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Short Communication

Relationship between socio-demographic and anthropometric variables and number of erupted primary teeth in suburban Nigerian children

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Abstract

The socio-demographic and anthropometric variables could influence the number of teeth present in the child's mouth. To determine the effect of anthropometric and socio-demographic variables on the number of erupted primary teeth, a cross-sectional study was performed involving 1013 children aged between 4 and 36 months who attended the immunization clinics in Ile-Ife, Nigeria. Statistical analyses were performed using STATA. The analyses included frequencies, cross-tabulations, chi squared test and *t*-test. The number of erupted teeth was modelled as the dependent variable in a multiple regression (Binomial) model, and the socio-demographic (age, gender and socio-economic status) and anthropometric variables, such as weight and height at presentation, as predictor variables. Statistical significance was inferred at $P < 0.05$. The age and height at presentation had significant association with the number of erupted teeth in this study population ($P < 0.001$). Also children from high socio-economic class in relation to low socio-economic class had significant larger number of erupted teeth in this study population ($P < 0.001$). The age and height of the child at presentation were significantly related to the number of erupted teeth. Also children from high socio-economic class had significant lager number of erupted teeth compared with children from low socio-economic class.

Keywords: primary teeth, anthropometric variables, socio-demographic variables, number of erupted teeth.

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Introduction

The number of teeth present in the mouth is related to the child's age. It is a useful complementary datum for evaluation of growth and development. Studies have pointed to variability in the relationship between age and number of erupted teeth because of the possibility of various extraneous confounding variables.

Some variables, such as ethnicity (Tanguay *et al.* 1984), socio-economic status (Enwonwu 1973), breastfeeding (Holman & Yamaguchi 2005) and gross malnutrition (Holman & Yamaguchi 2005), have explained the variation in age and pattern of primary tooth eruption observed within and between regions. Other studies (Infante & Owen 1973; Haddad & Correa 2005) have shown the effects of weight and height on the number of erupted primary teeth while some others have shown no association (Robinow *et al.* 1942; Lysel *et al.* 1962).

Variations in the pattern of tooth eruption have also been associated with various socio-demographic variables, one of which is gender; a few studies noted that girls had more erupted teeth than boys (Boas 1927; Magnusson 1982), while some others observed the opposite (Demirjian 1986; Holman & Jones 1998). Other studies had equally shown no gender difference (Enwonwu 1973; Holman & Jones 2003).

In the same vein, the authors have also demonstrated a relationship between the socio-economic status and number of teeth erupted. While some studies reported no statistically significant influence of the socio-economic status on the number of erupted teeth (Bambach *et al.* 1973; Singh *et al.* 2000), Enwonwu's study (1973) among Nigerian children did. He observed that the average child of a high socio-economic group had approximately two to five more erupted teeth than a child of a low socio-economic group of comparable age. Nevertheless, the children in the low socio-economic group had eruption rates comparable to those of children from richer and technically developed countries. Another study showed that lower-class African American children had significantly smaller number of erupted teeth when compared with middle-class African American children, but equal number when compared with middle-class Caucasian children (Fergusson *et al.* 1957).

There is a paucity of literature on the relationship between number of erupted teeth and child's growth and development. The sparse literature on this subject usually states that the number of erupted primary teeth is relatively independent of other growth processes (Sandler 1944; Wedgewood & Holt 1968; Infante & Owen 1973). A few, however, demonstrated a positive association between the height, weight and head circumference of the child and the number of primary teeth present with (Garn *et al.* 1965; Infante & Owen 1973; Haddad & Correa 2005) noting gender differences in this association.

While eruption chronology of the primary dentition has been studied in some populations (Falkner 1957; Bailey 1964; Billewicz *et al.* 1973; Lunt & Law 1974; Isiekwe 1984; Saleemi *et al.* 1994), few studies (Enwonwu 1973; Isiekwe 1984) have been reported from Nigeria and other African countries (Bailey 1964). Very few of these reports had linked the effect of socio-demographic and anthropometric variables and the number of erupted primary teeth.

This study will demonstrate how socio-demographic and anthropometric variables could predict the number of erupted primary teeth in a sample of children of a suburban region of Nigeria.

Materials and methods

This cross-sectional study, consisted of consecutive clinically healthy full-term babies, infants and pre-school children who visited the community health centre's immunization clinics in a semi-urban region (Ile-Ife) of Nigeria, over a period of 6 months. The comprehensive health centres are the only agencies that provide immunization and healthcare services for children under 16 years of age in Ile-Ife, hence making these data representative of the community. Preterm children as well as those with low birthweight (<2.5 kg) or birth complications and detectable genetic disorders were excluded from the study.

