Correlation between Eruption of Permanent Teeth and Anthropometric Measurements among School Children

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Abstract

Background: The assessment of nutritional status of a child is essential in the clinical practice. Several clinical and laboratory parameters are being used for this purpose, of which height and weight play a major role. This study was carried out to correlate the eruption of permanent teeth with anthropometric measurements among school children.

Method: This cross sectional study was carried out among 983 school children between the age group of 4-14 years. The height and weight were measured using standardized scales. Eruption of permanent teeth were examined clinically. The classification of stunting and underweight was carried out based on CDC standards.

Results: Stunting was present in around 10% of each age group upto 7 years, followed by 20-30% between 7-8.9 years. From 9-11 years, stunting was present in around 40% of the participants and beyond 10 year, it was present in around 50% of the participants.

Conclusion: Although this study has not demonstrated statistical significance, it has elucidated the increased prevalence of malnutrition with advances in age with respect to both stunting and underweight, warranting adequate addressing of the nutritional needs of the school children.

Key words: *Anthropometry, eruption of permanent teeth, nutritional status, stunting, underweight*

Introduction

The period of childhood is essentially important in terms of growth, development and maturation. The entire growth comprising of accumulating energy reserves, building the body's musculature, strengthening of the growing bones, take place during this period. Therefore, nutrition plays a major role in childhood, although it is important throughout a man's life. During the neonatal period and infancy, fat and protein are significantly lower, and therefore, there is a maximum requirement for adequate nutrition.[1]As the age advances, in addition to building energy and proteins, the need for accumulating extra reserves to combat infections is higher. Further, the period of adolescence witnesses another growth spurt, accompanied by sexual maturation characterized by puberty and development of secondary sexual characteristics. There is an increased demand for adequate nutrition during this phase, in order to combat the body's requirements of various micronutrients and minerals.

The assessment of nutritional status of a child is essential in the clinical practice. Several clinical and laboratory parameters are being used for this purpose, of which height and weight play a major role. In addition, the other anthropometric measurements include mid arm circumference, triceps fold, and eruption of permanent teeth. According to Centre for Disease Control (CDC) standards, the nutritional status of a child is evaluated

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based on weight for height, weight for age and height for age and based on these measurements, malnutrition is classified as, wasting, underweight andstunting respectively. [2]In addition to these measurements, eruption of teeth is significantly linked to the growth and nutritional status of a child. In most living individuals the age of eruption of permanent teeth remains fairly constant, within a narrow range.[3] However, the teeth eruption is influenced by several factors include nutritional, hormonal, hereditary or genetic factors. Socioeconomic and nutritional factors caries conditions and the secular trend have also been found to have some effect on the eruption of permanent teeth. Hence, nutritional deficiencies can delay the process of teeth eruption. Malnutrition and poor nutrition in early childhood affects tooth eruption and results in the delayed emergence of the teeth.[4]

Although several studies have documented the age of tooth eruption, very few studies have explored the correlation between the eruption of permanent teeth and anthropometric measurements. Establishing a scientific and statistical correlation between the two would help in incorporating dental assessment as a valid tool for assessing the nutritional status.

Objectives

This study was carried out to evaluate the correlation between eruption of permanent teeth and anthropometric measurements.

Methodology

Study setting and participants

This study was carried out as a cross sectional study among the school children of the urban field practice area of our medical college in Chennai. This study was carried out for a period of three months between July to September 2019.

Sample size and sampling technique

This study was carried out among all the children aged between four and fourteen years studying in a government school in the urban field practice area of our tertiary teaching institution. A total of 963 children participated.

Ethical approval and informed consent

Approval was obtained from the institutional ethics committee prior to the commencement of the study. Written consent was obtained from the principals of both the schools. Each participant was explained in detail about the study. Informed consent was obtained from both the parents and the participants prior to the commencement of data collection.

Data collection

A structured clinical proforma was used to obtain information regarding demographic characteristics like age, sex, etc. Clinical examination was carried out to measure the height and weight. Oral examination was carried out by the principal investigator to evaluate the dentition pattern among the study participants. The classification of stunting and underweight was carried out based on CDC standards.[5]

Data analysis

Data was entered and analyzed using SPSS ver. 20 software. The pattern of eruption of the permanent teeth was expressed in percentages. Independent sample t test was used to evaluate the association between eruption and background characteristics. A p value <0.05 was considered statistically significant.

