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Association of weight and height with timing of deciduous tooth emergence

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ABSTRACT

Objectives: The aim of this study was to associate weight and height with the timing of deciduous tooth emergence.
Methods: 1756 children, aged from 1 to 33 months (755 females and 1001 males) had been previously examined for the timing of deciduous tooth emergence and their weights and heights measured. Children were categorized into weight and height groups (underweight, normal, overweight, short stature, normal and tall stature). Probit regression analysis was used to calculate the ages at emergence of each deciduous tooth. Tooth emergence ages were compared pairwise across the weight and height groups.
Results: The deciduous dentition emerged between 7.9–31.5, 7.8–29.6 and 6.3–26.5 months in the underweight, normal and overweight children, respectively. In the height groups, the ranges were 9.0–31.3, 7.4–27.0 and 6.7–24.3 in the short, normal and tall children, respectively. The extremes of weight and height were related to the times at deciduous tooth emergence where a substantial increase in weight or height was associated with earlier emergence, and vice versa. However, only canines, lateral incisors and upper central incisor showed statistically significant association with weight and none of the teeth exhibited statistically significant association with height. Moreover, no emergence sequence change was associated with weight and height.
Conclusions: The present study provides the first weight and height– specific data on the timing of deciduous tooth emergence. Although both weight and height are generally associated with the timing of deciduous tooth emergence, weight shows a stronger association for canines, lateral incisors and upper central incisor. The findings will aid assessing normal emergence timing in children with variant weights and heights.

1. Introduction

Tooth emergence is a brief moment throughout the continuous dynamic path of tooth eruption when a tooth cuts through the overlying oral epithelium to make its first appearance into the mouth (Shaweesh, 2012a). Although, the timing and sequence of deciduous tooth emergence has recently been shown to be under the genetic control (Fatemifar et al., 2013), pre-natal maternal conditions, early childhood metabolic and nutritional factors along with socioeconomic variables have been associated with the emergence times of the deciduous dentition (Endo, 1980; Fadavi, Punwani, Adeni, & Vidyasagar, 1992; Haddad & Correa, 2002; Infante & Owen, 1973; Kaur & Singh, 1992; Lam et al., 2016; Mierzwinska, 1984; Neto & Falcao, 2014; Oziegbe, Adekoya-Sofowora, Folayan, Esan, & Owotade, 2009; Pavicin, Dumancic, Badel, & Vodanovic, 2016; Sajjadian, Shajari, Jahadi, Barakat, & Sajjadian, 2010; Shuper, Shohat, Sarnat, Varsano, & Mimouni, 1987; Watanabe & Kimura, 1999; Zadzinska, Nieczuja-Dwojacka, & Borowska-Sturginska, 2013; Zadzinska, Sitek, & Rosset, 2016).

The weight at birth is one indicator of prenatal maternal factors and its correlation with the emergence times or the number of erupted deciduous teeth has been well reported in the literature (Fadavi et al., 1992; Haddad & Correa, 2002; Mierzwinska, 1984; Neto & Falcao, 2014; Pavicin et al., 2016; Sajjadian et al., 2010; Watanabe & Kimura, 1999). Fadavi el al. found an average of 28% fewer teeth in prematurely born infants below the age of two years (Fadavi et al., 1992). In agreement with Fadavi et al., Sajjadian et al. (2010) suggested that lower birth weight may be linked to delayed first deciduous tooth emergence. More stringently, Chan et al. (2012) and Pavicin et al. (2016) reported that only very low birth weight can be a predictor for the delayed emergence of the first deciduous tooth. On the other hand, Haddad and Correa (2002) and Neto and Falcao (2014) did not find the age at birth as a strong predictor for the timing of deciduous tooth eruption. Therefore, the findings of these studies were variable.

Among the best indicators for the impact of childhood metabolic factors, nutrition and socioeconomic factors on the time of deciduous tooth emergence in infants are the age-related body weight, height and

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other anthropometric measures such as head circumference. Although this topic has received worthy interest for the permanent dentition, e.g. (Adler, 1963; Kaur & Singh, 1992; Kutesa, Nkamba, Muwazi, Buwembo, & Rwenyonyi, 2013), fewer accessible papers have been published for the deciduous teeth (Endo, 1980; Gaur & Kumar, 2012; Haddad & Correa, 2002; Infante & Owen, 1973; Kaur & Singh, 1992; Oziegbe et al., 2009; Shuper et al., 1987; Soliman, El-Zainy, Hassan, & Aly, 2011). While a significant correlation between both weight and height of children and the number of erupted deciduous teeth were reported in some of these studies (Endo, 1980; Kaur & Singh, 1992; Oziegbe et al., 2009), in other studies, height showed a stronger correlation than weight (Gaur & Kumar, 2012; Haddad & Correa, 2002; Soliman et al., 2011). Infante and Owen (1973) reported the latter finding only among females. On the other hand, Shuper et al. (1987) found the number of erupted deciduous teeth unrelated to anthropometric measures in children who fail to gain weight.

