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Growth, oral hygiene and emergence of permanent dentition among 5-14 year old Rajput Children of Solan District of Himachal Pradesh

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ABSTRACT

Growth in height and weight, oral hygiene and the emergence of permanent teeth in a cross-sectional sample of 509 Rajput boys and girls from the Kumarhatti and Dharampur areas of Solan District of Himachal Pradesh is reported. The data was collected from the various schools of the area. The girls were, by and large, taller and heavier than the boys; the differences were significant (P<0.05) at 12 years only. The oral hygiene of the sample was moderate and 15.28% children (9.76% boys and 5.52% girls) had one or more carious teeth. Mandibular teeth tended to emerge earlier than the maxillary teeth in both sexes. The emergence was earlier in girls, except the premolars. The bilateral differences were significant (P ≤ 0.05) only for maxillary central incisors and mandibular canines in girls and maxillary second incisors and canines and mandibular central incisors and second premolars in boys. The sequence of emergence in the first phase was the same (M_1, M^1, I_1, I^1, I_2, I^2) for both sexes. In the second phase of emergence, the maxillary canines emerged after the premolars in boys and after the first premolars but prior to the second premolars in girls. Partial correlations between number of emerged teeth and stature and weight were low and not significant, when the effect of age was partialed out. The emergence in the present sample was distinctly delayed in maxillary as well as mandibular first and second molars and mandibular lateral incisors as compared to a majority of other populations from within and outside India.

Key words: Permanent dentition, height, weight, Rajput, Himachal Pradesh

INTRODUCTION

Dental emergence has been of interest to physical anthropologists, forensic biologists and dental professionals. Tooth emergence is one of the important indicators of the biological age of an individual. Timing and sequence of tooth emergence allow the dental professionals to evaluate the normalcy or otherwise of the emergence pattern exhibited by an individual and thus aid in the clinical diagnosis of advanced or delayed emergence (Al-Jasser and Bello, 2003). In addition to the dental professionals, tooth emergence has been of interest to physical

anthropologists, biologists and forensic scientists. Tooth emergence is also important for demographic surveys (Townsend and Hammel, 1990), because it serves as a useful tool to age children in populations without birth records (Folayan et al., 2007).

Several workers have published on the relationship of height and weight with emergence timing of permanent dentition. Some studies indicate that tall and heavy children tend to be advanced dentally (Billewicz and McGregor 1975; Kaul et al. 1975; Visweswara Rao 1985, 1992; Banerjee et al. 1992; Kaur and Singh 1992). Arvystas (1976) reported the occurrence of a syndrome of short stature and delayed eruption of dentition. Stature has been reported to have a stronger correlation with dental emergence than weight (Vaslik 1972; Visweswara Rao 1992). However, some reports indicate a low correlation between height and dental emergence (Falkner, 1957; Steggerda, 1945). A couple of studies also suggest that dentition develops independent of general body development (Shuper et al., 1986). Thus the issue is yet to be completely resolved and needs further investigation.

Permanent tooth emergence timings show variations in different populations (Liversidge, 2003). India is a vast multiethnic and multicultural country where the time and sequence of emergence of permanent teeth is expected to vary from region to region. Several studies have reported on the permanent tooth emergence in different populations of India (Nayak and Patil 1977; Awasthi and Khare 1978; Tiwari and Chawla 1978; Singh 1980; Kaul and Prakash 1982; Jaswal 1983; Rami Reddy 1985; Banerjee, et al. 1992, Gaur and Singh 1994; Sharma and Mittal 2001). However, very little is known about dental emergence from different populations of Himachal Pradesh, particularly in relation to growth. Here we report the emergence timings of permanent teeth among the Rajput children of Himachal Pradesh in relation to their height and weight.

MATERIALS AND METHODS

Present study is based on a cross-sectional sample of 509 school-going Rajput children (267 boys and 242 girls) ranging in age from 5 to 14 years. The data was collected from ten Primary, High and Senior Secondary schools located in and around Dharampur and Kumarhatti Towns of Himachal Pradesh. The area is mountainous with moderate altitude. Agriculture, and

to a limited extent horticulture, is the main occupation of the people and the major crops consist of wheat, maize and paddy, which also form the staple food of the people here. The people of the area are mainly Hindus, consisting of Rajputs, Brahmins, Kanets and Scheduled Castes and Scheduled Tribes. The Rajput community is widely distributed over the whole of Himachal Pradesh.

The subjects were divided into 10 age groups of one year each on the basis of decimal age, which was calculated following Tanner and Whitehouse (1966). The distribution of the sample in different age groups is given in Table-1. Correct dates of birth of the subjects were obtained from school records. Each age group included individuals not more than 6 months younger or older than the age group. Only those children who were physically and mentally normal were included in the sample. Majority of the children included in this study belonged to middle class families with per-capita incomes ranging from Rupees 500/- per month to more than Rupees 2500/- per month.

Table-1 Distribution of the present sample in different age groups according to sex

Age group	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**5-14**
Boys	20	23	25	24	24	23	26	32	39	31	267
Girls	22	23	24	23	25	24	30	26	23	22	242

The subjects were examined in daylight for gingival emergence of permanent dentition. A tooth was recorded as emerged if any part of the crown had pierced the gum. The sequence and number of emerged permanent teeth were recorded on a specially designed proforma. In addition to dental emergence data, stature of each subject was measured employing standard instrument and technique given in Weiner and Lourie (1981). In addition, some general information about the family and its socioeconomic conditions was also recorded. Median ages of emergence of permanent teeth were calculated using the probit transformation (Mayhall et al. 1978). The relationship of the number of emerged teeth and stature was calculated with the help of partial correlation.