Results

This study was carried out among 963 school students in the field practice area of our tertiary teaching institution. Majority of the participants were aged between 4-7.5 years (41.4%) and were males (64.4%). (Table 1)

It was observed that central incisor had erupted in 31.1% of the participants followed by first molar (29.6%). Lateral incisor and second molar had erupted in 22.2% of the participants. (Figure 1)

The gender-wise comparison of the mean height of the participants is given in table 2. Overall, there was a negligible difference in the mean height between males and females in any given age group. While the mean height range of the boys began with 98-103.4 cm in the age group of 4.0-4.5 years, the height range of the girls in the same age group was 97.1-102.4cm. As the age advanced, the mean height range was higher for the males compared to the females.

On comparing the mean weight range between males and females for each age group, it was observed that the weight range of the males were greater than

females in the initial ages, and as the age advanced, the weight range were similar among both the groups, for any given age. (Table 3)

The correlation between stunting and eruption of permanent teeth for each age group was analyzed. It was observed that stunting was present in around 10% of each age group upto 7 years, followed by 20-30% between 7-8.9 years. From 9-11 years, stunting was present in around 40% of the participants and beyond 10 year, it was present in around 50% of the participants. (Table 4)

Underweight was present in around 40% of the participants upto 5.5years. later on, the prevalence of underweight was as low as 13.2% upto7.9 years. There was again an increase in the prevalence of underweight to around 40% till 9.9 years of age. Beyond this age group, underweight prevalence increased to as high as 80%. (Table 5)

Table-1: Background characteristics of the study participants:

S. No	Characteristics	Frequency N=963	Percentage (%)
1	Age of the participants (in years)		
	4-7.5	399	41.4
	7.51-11.5	341	35.4
	11.6-14.5	223	23.2
2	Sex		
	Males	620	64.4
	Females	343	35.6
3	Socioeconomic status		
	Low	490	50.9
	High	473	49.1

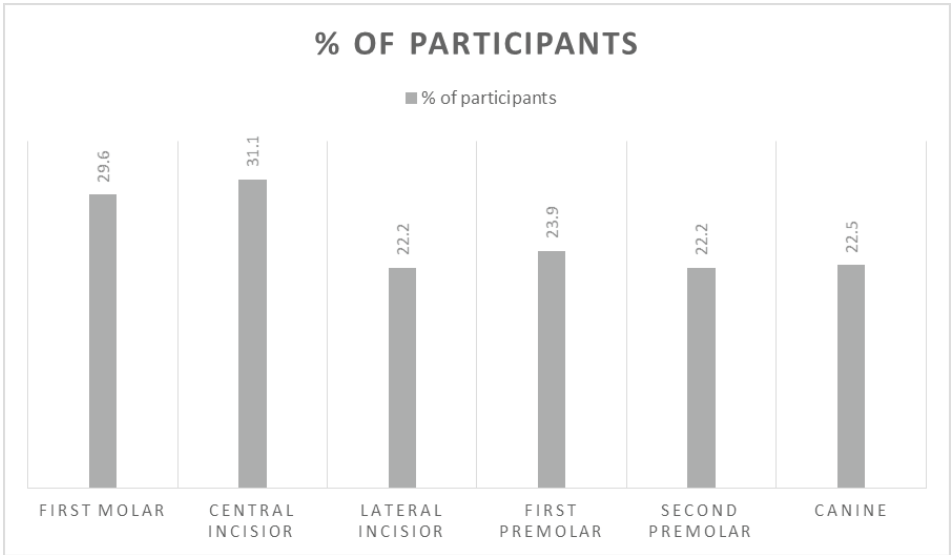

Figure-1: Eruption of permanent teeth:

Table-2: Mean height of the participants:

S. No	AGE GROUP	Mean height (cm)		MALES	FEMALES	TOTAL
		MALES	FEMALES			
1	4.0-4.5	98.0-103.4	97.1-102.4	5	4	9
2	4.51-4.9	100.8-106.6	100.0-102.8	16	22	38
3	5.0-5.5	103.8-109.9	103.1-108.8	33	33	66
4	5.51-5.9	107.2-113.3	105.0-112.0	28	19	47
5	6.0-6.5	112.0-118.0	108.0-115.9	45	37	82
6	6.51-6.9	113.5-120.7	111.1-118.4	40	36	76
7	7.0-7.5	115.9-123.0	113.7-121-3	47	34	81
8	7.51-7.9	117.8-125.2	116.4-124.4	23	38	61
9	8.0-8.5	119.7-127.4	119.3-127.5	10	15	25
10	8.51-8.9	121.9-129.8	122.2-130.7	32	18	50
11	9.0-9.5	124.2-132.5	125.1-133.8	16	17	33
12	9.51-9.9	126.7-135.3	128.0-136.9	20	11	31
13	10.0-10.5	129.4-138.3	130.8-139.8	20	15	35
14	10.51-10.9	132.2-141.5	133.7-142.7	17	23	40
15	11.0-11.5	135.6-144.7	136.4-145.4	34	32	66
16	11.51-11.9	138.0-147.9	139.0-147.9	30	30	60
17	12.0-12.5	141.0-151.1	141.5-150.3	24	36	60
18	12.51-12.9	143.9-154.2	143.8-152.5	10	42	52
19	13.0-13.5	146.8-157.3	145.9-154.4	6	20	26
20	13.51-13.9	149.7-160.2	147.8-156.2	5	8	13
21	14.0-14.5	152.4-162.9	149.4-157-6	2	2	4

