conducted after the anthropometry assessment. All intra oral examination was performed with volunteers sitting in a portable dental unit and by using intra oral mirror hand instrument and additional head lamp. Tooth eruption is a complex and tightly regulated process which is divided into five stages namely pre-eruptive movements, intra-osseous stage, mucosal penetration, pre-occlusal and post-occlusal stages. This study used mucosal penetration stage as tooth eruption.

All permanent first molar erupted was recorded. All intra oral examination procedure was started from the right then left upper jaw and then down to the left lower and finished at the right lower jaw. Permanent molars teeth which was clinically seen was recorded as erupted. SPSS 13.0 was used for data analysis and the correlation was assessed using independent t'test and ANOVA if required.

Results

This study reports the role of body composition on eruptive times of first permanent molar in 6 and 7 years old male students living in Jember administration city. This study focused on how %FM influence eruption Times of the first permanent molar. This study involves on male students only to avoid the gender effect. Many studies have reported that eruptive times is gender specific and reported that female teeth erupt earlier than male children.[14,15,16]

We studied 234 elementary male students studying in elementary school around Jember city areas and consist of 64 students being 6 years old and 170 students being of 7 years old with varying body composition status. The characteristic of the respondent is presented in the following table.

Table 1 shows that there is no significant difference in height (m) between the 6 year old group (1.12 ± 0.01) and the 7 year old group (1.16 ± 0.01), in weight (Kg) between the 6 year old group (21.30± 1.86) and the 7 year old group (21.96 ± 0.33) and in %FM between the 6 year old group (18.52 ± 1.02) and the 7 year old group (18.23 ± 1.71). This result suggest that the different both groups is only on their chronological age.

Based on WHO (2006), and as used by the Indonesian Ministry of Health for standard reference for child and growth, the population studied were within normal nutritional status [17, 18]. The thin and fat subgroup in this study were based on midline Z score for each group in order to divide the population into two subgroups

according to their calculated %FM. The characteristic of the respondent is presented in Table 1.

	6 y.o. (n=64) Mean ± s.e.m	7 y.o. (n=170) Mean ± s.e.m
Height (m)[1]	1.12± 0.01	1.16± 0.01
Weight (Kg)[1]	21,30± 1.86	21,96± 0.33
BMI[1]	16.49 ± 1.12	16.33 ± 0.13
% fat*[1]	18,52± 1.02	18,23± 1.71
Body composition status:		
6 years old group**		-
Thin [%FM <18.52] (%)	44 (68.75)	-
Fat [%FM>18.51] (%)	20 (31.25)	
7 year old group	-	69 (40.84%)
Thin [%FM <18.33] (%)	-	101 (59.16%)
Fat [%FM>18.32] (%)		

* Calculated from BMI using the Deurenberg calculation
** Calculated based on Z score
[1]Not Significant

Table 1. The Characteristic of the Respondent.

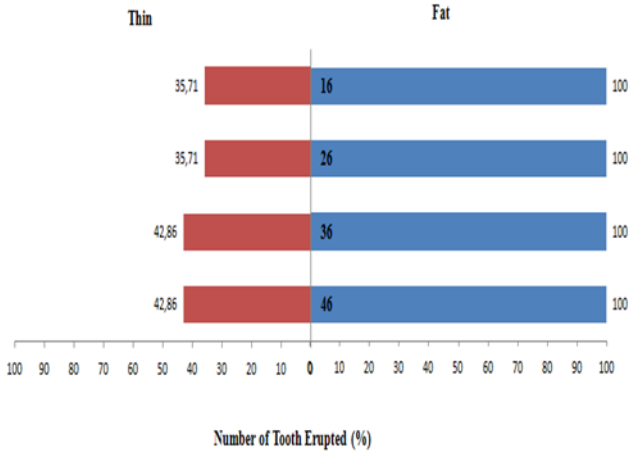

Figure 1. This Figure Shows the Comparison of the Number of the Following Tooth: 16, 26, 36, And 46 Between the Thin and Fat Subgroup Within The 6 Year Old Group. All First Permanent Molars (100%) Have Been Erupted in the Fat Subgroup.

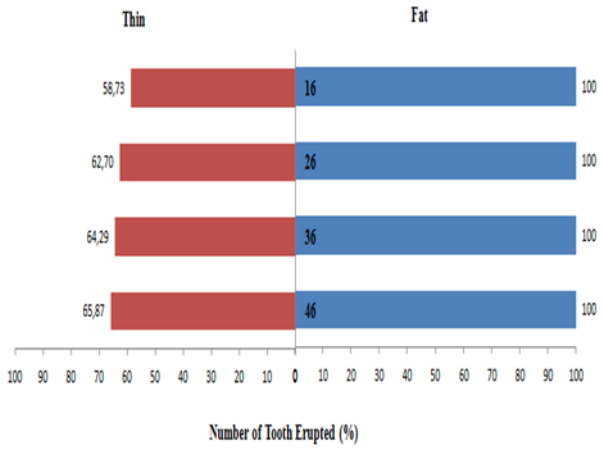

Figure 2. This Figure Shows the Comparison of the Number (%) of the Following Tooth: 16, 26, 36, And 46 Between the Thin and Fat Subgroup in the 7 Year Old Group. As Seen in Figure 2, All First Permanent Molars (100%) Have Also Been Erupted in the Fat Subgroup.