RESULTS

Oral Hygiene:

To understand the oral hygiene, information about the dentifrice used and the regularity of its use was obtained. In addition, the carious teeth were also marked on the

proforma of each subject. The oral hygiene of the sample was found to be moderate. A majority of the children (72.73%) regularly cleaned their teeth once a day, usually in the morning, using toothpaste (79%), 'Acacia Datun' (19.7%) or tooth powder (1.3%). Considering the sample as a whole, 15.28% children (9.76% boys and 5.52% girls) had one or more carious teeth. In both sexes, the mandibular first molar was the tooth most affected by dental caries. It was followed by maxillary second premolar in boys and maxillary first molar in girls. Children older than 10 years were more affected by dental caries. The maximum number of children affected by caries belonged to age groups 12 and 13 years.

Growth Status:

Table-2 shows the descriptive statistics of height and weight of Rajput boys and girls of the present sample. As can be seen in the table, in mean height, the girls tended to be taller than the boys over the entire age range, except at 9 years. However, the sex differences were found to be significant ($P< 0.05$) at 12 years only. Except at 8 and 9 years, in mean weight also the girls showed a better growth performance than the boys. The differences in mean weight were significant ($P< 0.05$) at 9 and 12 years only. The sex differences were very significant at 12 years in height as well as weight.

Dental Emergence:

Table-3 displays the median ages of emergence of permanent teeth of the children of the Dharampur area. The first permanent tooth to emerge was the first mandibular molar which emerged at 6.0 and 5.9 years in boys and girls, respectively. The last permanent tooth, except M3, to emerge was the maxillary second molar, which emerged at 12.6 years in boys and 12.3 years in girls. The overall sequence of emergence of the first 28 permanent teeth was M_1, M^1, I_1, I^1, I_2, I^2, C_1, P^1, P_1, P^2, P_2, C^1, M_2, M^2 for boys and M_1, M^1, I_1, I^1, I_2, I^2, C_1, P_1, P^1, C^1, P^2, P_2, M_2, M^2 for girls. The interval of rest between the first and second phase of permanent tooth emergence was 1.50 years for mandible and 2.85 years for maxilla in girls and 2.24 and 2.00 years for maxilla and mandible, respectively, in boys. All the first 28 permanent teeth had erupted by the mean age of 12.77 years in girls and 13.2 years in boys.

Table-2

Mean height (cm) and weight (kg) of Rajput boys and girls of Dharampur area

Sr. No.	Age Group (Years)	Height ± SD		Weight ± SD	
		Boys	Girls	Boys	Girls
1	5	109.45±8.40	110.31±8.15 (-0.364)	16.55±2.84	17.28±2.02 (-1.083)
2	6	109.55±5.76	112.70±5.41 (-1.802)	16.90±3.53	17.33±2.18 (-0.475)
3	7	115.66±7.87	116.80±9.42 (-0.411)	19.40±3.12	18.74±2.80 (0.647)
4	8	120.25±5.18	121.42±5.89 (-0.685)	21.00±2.25	20.86±3.14 (-0.170)
5	9	125.09±7.05	123.95±7.61 (0.443)	22.93±2.88	21.31±3.81* (2.277)
6	10	131.58±7.10	134.83±9.01 (-1.387)	24.90±3.08	26.79±6.45 (-1.245)
7	11	139.25±6.40	139.46±.78 (-0.109)	28.60±4.40	30.43±6.81 (-1.041)
8	12	142.78±7.66	147.60±6.20* (-4.314)	31.68±5.21	35.46±7.13* (-3.375)
9	13	146.43±7.81	147.79±5.41 (-0.650)	34.31±6.03	37.20±6.61 (-1.607)
10	14	152.95±11.90	153.84±6.10 (-0.266)	39.68±9.11	39.54±4.56 (0.055)

*Significant sex difference (P<0.05).

Figures in parentheses represent the t-values.

As can be seen in Table-3, the mandibular teeth showed a tendency to emerge earlier than their maxillary counterpart. The inter-jaw differences were by and large significant (P≤0.05) in both sexes, except for the premolars in girls and the first premolar and the first molar in boys. The emergence was earlier in girls, except for the premolars. The sex differences in median emergence times were significant (P < 0.05) for a majority of the teeth. No definite pattern could be observed for the bilateral differences in median tooth emergence times. The bilateral differences were significant (P≤ 0.05) only for maxillary central incisors and mandibular canines in girls and maxillary second incisors and canines and mandibular central incisors and second premolars in boys. However in the second phase of emergence, the maxillary canines emerged after the premolars in boys while in girls the same emerged after the first premolars

but prior to the second premolars. Another difference was that in boys the maxillary first premolar emerged earlier than the mandibular one while in girls it was the reverse.

Table – 3 Median ages ±S.D. of emergence of first 28 permanent teeth among Rajput boys and girls of Dharampur area (H.P.)