Table-3: Mean weight of the study participants:

S. No	AGE GROUP	Mean weight (kg)		MALES	FEMALES	TOTAL
		MALES	FEMALES			
1	4.0-4.5	14.3-15.5	13.9-16.3	5	4	9
2	4.51-4.9	15.1-17.4	14.6-17.3	16	22	38
3	5.0-5.5	16.0-18.4	15.6-18.2	33	33	66
4	5.51-5.9	17.0-19.5	16.0-18.8	28	19	47
5	6.0-6.5	18.0-20.7	16.4-19.2	45	37	82
6	6.51-6.9	18.6-21.9	16.9-19.9	40	36	76
7	7.0-7.5	194-22.9	17.3-20.9	47	34	81
8	7.51-7.9	20.0-23.9	18.0-22.2	23	38	61
9	8.0-8.5	20.7-25.0	18.7-23.5	10	15	25
10	8.51-8.9	21.3-26.3	19.6-25.3	32	18	50
11	9.0-9.5	22.0-27.7	20.7-27.2	16	17	33
12	9.51-9.9	22.9-29.4	22.1-29.3	20	11	31
13	10.0-10.5	24.1-31.3	23.6-31.4	20	15	35
14	10.51-10.9	25.5-33.4	25.3-33.7	17	23	40
15	11.0-11.5	27.1-35.6	27.1-36.0	34	32	66
16	11.51-11.9	28.9-37.9	28.9-38.4	30	30	60
17	12.0-12.5	30.7-40.3	30.8-40.7	24	36	60
18	12.51-12.9	32.7-42.7	32.6-42.9	10	42	52
19	13.0-13.5	34.7-45.1	34.5-45.1	6	20	26
20	13.51-13.9	36.8-47.6	36.2-47.1	5	8	13
21	14.0-14.5	38.8-50.0	37.8-48.9	2	2	4

Table-4: Correlation between eruption of teeth and stunting:

S. No	Age group	Stunting Height for age N(%)	First molar N(%)	Central incisor N(%)	Lateral incisor N(%)	First premolar N(%)	Second premolar N(%)	Canine N(%)
1	4.0-4.5	1(11.1)	3(33)	3(33)	1(9)	-	-	-
2	4.51-4.9	4(10.5)	4(11)	3(8)	1(3)	-	-	-
3	5.0-5.5	7(10.6)	6(9)	5(8)	0(0)	-	-	-
4	5.51-5.9	6(12.7)	27(57)	11(23)	1(2)	-	-	-
5	6.0-6.5	11(13.4)	49(60)	39(48)	9(11)	-	-	-
6	6.51-6.9	9(11.8)	66(84)	49(64)	13(17)	-	-	-
7	7.0-7.5	16(19.7)	72(89)	60(74)	31(38)	1(1)	-	-
8	7.51-7.9	20(32.8)	58(95)	55(90)	28(46)	1(2)	-	-
9	8.0-8.5	8(32)	-	25(100)	20(80)	2(8)	-	-
10	8.51-8.9	11(22)	-	50(100)	48(96)	3(6)	3(6)	-
11	9.0-9.5	14(42.4)	-	-	31(94)	3(9)	3(9)	1(3)
12	9.51-9.9	15(48.4)	-	-	31(100)	2(6)	1(3)	1(3)
13	10.0-10.5	13(37.1)	-	-	-	14(40)	10(29)	9(26)
14	10.51-10.9	10(25)	-	-	-	20(50)	14(25)	14(35)
15	11.0-11.5	34(51.5)	-	-	-	39(59)	33(21)	30(45)
16	11.51-11.9	35(58.3)	-	-	-	40(67)	31(55)	33(55)
17	12.0-12.5	34(56.6)	-	-	-	55(92)	47(52)	45(75)
18	12.51-12.9	22(42.3)	-	-	-	52(100)	46(90)	47(90)
19	13.0-13.5	12(46.1)	-	-	-	-	26(100)	26(100)
20	13.51-13.9	5(38.5)	-	-	-	-	-	11(85)
21	14.0-14.5	2(50)	-	-	-	-	-	-