The children enrolled in this study were between 4 and 36 months of age and both parents were Nigerians. Institutional consent was obtained from the health centres, while parental informed consent was obtained before the child's examination.

For the purpose of this study, an erupted tooth was defined as a tooth with any part of its crown penetrating the gingiva and visible in the oral cavity (Al-Jasser & Bello 2003). Extracted teeth were recorded as emerged. An assistant recorded the data according to the Fédération Dentaire Internationale nomenclature.

The socio-economic status of the children was determined using the standard occupation classification designed by the Office of Population Census and Surveys, London (OPCS 1991). Social classes I and II were grouped as high, III [NM (Non Manual)] and III [M (Manual)] as middle and classes IV and V as low socio-economic classes.

Each child was weighed without clothes, diapers or shoes. Children under 24 months of age were weighed lying down or sitting on a levelled pan scale (Salter model 180) with a beam and movable weights and a 16-kg capacity, calibrated to precision of 10 g. The infant was placed on the scale so that the weight was distributed equally to the centre of the pan. Weight was recorded when the child was lying down quietly. Children over 24 months or those who were able to stand by themselves were weighed in the standing position on a platform scale (Hana Power), calibrated to a precision of 100 g. The child would stand in the centre of the platform, with the body weight evenly distributed between both feet.

The infant's height was measured from head to heels lying down in supine position with an anthropometric bar (Weylux model 424), composed of a vertical board with an attached metric rule and a horizontal headboard that could be brought into contact with the uppermost point of the head. The crown of the infant's head touched the stationary vertical headboard. The head was held with the line of vision aligned perpendicular to the plane of the measuring surface. The shoulders and buttocks were flat against the table top, with the shoulders and hips aligned at right angles to the long axis of the body. The legs were extended at the hips and knees and laid flat against the table top. The legs were placed flat on the table and the movable board shifted against the heels. The length was recorded to the nearest 0.1 cm.

The data were analysed with STATA (Intercooled release 9) for windows. The analysis included frequencies and cross-tabulations. Association between categorical variables was tested with chi square while those between continuous variables were tested with the student *t*-test and non-parametric equivalents were used as appropriate. The number of erupted teeth was modelled as the dependent variable in a multiple regression (Binomial model) with the socio-demographic and anthropometric variables as predictors.

Using the Poisson model, it was noted that the number of erupted teeth had a variance that was significantly greater than the mean and therefore did not correspond to a Poisson distribution. The goodness of fit test confirmed this. The negative binomial distribution which is recommended where there is over-dispersion was also fitted and did better than the Poisson, judging by the likelihood ratio test of alpha from the STATA output. In addition, the outcome variable was checked to see how it fitted both distributions using the *nbvargr* command of STATA. This command graphs the variable against a Poisson distribution with the same mean and a negative binomial distribution with the same mean and variance. The graph displayed the same conclusion that the negative binomial was a better fit.

Nevertheless, from our viewpoint, the binomial distribution produced the best fit. We checked the adequacy of fit using the deviance residuals as recommended by McCullagh & Nelder (1989). The deviance residuals were approximately normally distributed and we also plotted the residuals against each of the covariates to check the fit. However, the scaled deviance still suggested problems in the model fit. This is to be expected as some teeth are more likely to erupt early and others erupt later.

We included the most important predictors based on biological plausibility and published articles. The model was built using forward selection. Statistical significance was inferred at $P \leq 0.05$.

Results

A total number of 1013 children, with a mean age of 19.04 months (±9.34 months), met the inclusion criteria. The sample consisted of 514 boys (50.7%) and 499 girls (49.3%). The mean age for boys was 19.24 + 9.59 months and for girls, 18.83 ± 9.09 months. No statistically significant difference was found in the mean ages of boys and girls ($P = 0.48$). Neither was there a significant difference in the age group distribution of the study population ($P = 0.49$) (Table 1). One hundred and five (10.4%), 446 (44%)

Table 1. Age and gender distribution of the children

Age group (Months)	Gender				Total	
	Boys		Girls		No	%
	No	%	No	%		
4–6	49	4.84	40	3.95	89	8.79
7–12	112	11.06	113	11.15	225	22.21
13–18	92	9.08	109	10.76	201	19.84
19–24	90	8.89	86	8.49	176	17.37
25–30	87	8.59	85	8.39	172	16.98
31–36	84	8.29	66	6.52	150	14.81
Total	514	50.70	499	49.30	1013	100.00

$\chi^2 = 4.41$, d.f. = 5, $P = 0.49$.

and 462 (45.6%) children belonged to the high, middle and low socio-economic classes, respectively.