MAXILLA

TOOTH	LEFT		RIGHT		COMBINED	
	BOYS	GIRLS	BOYS	GIRLS	BOYS	GIRLS
	MD ± S.D	MD ± S.D	MD ± S.D.	MD ± S.D.	MD ± S.D.	MD ± S.D.
I^1	7.10±1.23	6.90±1.15*	7.10±1.23	6.61±1.20	7.10±1.23**	6.78±1.18#**
I^2	7.60±1.15	7.44±1.43	7.70±1.15	7.44±1.15	7.66±1.15**	7.44±1.29#**
C	11.00±1.12*	10.35±1.11	10.50±1.10	10.35±1.11	10.70±1.11**	10.35±1.11#**
P^1	9.90±1.16	10.29±1.16	9.90±1.17	10.29±1.16	9.90±1.17	10.29±1.16#
P^2	10.20±1.12	10.47±1.11	10.00±1.12	10.53±1.10	10.10±1.12**	10.49±1.11#
M^1	6.28±1.20	6.27±1.20	6.32±1.20	6.16±1.17	6.31±1.20**	6.22±1.19**
M^2	12.60±1.15	12.16±1.12	12.60±1.15	12.10±1.13	12.60±1.15**	12.13±1.13#**

MANDIBLE

TOOTH	LEFT		RIGHT		COMBINED	
	BOYS	GIRLS	BOYS	GIRLS	BOYS	GIRLS
	MD ± S.D	MD ± S.D	MD ± S.D.	MD ± S.D.	MD ± S.D.	MD ± S.D.
I_1	6.55±1.17	6.30±1.50	6.70±1.15	6.20±1.17	6.64±1.16	6.25±1.34#
I_2	7.15±1.15	6.92±1.15	7.20±1.12	6.92±1.15	7.20±1.14	6.92±1.15#
C	9.10±1.17	8.22±1.50*	9.30±1.23	8.52±1.70	9.20±1.20	8.42±1.60#
P_1	9.80±1.17	10.18±1.10	9.85±1.16	10.29±1.46	9.83±1.17	10.23±1.28#
P_2	10.30±1.15	10.65±1.12	10.50±1.06	10.65±1.12	10.40±1.11	10.65±1.12#
M_1	6.00±1.20	5.90±1.15	6.00±1.20	5.90±1.15	6.00±1.20	5.90±1.15
M_2	12.30±1.15	11.68±1.09	12.30±1.15	11.82±1.10	12.30±1.15	11.75±1.10#

Significant difference between sexes (P ≤ 0.05)

* Significant bilateral difference (P ≤ 0.05)

** Significant inter-jaw difference (P ≤ 0.05)

Table-4 Values of partial correlation coefficient (r) between number of emerged teeth (T) and height (Ht) and weight (Wt)

Age Group	FEMALES		MALES	
	Wt/T	Ht/T	Wt/T	Ht/T
5	0.630*	0.300	0.330	0.297
6	0.422	0.355	0.401	0.398
7	0.435	0.473 *	0.384	0.402
8	0.285	0.398	0.306	0.468*
9	0.476	0.260	0.403	0.298
10	0.350	0.298	0.389	0.256
11	0.325	0.257	0.366	0.257
12	0.374	0.209	0.374	0.209
13	0.288	0.056	0.288	0.056
14	--	--	--	--
COMBINED	0.123	0.121	0.178	0.146

* Significant Partial correlation
-- Partial correlation not computable.

Table-4 shows the values of partial correlation coefficient between stature and weight and number of emerged teeth, after partialing out age. As can be seen in the table, in both sexes, partial correlation of number of emerged teeth and height and weight was not significant for weight as well as height, except for a few age groups. The partial correlation for the sample as a whole was also not significant for boys as well girls. This indicates that, after removing the effect of age, the number of teeth in the Rajput boys as well as girls of the present sample was not directly correlated with stature and weight.

DISCUSSION

Growth status:

Figure-1 and Figure-2 show plots of mean height and weight, respectively, of Rajput boys and girls of the present sample on WHO (2007) percentiles. Overall, in mean height, the Rajput boys are placed below the WHO 15th percentile, while the girls are located below the WHO 25th percentile curve, with some variation. The growth in height of the girls is somewhat better than

that of the boys. In mean weight, the boys as well girls are broadly placed below the WHO 15th percentile curve (Figure-2).