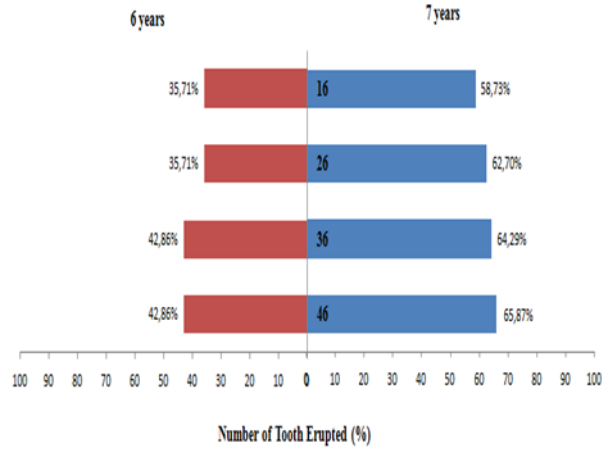

Figure 3. This Figure Shows the Comparison of the Number (%) of 16, 26, 36, and 46 Erupted within Thin Subgroup Between 6 and 7 Years Old Group. There Was No Significant Different Between the Two Subgroups.

The following figure is the comparison of the number of each element of erupted tooth such as the upper right of first permanent molar (16), upper left of first permanent molar (26), the lower left of first permanent molar (36) and the lower right of first permanent molar (46) between thin and fat subgroup in 6 year old group (Figure 1). The figure shows that in the fat subgroup all first permanent molar has been erupted. It means that all 6 year old respondent categorized as fat in this study have their first molar erupted. While only 37.71% of the thin respondent have their upper first permanent molar erupted and only

42.86% of this subgroup have their lower first permanent molar erupted. These differences are all significant ($p < 0.000$). It suggests that %FM significantly influence the eruptive time of first permanent molar. Clinical study had shown that obese children show to have faster bone maturation in comparation of those thin individual.[15,16] Similar results as in 6 years old group was seen in the 7 years old group (Figure 2). Comparison of the sum of all permanent first molars between thin subgroup in both 6 and 7 years old population is presented in Figure 3.

Discussion

The thin subgroup for both 6 and 7 years old population in this study showed delayed eruption on their first permanent molar compared to the fat subgroup or on the other hand the fat group showed to have an accelerated eruption of permanent first molars. Psoter W. et al. (2008) in their study among the Haitian adolescents reported that chronic malnutrition in early childhood was correlated with delayed teeth eruption.[19] This could be explained that % FM as part of body composition compartment might play a significant role on the eruption of permanent teeth. In under nutrition, where % FM is below normal could explained the findings in Psoter study. On the other hand, Alvarez JO. (2009) in his study reported that there is an acceleration eruption of permanent first molars and incisors in 6 years old group of children with early childhood under nutrition. However, his study failed to report nutritional status of the respondents and also the number of samples was considerably small.[20]

This study showed that %FM can be used as eruptive time predictor for first permanent molars. A high %FM in children will accelerate the eruption of first permanent molars through a coordination with the osseous maturity. It can thus be expected that a second permanent molar will erupt early if the patient's first molar erupted early and there is thus a correlation between eruption times between subgroups.

Obesity have been proven to accelerate bone maturity.[21,22] However, this study failed to determine the early eruption of first permanent molar in fat subgroup, as the results showed that the fat subgroup already have all of their first permanent molar erupted at the age of 6 year. This finding suggests that early eruption times in the fat subgroup may begin at 5 or earlier age. The fact that there were no significant different between 6 years old and 7 years old group in their total number of teeth eruption within the same subgroup, it means that the correlation between chronological age and eruption time is weak, as shown in Figure 1, 2 and 3.

Conclusion

Although our population is on healthy nutritional status category based on WHO, our results suggest that higher %FM accelerate first permanent molar eruption and thus erupt earlier than those children with lower %FM. Chronological age had a weak predictor of first permanent molars eruption. It is not clear from this study the beginning of eruptive times in children with higher %FM, future studies should examine the timing of the onset of increase %FM with respect to tooth emergence to establish how incidence will affect this association. Finally, more research is needed to examine the association between %FM and the order of permanent teeth eruption. These findings may have implications for dental and orthodontic health care. This finding is substantial and noteworthy for the orthodontist because may have implications for the planning and timing of orthodontic treatment.

Declaration of Interest

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