The mean weight at presentation of the children was 9.79 ± 2.26 kg and the mean height at presentation was 77.70 ± 9.81 cm. Although there were no significant gender differences in the mean height, the mean weight was significantly greater in boys ($P < 0.001$) (Table 2).

Table 3 shows the mean number of erupted teeth in boys and girls according to age (months). None of the Nigerian children studied had teeth erupted before the age of 6 months, whereas all children had the 20 primary teeth present in their mouth at the age of 35 months.

The multiple regression (Binomial model) analysis showed that the age and height at presentation, as well as high socio-economic class in relation to low socio-economic class, had significant association with the number of erupted teeth in this study population ($P < 0.001$) (Table 4). In this model, variables fitted were age, height at presentation, gender and socio-economic status.

The *P*-values from the negative binomial and Poisson models were similar to those from the binomial model; therefore, the general conclusions are not model-dependent. However, the binomial model produced the best fit.

Table 5 shows the percentage of children with erupted teeth at selected ages. The mandibular central incisors (81, 71) erupted at 6 months of age in 13.5% of the children. At 35 months, all children had completed eruption of the twenty primary teeth.

Discussion

Previous African studies (Mackay & Martins 1952; Enwonwu 1973; Isiekwe 1984) have used the number of erupted teeth according to age to estimate eruption times of primary teeth because of difficulties in estimating actual mean age of eruption. However, from our study, the type of tooth erupted rather than the number of erupted teeth may be a better predictor of age (Table 5). In this study, the mandibular central incisors (81, 71) erupted at 6 months of age in 13.5% of the children; however, all mandibular central incisors had erupted by 18 months. At 35 months, all children had completed eruption of the primary teeth. This is in contrast to a previous Nigerian study Enwonwu (1973), showing that between 4 and 6 months of age, 84% and 15% of the 'optimal' and 'village' children, respectively, had erupted the mandibular central incisors. In another Nigerian study (Isiekwe 1984), the mandibular central incisor erupted at 5 months of age in 10.9% of the children.

In agreement to the Enwonwu's (1973) report, this study did not observe a gender difference in the number of teeth erupted. This hypothesis, however, was not confirmed in Isiekwe's (1984) Nigerian-based study. He found gender differences in the number of erupted teeth per age group.

In contrast to other studies (Bambach *et al.* 1973; Singh *et al.* 2000), the present study observed a significant dependency of the number of erupted teeth between high and low socio-economic statuses. This is in-keeping with Enwonwu's (1973) observation 35 years ago.

Height and weight are strong physical features that reflect the degree of cell and tissue development as well as the nutritional status of the child. This study showed that height at presentation might be a strong factor in predicting the number of erupted teeth as in Infante & Owen (1973) and Haddad & Correa (2005).

Studies on eruption of primary teeth in Africa are mostly on the mean number of erupted teeth (Mackay & Martins, 1952; Enwonwu 1973; Isiekwe 1984). A comparison of the mean number of erupted teeth in this study was done with that of other African studies and some non-African countries. Children from Kenya (Mackay & Martins, 1952) had

Table 2. Mean weight and height of the children at presentation

	Sample size	Mean weight at presentation (kg)	Standard deviation	Mean height at presentation (cm)	Standard deviation
Boys	514	10.01	2.24	78.17	9.78
Girls	499	9.57	2.26	77.22	9.82
t		3.11		1.54	
P-value		<0.001		0.12	

Table 3. Comparison of mean number of erupted teeth according to age in boys and girls

Age (months)	Boys			Girls			Total No. of children
	No.	Mean	Standard deviation	No.	Mean	Standard deviation	
4–5	33	0.000		19	0.000		52
6	16	0.375	1.0878	21	0.286	0.7171	37
7	16	1.562	1.5478	13	1.769	4.3618	29
8	20	1.800	2.1908	27	1.777	1.7171	47
9	24	2.666	1.9486	19	3.157	1.7404	43
10	20	4.500	2.3056	19	3.526	2.5247	39
11	14	5.928	1.8999	17	4.176	4.7333	31
12	18	5.555	2.4548	18	6.277	4.3899	36
13	12	8.833	3.5632	19	6.210	3.1015	31
14	18	8.444	4.0904	18	6.444	2.3570	36
15	13	11.076	4.6090	19	10.526	3.8495	32
16	15	10.600	4.5481	17	11.058	3.9444	32
17	19	14.368	4.7866	18	12.388	3.5502	37
18	15	14.066	2.7115	18	12.388	3.3455	33
19	14	13.357	3.2958	11	13.545	2.8058	25
20	16	14.500	3.1198	11	14.181	3.9450	27
21	14	14.928	3.1977	13	14.923	3.7740	27
22	16	16.562	2.4757	12	15.916	2.7122	28
23	18	17.000	1.9703	18	15.722	2.2959	36
24	12	16.666	1.5570	21	17.809	1.6006	33
25	16	17.750	2.0166	16	18.062	2.4349	32
26	12	18.666	1.8257	13	17.923	1.8466	25
27	18	17.555	3.7764	17	18.588	1.5024	35
28	8	18.750	1.8322	13	18.923	1.3821	21
29	16	19.562	1.0935	14	19.642	0.9287	30
30	17	19.176	1.2862	12	19.833	19.833	29
31	14	19.785	0.5789	10	19.200	1.3984	24
32	13	19.692	1.1094	13	19.846	0.5547	26
33	13	20.000	0.0000	11	19.818	0.6030	24
34	14	18.857	1.8752	8	19.000	1.8516	22
35	11	20.000	0.0000	10	20.000	0.0000	21
36	19	20.000	0.0000	14	20.000	0.0000	33