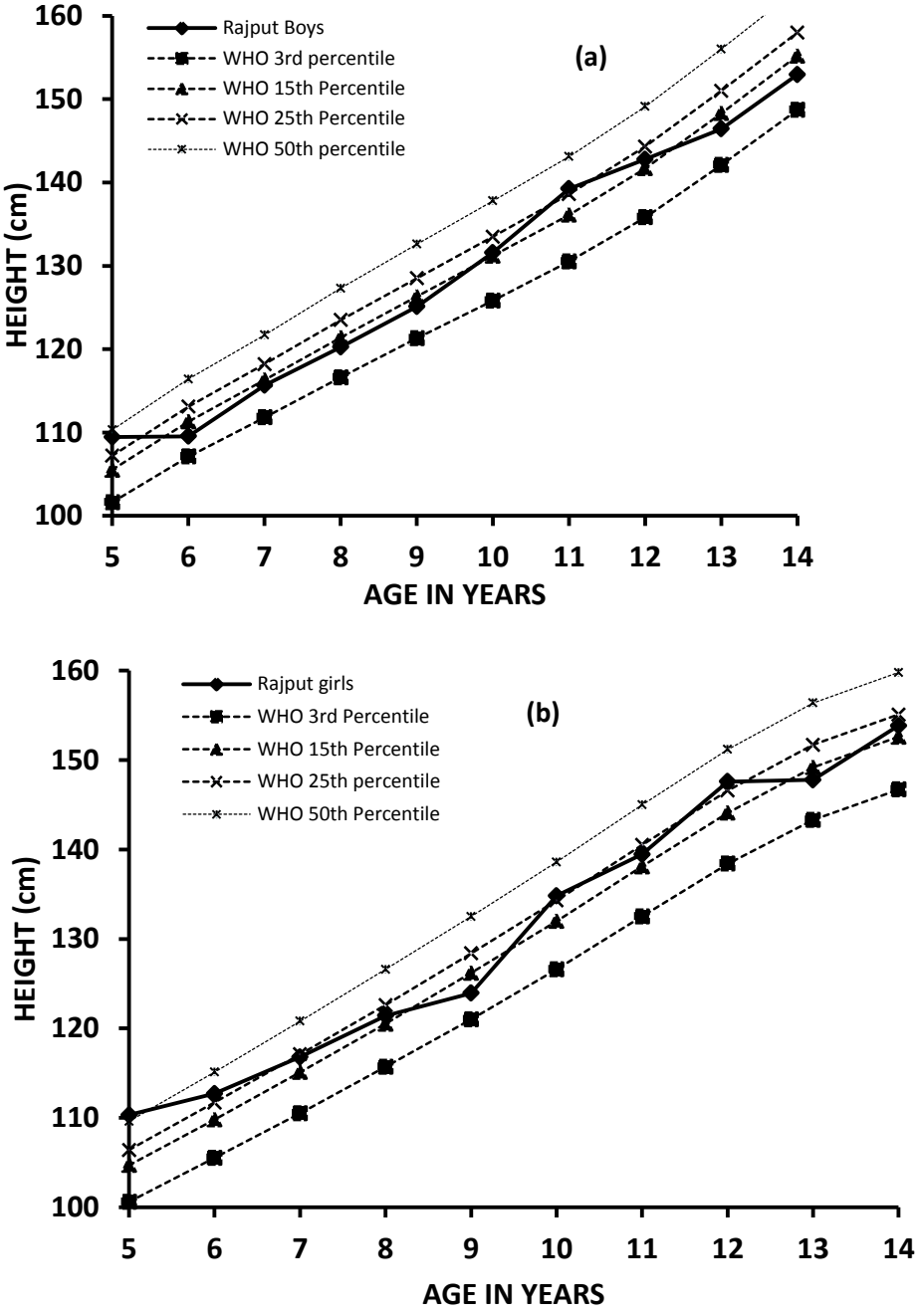

Figure-1. Mean height, according to age, of Rajput boys (a) and girls (b) of Dharampur area plotted on the WHO percentiles.