Table- 5: Correlation between eruption of teeth and underweight:

S. No	Age group	Underweight Weight for age N(%)	First molar N(%)	Central incisor N(%)	Lateral incisor N(%)	First premolar N(%)	Second premolar N(%)	Canine N(%)
1	4.0-4.5	4(44.4)	3(33)	3(33)	1(9)	-	-	-
2	4.51-4.9	13(34.2)	4(11)	3(8)	1(3)	-	-	-
3	5.0-5.5	28(42.4)	6(9)	5(8)	0(0)	-	-	-
4	5.51-5.9	7(14.9)	27(57)	11(23)	1(2)	-	-	-
5	6.0-6.5	29(35.4)	49(60)	39(48)	9(11)	-	-	-
6	6.51-6.9	10(13.2)	66(84)	49(64)	13(17)	-	-	-
7	7.0-7.5	24(29.6)	72(89)	60(74)	31(38)	1(1)	-	-
8	7.51-7.9	12(19.6)	58(95)	55(90)	28(46)	1(2)	-	-
9	8.0-8.5	9(36)	-	25(100)	20(80)	2(8)	-	-
10	8.51-8.9	14(28)	-	50(100)	48(96)	3(6)	3(6)	-
11	9.0-9.5	14(42.4)	-	-	31(94)	3(9)	3(9)	1(3)
12	9.51-9.9	15(48.4)	-	-	31(100)	2(6)	1(3)	1(3)
13	10.0-10.5	21(60)	-	-	-	14(40)	10(29)	9(26)
14	10.51-10.9	14(35)	-	-	-	20(50)	14(25)	14(35)
15	11.0-11.5	53(80.3)	-	-	-	39(59)	33(21)	30(45)
16	11.51-11.9	43(71.6)	-	-	-	40(67)	31(55)	33(55)
17	12.0-12.5	41(68.3)	-	-	-	55(92)	47(52)	45(75)
18	12.51-12.9	20(38.5)	-	-	-	52(100)	46(90)	47(90)
19	13.0-13.5	17(65.4)	-	-	-	-	26(100)	26(100)
20	13.51-13.9	6(46.2)	-	-	-	-	-	11(85)
21	14.0-14.5	3(75)	-	-	-	-	-	-

Discussion

Out of 963 subjects examined for height, 296 subjects belong to the low category, 441 belong to the middle category and 226 belong to the higher category. Similarly, for weight, 400 belong to the low, 393 belong to the middle, and 170 belong to high category.Height is a stable measurement of growth as opposed to body weight. Whereas weight reflects only the acute states of malnutrition, height indicates chronic malnutrition past also.[6] weight and weight were considered in the study and there is no significant correlation of height and weight with socio-economic status and eruption of teeth.The comparison of nutritional status in terms of stunting and underweight in this study demonstrated that as the age advances, there prevalence of stunting and underweight significantly increased. However, this was not accompanied with delay in the eruption of the permanent teeth.

Dental age can reflect an assessment of physiological age comparable to age based on skeletal development, weight or height.[7] In addition, the crowns and roots of the teeth appear to be the tissues least affected by environmental influences at the time of formation.Dentition may be considered to be single best physiological indicator of chronological age among adolescents. Moreover, studies have proven that there would not be any deciduous teeth above 12 years.[8] The emergency of permanent teeth whether it is primarily in the mandibular or maxillary regions was not a part of this study as the emergence of teeth in any of the quadrants were taken as the corresponding age group of the individual but in the majority of the cases it was noted that the mandibular teeth erupts earlier than the maxillary teeth.

Although the present study did not document any statistical association between anthropometric measurements and eruption of permanent teeth, studies have demonstrated the linkages between obesity and non-eruption rates, measured in terms of waist hip ratio, weight for height and waist circumference. The present study has provided the need for further comparisons with respect to various other anthropometric parameters in order to identify the predictive role of various nutritional problems of childhood and adolescence.

Conclusion

Eruption of permanent teeth is an important phenomenon during childhood and is influenced by various factors, including nutritional status. Several anthropometric parameters like height for age and weight for age were used in the present study to correlate with eruption of permanent teeth. Although the present study did not demonstrate any correlation between these two variables, this study has highlighted the increasing prevalence of stunting and underweight during the early adolescence period, wherein a normal growth spurt is expected. There is a need for further comparative analysis with various other parameters including waist circumference and waist hip ratio in order to arrive at a consensus regarding this correlation.

Conflict of Interest – Nil

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Ethical approval – Obtained

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