a greater mean number of erupted teeth when compared with the present study at every age, while Nigerian children had more erupted teeth when compared with children from Senegal (Falkner 1957) in most age groups. The differences noted within these African countries may be due to environmental factors. Studies from Paris (Falkner 1957), London (Falkner 1957) and the USA (Doering & Allen 1942) showed a similar mean number of erupted teeth; however, they have smaller number of erupted teeth when compared with the result of the present study for most age groups. The reason for this variation could be explained through differences in genetic factors.

Table 4. Multiple regression of the various predictors against number of erupted teeth

Predictors	Odds ratio	Standard error	*P*	95% CI
Male	1.041	0.043	0.319	0.961–1.130
Age	1.211	0.006	≤0.001*	1.198–1.224
Height at presentation	1.072	0.005	≤0.001*	1.062–1.082
Socio-economic class 2	1.106	0.081	0.170	0.958–1.277
Socio-economic class 3	1.249	0.092	0.002*	1.082–1.443

*Significant values.
Deviance = 2479.093586; (1/d.f.) deviance = 2.461861; Pearson = 2411.933078; (1/d.f.) Pearson = 2.395167; Akaike Information Criterion (AIC) = 4.305466.

Table 5. Percentage of children with erupted tooth type at selected ages

Tooth type (FDI coding)	6 months $n = 37$	9 months $n = 43$	12 months $n = 36$	18 months $n = 33$	24 months $n = 33$	36 months $n = 33$
51	3.80	44.2	80.6	100.0	100.0	100.0
52	0.00	6.90	50.0	94.0	100.0	100.0
53	0.00	0.00	5.56	54.5	100.0	100.0
54	0.00	0.00	8.30	81.80	100.0	100.0
55	0.00	0.00	0.00	0.00	24.20	100.0
61	2.70	44.2	77.8	100.0	100.0	100.0
62	0.00	11.6	47.2	93.90	100.0	100.0
63	0.00	0.00	5.56	57.60	100.0	100.0
64	0.00	0.00	8.30	84.80	100.0	100.0
65	0.00	0.00	0.00	0.00	24.20	100.0
71	13.5	83.7	97.2	100.0	100.0	100.0
72	0.00	5.56	47.2	93.90	100.0	100.0
73	0.00	0.00	5.56	45.50	100.0	100.0
74	0.00	0.00	5.56	78.80	100.0	100.0
75	0.00	0.00	0.00	3.00	42.40	100.0
81	13.5	86.0	97.2	100.0	100.0	100.0
82	13.5	86.0	97.2	100.0	100.0	100.0
83	0.00	0.00	5.56	45.50	100.0	100.0
84	0.00	0.00	5.56	75.80	100.0	100.0
85	0.00	0.00	0.00	5.56	48.50	100.0

FDI, Fédération Dentaire Internationale.

The generalization of this study is, however, limited by the design. This is a cross-sectional study and, therefore, the study can only establish an association between the variables. In addition, there is an observed gender difference in the mean weight at presentation of the sampled children; this may have contributed to some form of beta error in the analysis.

Conclusion

Within the limitation of the design of this study, the authors found a significant association between age and height at presentation and the number of erupted teeth in children in Ile-Ife. In addition, there was a significant difference in the number of erupted teeth between children from high socio-economic class when compared with those from low socio-economic class.

Conflicts of interest

None declared.

Key messages

- No significant difference noted in the number of erupted teeth and gender.
- The age of the child may be useful in predicting the number of erupted teeth.
- As a follow-up to this study, further studies should be done to evaluate the effect of nutrition on the number of erupted teeth.

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