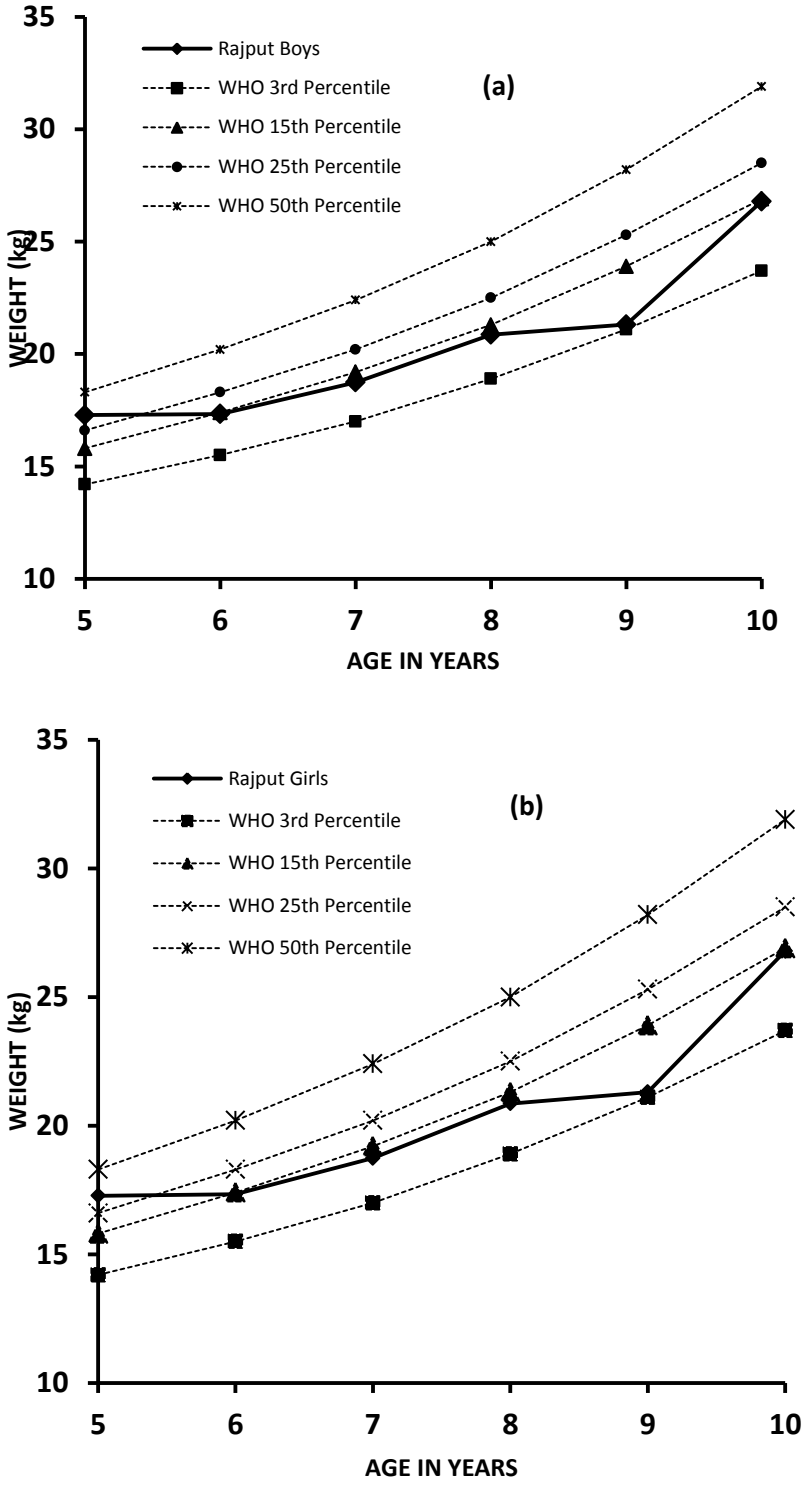

Figure-2 Mean weight, according to age, of Rajput boys (a) and girls (b) of Dharampur area plotted on the WHO percentiles.

Inter-jaw and bilateral differences:

The mandibular teeth in the present sample emerged earlier than the maxillary teeth. A majority of the workers have also reported earlier emergence in the mandible in several other populations (Mayhall et al., 1978; Jaswal, 1983; Demirjian 1986; Romo-Pinales et al.,

1989; Zhao et al., 1990; Gaur and Singh, 1994; Mugonzibwa et al., 2002; Gaur and Singhal, 2005; Wedl et al., 2005). The bilateral differences in a majority of the teeth are not significant in the present sample. This is in agreement with previous studies, which suggest that there is symmetry in the emergence times of the left and right sides (Helm and Seider 1974; Billewickz and McGregor 1975; Demirjian 1986).

Sex differences:

In the present sample, a clear sexual dimorphism in the emergence times of permanent teeth was observed. The girls registered earlier emergence than the boys, except for the premolars. This in agreement with several other studies that have also noted similar sexual dimorphism in a number of other populations (Mayhall et al. 1978; Jaswal 1983; Demirjian 1986; Romo-Pinales et al.1989; Zhao et al.1990; Gaur and Singh 1994; Mugonzibwa et al. 2002). Though, some studies also report earlier emergence in boys (Infante 1974; Taranger et al. 1976; Tanguay et al. 1984). However, the majority evidence supports earlier emergence in girls.

Population comparisons:

Table-5 shows a comparison of the median emergence times of the first 28 permanent teeth of the Rajput boys and girls of the present sample with populations from within and outside India. As can be seen in the table, the emergence timings of permanent teeth of Rajput children of the present sample show a mixed pattern, some teeth showing earlier emergence ages than some populations while other teeth showing delayed emergence. On the average, with the exceptions of some teeth, the emergence in the present girls was delayed as compared to Meiteis, Karnataka girls, Britishers, Japanese, Canadian-Eskimos, Ghanese, Hong Kong Chinese, and New Guineans. As compared to the Bengalee, Punjabi Gujjar, Madras, Thai,

Table-5 Permanent tooth emergence times (years) in different populations of the world