Almost all the studies that investigated the impact of weight and height on the time of deciduous tooth eruption relied on correlating these anthropometric measures with the number of deciduous teeth erupted. There has not been any studies that attempted to calculate and statistically compare the age of deciduous tooth emergence between variant weight and height categories of children. Therefore, the aim of the present study, which used a large representative sample of Jordanian children, was to compare the ages of deciduous tooth emergence among different weight and height categories of children in order to investigate the relationship between physical development and emergence timing. The results are believed to find fruitful application in oral health and general health care of children.

2. Materials and methods

The participants were among a large cohort of children who took part in a previous cross-sectional study that reported the first standards of deciduous tooth emergence in Jordanian children (Al-Batayneh, Shaweesh, & Alsoreelay, 2015). Among the total of 1988 children who had taken part in Al-Batayneh et al's study, there were 1756 children, aged from 1 to 33 months, whose weight and height were measured (755 females and 1001 males). The present study is under the extended ethical approval of the Institutional Review Board (IRB) in Jordan University of Science and Technology (Approval Number 86/2011).

We refer the reader to Al-Batayneh et al. (2015) study for the details of the sampling and data collection. In summary, the data had been collected from the participants, who were Jordanian citizens of Arab ancestry with minimal ethnical divergence, between April – Sept 2011. The sampling had been based on multistage clustering where the children were randomly selected from maternity, childcare and child health centres within three governorates to represent the north, the middle and the south of Jordan. Urban and rural distribution had been considered in the sample selection.

During the dental examination of children, emerged deciduous teeth were recorded. A tooth was considered "emerged" had any part of it been visible in the mouth. In this respect, the outcome for any deciduous tooth under examination was dichotomous; emerged/non-emerged (EM/non-EM). One examiner collected all the data (see acknowledgment) and intra-examiner reliability was tested and revealed non-statistically significant differences between the first and second attempts (Al-Batayneh et al., 2015). Body weight to the nearest 0.1 kg and height/length (heal to vertex) to the nearest full cm were recorded for each child using a digital scale and a measuring tape, respectively. For very young infants, it was important to make sure that the legs were fully extended before measuring body length. Then, the children were categorized into three body weight and three body height groups by reference to the gender-specific weight and height for-age growth charts of the Centers for Disease Control and Prevention (CDC): The United States (Centers for Disease Control and Prevention, 2017). Body weight groups 1 and 3 comprised the underweight (UW) and the overweight (OW) children below and above the 5th and the 95th percentiles, respectively while the children whose weight was equal or greater than the 5th percentile and equal or smaller than the 95th percentile made group 2; the normal weight (NW) group. Similarly, there were three body height groups; short stature (SS), normal stature (NS) and tall stature (TS).

The chronological age of each child was calculated by subtracting the date of birth from the date of examination. Then, the age was approximated to the nearest full three months to give 11 three-month apart age groups from 3 to 33 months per each of the weight and height groups. As a result of weight, height and age categorizations, there were relatively low numbers of children in some older age groups in UW, OW, SS and TS. Consequently, and in order to increase the sample sizes in these groups and the statistical power for comparisons, the data in the present study were not separated by gender.

For each age group, cases of 'emerged tooth' (response frequency) were counted against the total number of children in that age group (total observed). The lists of response frequencies and totals observed across all age groups were imported into SPSS (Version 20.0) for probit regression analysis per tooth a time.

2.1. Statistical analysis

Through probit regression, the Median Age of Emergence (MAE – the 50th percentile) was calculated along with the 5th and 95th percentiles per tooth and per each of the weight and height groups. Probit regression is a useful choice for a situation where a dichotomous (dependent) output is influenced by some levels of an explanatory (independent) variable. In the present study the dependent variable was the dichotomous response output of EM/non-EM while the independent variable was the chronological age of subjects. Further details on Probit regression and the justification for its use are found in a previous publication on the standards of permanent tooth emergence in Jordanians and in Al-Batayneh et al's study (Al-Batayneh et al., 2015; Shaweesh, 2012b). According to Al-Batayneh et al., the differences in MAE in all corresponding pairs of contra-lateral teeth were found to be non-statistically significant (at an α level of 0.05), indicating that the MAE for all deciduous teeth was significantly symmetrical. Therefore, only the data for the right side are presented. A single-sided presentation is consistent with the approach followed by relevant studies (Al-Batayneh et al., 2015; Shaweesh, 2012b).

Using probit regression analysis, body weight group and body height group were entered at a time as a grouping (factor) variable to investigate the statistical significance (at an level of 0.05) for the differences at the time of deciduous tooth emergence across all possible pairs within the weight and height groups. The 95% confidence limits of the relative median potency indicates that the difference between any given two groups is non-statistically significant when the Null value 1.0 falls within the limits of the 95% confidence range.

3. Results

Table 1 summarizes the distribution of all age, weight and height groups of the participants. It is apparent that the limited numbers of children in UW, OW, SS and TS groups per age groups justified investigating the whole sample without separating it into male and female samples.

Table 2 presents the ages at deciduous tooth emergence per weight and height groups along with the pairwise statistically significant differences in median emergence age across the groups. It is obvious that the emergence ages tend to increase as we move from the greater to the smaller weight and height groups. In other words, the deciduous teeth emerge into the mouth later as the weight or the height decreases. However, none of the differences in the height groups are statically significant. In contrast, in the weight groups, the differences are statistically significant for the canines, lateral incisors and upper central