POPULATION	SEX	MAXILLA							MANDIBLE						
		I1	I2	C	P1	P2	M1	M2	I1	I2	C	P1	P2	M1	M2
Rajputs of Himachal Pradesh (Present Study)	F	6.78	7.44	10.35	10.29	10.49	6.22	12.13	6.25	6.92	8.42	10.23	10.65	5.90	11.75
	M	7.10	7.66	10.70	9.90	10.10	6.31	12.60	6.64	7.20	9.20	9.83	10.40	6.00	12.30
Gaddi Rajputs 11	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	M	7.02	8.83	10.96	10.82	11.51	6.21	11.87	6.29	7.96	10.52	11.07	11.82	6.18	11.84
Gurung (Uttar Pradesh) 12	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	M	7.30	7.57	11.54	10.30	11.45	6.30	12.66	6.57	7.00	10.30	10.78	11.90	5.90	12.30
Khasis (Meghalaya) 13	F	6.90	8.10	10.35	9.70	10.60	6.20	11.50	6.49	7.50	9.70	9.80	10.70	6.00	11.05
	M	7.50	8.75	11.00	10.10	10.70	6.25	12.30	6.50	7.65	10.55	10.60	11.20	5.70	11.70
Meities (Manipur) 1	F	6.55	7.94	10.10	9.77	10.84	5.7	11.18	6.04	6.75	9.54	9.45	10.71	5.81	10.80
	M	7.28	8.28	10.65	10.17	11.10	6.37	11.61	6.38	7.28	10.35	10.29	11.21	5.85	11.22
Bangalees 2	F	7.20	8.20	10.80	11.10	11.80	5.80	11.80	6.30	7.80	10.30	11.30	11.80	5.80	11.80
	M	7.80	8.90	11.30	10.80	-	5.80	9.10	6.50	7.80	11.70	10.80	-	5.80	-
Jats (Haryana) 3	F	6.46	7.67	10.35	10.59	10.70	5.37	11.35	5.96	7.16	9.88	10.23	11.09	4.77	11.85
	M	6.92	8.03	10.71	10.23	10.84	5.12	11.48	6.09	7.41	10.47	10.23	11.09	4.09	11.00
Punjabis	F	6.92	8.19	10.47	0.23	11.22	6.3	11.22	6.46	7.59	9.77	10.47	11.22	5.62	10.72
	M	7.08	8.13	10.97	10.47	11.48	6.41	12.02	6.61	7.59	10.71	10.97	11.75	6.17	11.18
Punjabis (Patiala) 5	F	6.82	7.75	10.63	10.10	11.35	3.72	12.5	6.35	7.30	0.42	10.5	11.12	5.50	11.20
	M	7.15	8.32	11.50	10.55	11.40	5.50	12.15	6.50	7.52	10.95	10.85	11.27	5.25	11.50
Gujjars (Punjab) 15	F	7.50	8.04	10.41	9.28	11.15	6.57	11.95	7.12	7.50	8.91	9.94	11.54	6.53	11.68
	M	7.81	8.71	11.28	10.29	11.54	6.92	12.45	7.29	7.85	10.12	11.15	12.59	6.80	12.09
Karnataka (Gulbarga) 14	F	6.50	8.00	10.88	10.13	11.00	5.75	11.00	6.75	6.88	10.00	10.00	11.00	5.50	10.63
	M	6.38	8.13	11.25	10.00	11.00	5.75	12.13	7.00	7.13	10.38	10.63	11.75	5.50	12.00
Madrasis 6	F	7.27	7.51	10.87	10.55	11.47	6.91	11.86	7.23	7.54	0.052	10.07	11.42	6.81	11.59
	M	7.34	8.34	11.13	10.59	10.52	6.63	12.37	7.13	7.86	11.22	10.88	11.78	6.59	12.08
Britishers 7	F	6.62	7.82	10.67	9.79	10.6	5.94	11.50	5.77	7.01	9.41	10.35	11.64	5.84	11.18
	M	7.01	8.18	11.46	10.41	11.52	6.11	11.97	6.08	7.30	10.51	11.35	12.32	6.14	11.41
Japanese 8	F	6.65	8.12	10.35	9.14	10.35	6.10	11.83	6.10	6.85	9.15	9.90	10.85	5.90	11.35
	M	7.25	8.57	10.75	9.53	10.77	6.35	12.37	6.55	7.15	9.98	10.32	11.15	5.95	11.30
New Guineans 9	F	6.48	7.62	9.13	9.73	10.20	5.77	10.92	5.99	6.89	8.87	9.39	10.34	5.76	10.54
	M	6.43	7.49	9.52	9.72	10.57	5.91	11.31	6.10	6.98	9.34	9.93	10.57	5.91	11.02
Sri Lankan Tamils 10	F	7.15	8.03	10.87	10.15	11.19	5.72	11.56	6.32	7.38	10.00	10.22	11.31	5.62	11.07
	M	7.24	8.69	11.55	10.52	11.21	5.54	11.89	5.18	7.72	11.04	10.78	11.28	5.02	11.73
Chinese Hong Kong) 16	F	7.16	8.25	10.40	9.53	10.39	6.19	11.95	6.08	7.15	9.59	9.82	10.66	5.89	11.28
	M	7.36	8.67	11.32	9.80	10.86	6.40	12.62	6.22	7.52	10.52	10.44	11.26	6.04	11.93
Canadian Eskimo 17	F	6.84	7.67	10.01	9.02	9.83	5.58	10.69	6.08	6.86	8.90	8.97	10.36	5.54	10.45
	M	7.43	8.47	11.10	9.57	10.70	5.61	11.39	6.32	7.20	9.52	10.32	11.38	5.40	10.78
Thailand 18	F	7.8	8.80	10.90	9.80	11.60	7.00	12.10	7.00	7.60	9.90	10.40	11.50	7.00	11.60
	M	8.10	9.10	11.50	10.50	11.90	7.00	12.20	7.00	8.20	11.30	11.10	11.80	7.00	11.70
Americans 19	F	7.20	8.20	10.98	10.03	10.88	6.22	12.27	6.26	7.34	9.86	10.18	10.89	5.94	11.66
	M	7.47	8.67	11.69	10.40	11.18	6.40	12.68	6.54	7.70	10.79	10.82	11.47	6.21	12.12
Australian 20	F	7.10	8.00	10.80	10.00	10.90	6.30	11.50	6.20	7.20	9.80	10.50	11.50	6.10	11.10
	M	7.60	8.30	11.60	10.40	11.20	6.40	12.10	6.40	7.70	10.70	11.30	12.30	6.30	11.70
Ghana 21	F	6.00	7.30	9.50	9.00	10.00	5.00	10.90	5.10	6.40	8.90	9.20	10.30	4.50	10.50
	M	6.30	7.50	10.40	9.50	10.50	5.00	10.90	5.30	6.10	10.00	9.80	10.60	4.90	10.80

1. Gaur and Singh, 1994; 2. Banerjee et al., 1992; 3. Kaul and Parkash, 1982; 4. Kaul et al., 1975; 5. Sidhu and Gupta, 1973; 6. Shorie, 1946; 7. Clements et al.,1953; 8. Eveleth and de Freitas,1969; 9. Friedleander and Bailet, 1969;10. Pathmanathan et al., 1985; 11. Singh,1980; 12. Awasthi & Khare, 1978; 13. Jaswal. 1983; 14. Rami Reddy, 1985; 15. Sharma and Mittal, 2001; 16. Lee et al.,1965; 17. Mayhall et al.,1978; 18. Kamlanathan, et al.,1960; 19. Graber,1966; 20. Halikis, 1961; 21. Houpt et al.,1967.

American and Australian girls, the girls in the present sample showed earlier emergence, with the exception of a few teeth. Overall, the emergence of maxillary and mandibular first and second molars and to some extent the central incisors was delayed in the Rajput girls of the present sample, as compared to a majority of the listed populations. However, as compared to a majority of other populations, the canines and second premolars in both jaws showed earlier emergence.

Like Rajput girls, the emergence pattern of Rajput boys too displays a mixed picture, with earlier emergence in some teeth and delayed emergence in others (Table-5). However, the emergence of permanent teeth in the Rajput boys of the present sample was by and large earlier than Gaddi Rajput, Punjabi Gujjar, Bengalee, Madras, Thai, American and Australian boys, with a few exceptions. On the other hand, the emergence was delayed in a majority of the teeth as compared to the Jats of Haryana, Japanese, Ghanese, Canadian-Eskimos, and the New Guineans. The emergence in the present sample was distinctly delayed in maxillary as well as mandibular first and second molars and mandibular lateral incisors as compared to a majority of other populations from within and outside India. However, the mandibular and maxillary second premolars and mandibular first premolars and canines in the Rajput boys of the present sample emerged earlier than a majority of the populations with which they have been compared here. It can be concluded that the emergence in the present sample was distinctly delayed in maxillary as well as mandibular first and second molars and mandibular lateral incisors as compared to a majority of other populations from within and outside India.

The relationship of weight and stature with dental emergence has been investigated by several workers. A number of studies suggest that tall and heavy children tend to be advanced dentally (Billewicz and McGregor 1975; Kaul et al. 1975; Visweswara Rao 1985, 1992; Pathak et al. 1985; Banerjee et al. 1992). Stature has been reported to have a stronger correlation with dental emergence than weight (Vaslik 1972; Pathak et al. 1985; Visweswara Rao 1992). In the present sample of Rajput children, partial correlation did not reveal any significant relationship between the number of emerged teeth and stature and weight. Low correlation between

height and dental emergence were also reported by Falkner (1957) and Steggerda (1945). Studies also suggest that dentition develops independent of general body development (Shuper et al., 1986). Though, some studies indicate a positive relationship between permanent tooth emergence and height and weight, a few also report a low or no relationship between these variables. The issue, therefore, requires further investigations through longitudinal studies based on larger samples.

REFERENCES

Al-Jasser NM, Bello LL. 2003. Time of eruption of primary dentition in children from Saudi Arabia. *J Contemp Dent Pract* **4**:65–75.

Arvystas MG.1976. Familial generalized delayed eruption of the dentition with short stature. *Oral Surg Oral Med Oral Pathol* **41**(2): 235-243.

Awasthi SC , Khare BP. 1978. Sequence and age of eruption of permanent dentition among Gorkhas of Dehradun (UP). Proceedings 4th Annual Conference of Ethnographic and Folk Culture Society, Ahmedabad, India.

Banerjee P, Banerjee Arup R, Banerjee, AR. 1992. Eruption of permanent teeth in Bengalee school children. *J Hum Eco (Special Issue)* **2**: 31-36.

Billewicz WZ, McGregor IA. 1975. Eruption of permanent teeth in West African (Gambian) children in relation to age, sex and physique. *Ann Hum Biol* **2**:117-128.

Clements EMB, Davies T E, Pickett KG. 1953. The time of eruption of permanent teeth in British children in 1947-48. *Br Med J* **1**:1421-1431.

Demirjian A. 1986. Dentition In : Falkner, F and Tanner, JM editors. Human Growth: A comprehensive treatise, 2nd edition. New York: Plenum, p. 269 – 298.

Eveleth PB, de Freitas JA. 1969. Tooth eruption and menarche of Brazilian-born children of Japanese ancestry. *Hum Biol.* **41**(2):176-84.

Falkner F. 1957. Deciduous tooth eruption. *Arch Dis Child* **32**:386-391.

Folayan M, Owotade F, Adejuyigbe E, Sen S, Lawal B, Ndukwe K. 2007.The timing of eruption of the primary dentition in Nigerian children. *Am J Phys Anthropol* **134**:443–448.

Friedleander JS, Bailit HL. 1969. Eruption times of deciduous and permanent teeth of natives of Bouganville Island, territory of New Guinea. *Hum Biol* **41** : 51 – 63.

Gaur R, Singh, NY. 1994. Emergence of permanent teeth among the Meiteis of Manipur, India. *Am J Hum Biol*, **6**: 321 – 328.

Gaur R, Singhal T. 2005. Stature, Weight and BMI in relation to permanent tooth emergence amongRajput boys of Theog area, Himachal Pardesh. Ind J Phys *Anthrop and Hum Genet*, **24**: 199-211.

Graber T. M. 1966. *Orthodontics: Principles and Practice.* Saunders: Philadelphia.

Halikis, S.F., 1961. Variability of eruption of permanent teeth and loss of deciduous teeth in western Australian Children,1. Times of eruption of permanent teeth. Aus. Dent. J., **6**:137-140.

Helm S , Seidler B. 1974 .Timing of permanent of permanent tooth emergence in Danish children. *Community Dent Oral Epidemiol* **2**:122-129.

Houpt, MI., Adu-Aryee, S. and Grainger, RM. 1967. Eruption times of permanent teeth in the Brong Ahafo region of Ghana. *Am. J. Orthod.,* **53**: 95-99.

Infante PF. 1974. Sex differences in the chronology of deciduous tooth emergence in white and black children. *J Dent Res* **53**: 418.

Jaswal S. 1983. Age and sequence of permanent tooth emergence among Khasis. *Am J Phys Anthropol* **62** : 177 – 186.

Kamlanathan, G.S., Hauk, H.M. and Kittiveja, C., 1960. Dental development of children in a Siamese village, Bangchan, 1953. *J. Dent. Res.,* **39**:455-461.

Kaul S, Saini S, Saxena B. 1975. Emergence of permanent teeth in school children in Chandigarh, India. *Arch Oral Biol* **20** : 587 – 593.

Kaul V, Prakash S. 1982. Eruption of permanent teeth in Jats of Haryana. In: Borms J, Hauspie R, Sand A, Susanne C, Hebbelinck M, editors. *Human Growth and Development*. New York: Plenum, 243-352.

Kaur B and Singh R. 1992. Physical growth and age at eruption of deciduous and permanent teeth in well-nourished Indian girls from birth to 20 years. *Amer Jour Hum Biol*, 757–766.

Lee MMC, Low WD, Chang KSF. 1965. Eruption of permanent dentition of Southern Chinese children in Hong Kong. *Arch Oral Biol* **10**:849 – 861.

Liversidge H. 2003. Variation in modern human dental development. In: Thompson JL, Krovitz GE and Nelson AJ editors. *Patterns of Growth and Development in the Genus Homo*. Cambridge: Cambridge University Press, 73-113.

Mayhall JT, Belier PL, Mayhall MF. 1978. Canadian Eskimo permanent tooth emergence timing. *Am J Phys Anthropol* **49**:211-216.

Mugonzibwa EA, Kuijpers-Jagtman AM, Laine-Alava MT, van't Hof MA. 2002. Emergence of permanent teeth in Tanzanian children. *Community Dent Oral Epidemiol* **30**(6):455-462.

Nayak SK, Patil S. 1977. Age of eruption of permanent teeth and its sequence among the Tibetan refugees. *J Ind Med Assoc* **69**:146-149.

Pathak RK, Jaiswal S, Kaul S. 1985. Association of permanent dental maturity status with stature and weight in Punjabi children of Chandigarh, India. In: Rami Reddy V, editor. *Dental Anthropology: Applications and Methods*. New Delhi: Inter-India Publications. P.49-53.

Pathmanathan, G., Prakash, S. and Kaul, V. 1985. Permanent tooth emergence in Tamils of Sri Lanka. In: *Dental Anthropology: Applications and Methods*. V. Rami Reddy (ed.). New Delhi: Inter- India Publications. P. 55-73.

Rami Reddy V. 1985. Dental eruption of India. In: Rami Reddy V, editor. *Dental Anthropology: Applications and Methods.* New Delhi: Inter–India Publications. P.55–73.

Romo-Pinales MR, Sanchez-Carlos IR, Garcia-Romero JS. 1989. Chronology of dental eruption in school children. *Salud Publica Mex*, **31**(5): 688-695 (in Spanish).

Sharma K, Mittal S. 2001. Permanent tooth emergence in Gujjars of Punjab, India. *Anthrop Anz* **65**(2):165-178.

Shourie K.L. 1946. Eruption of teeth in India. *Ind J Med Res* **34** : 105-118.

Shuper A, Shohat M, Sarnat H, Varsano I, Mimouni M. 1986. Deciduous tooth emergence in children who fail to gain weight. *Helv Paediatr Acta* **41**:501-504.

Sidhu, L.S. and Gupta, P., 1973. Sequence and age of eruption of permanent teeth in the Punjabi population of Patiala. *East. Anthropol.,* **25**: 261 – 270.

Singh SP. 1980. Physical growth of Dhaula Dhar Gaddi Rajputs of Dhaula Dhar Range of the Himalayas. *Z Morphol Anthrop* **54**: 272-292.

Steggerda M. 1945. Anthropometry and eruption time of teeth. *Jour Amer Dent Assoc* **32**:339-342.

Tanguay R, Demirjian A, Thibult HW. 1984. Sexual diformism in the emergence of the deciduous teeth. *J Dent Res* **63**: 65.

Tanner JM, Whitehouse RH. 1966. *Notes on the use of height and weight standard charts.* London: Creasey, Hertford.

Taranger J, Lichtenstein H, Svenneberg-Redegren I. 1976. Dental development from birth to 16 years. *Acta Paediat Scand (Suppl)*, **258**: 83-97.

Tiwari A, Chawla AS. 1978. Study of sequence and eruption age of permanent teeth in North Indian Children, Chandigarh. *Bull P G I M E Res Chandigarh,* **12**: 58-68.

Townsend N, Hammel EA. 1990. Age estimation from the number of teeth erupted in young children: an aid to demographic surveys. *Demography* **27**:165–174.

Vaslik JA.1972. Correlation of permanent dentition with stature and weight in Nubian children. *Scripta Medica* **45**: 149-153.

Visweswara Rao K. 1985. Nutritional status, deciduous dental eruption and age assessment In: Rami Reddy V, editor. *Dental Anthropology: Application and Methods*. New Delhi: Inter-India Publications: 3–11.

Visweswara Rao, K., 1992. Differential growth and dental eruption in Indian children. *J. Hum. Ecol*. (Special Issue), **2**: 25 – 30.

Wedl JS, Danias S, Schmelzle R, Friedrich RE. 2005. Eruption times of permanent teeth in children and young adolescents in Athens (Greece). *Clin Oral Investig*, **9**:131-134

Weiner JS, Lourie JA. 1981. Practical Human Biology. London: Academic Press.

WHO. 2007. WHO Reference 2007: Growth Reference data for 5-19 years. htpp://www.who.int/growthref/en/

Zhao J, Ding L, Li R. 1990. Study of dental maturity in children aged 3-16 years in Chengdu. *Hua Xi Yi Ke Da Xue Xue Bao*, **21**(3):242-246. (In Chinese).