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Growth Pattern of The War Khasi Children of Meghalaya

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ABSTRACT The present study deals with the growth pattern of the War Khasi children in the East Khasi Hills district of Meghalaya. The study was based on a cross-sectional sample of 514 apparently healthy boys and girls, who are aged 3 to 15 years. The findings reveal that there is a continuous increment in almost all the measurements with the advancing age of both boys and girls. It is observed that, with the exception of skinfold thicknesses, the mean values of measurements are higher in boys than in girls at all ages, except at 11 and 12 years of age when the boys are surpassed by the girls. It is also found that adolescent growth spurt occurs at the age of 14 years in boys and 12 years in girls in respect of many measurements. With regard to skinfold thickness, it is found that a considerable amount of fat deposit at biceps and triceps was lost at the age between 4 and 5 years in boys and at 4 and 6 yeas in girls. However, a large amount of fat accumulation takes place at the age of 14 years in boys and 13 years in girls.

INTRODUCTION

Reviews have revealed that growth studies in North-East India are very limited (Gaur and Singh, 1995; Talwar and Singh, 1995; Khongsdier and Ghosh, 1995). Besides, all growth studies, so far reported for the populations in the North-Eastern region, have been carried out only among some populations of Assam and Manipur (Khongsdier and Ghosh, 1995). No other studies have been published on physical growth and development of children from other States of North-Eastern region. Accordingly, an attempt has been made in the present study to describe the growth pattern of the War Khasi children of Meghalaya.

MATERIAL AND METHODS

The present study was based on a cross-sectional sample of 514 apparently healthy children aged 3 to 15 years from five villages of the War Khasi in the East Khasi Hills district of Meghalaya. Methods for selection of sample villages have already been reported for other purposes (Khongsdier, 1993, 1994, 1995). Anthropometric measurements such as weight, height, sitting height, biacromial diameter, bi-iliac diameter, head circumference, mid upper arm circumference (left), and skinfold thickness at biceps and triceps (left) were taken on boys and girls, following standard techniques (Weiner and Lourie, 1981; Singh and Bhasin, 1989; Sen, 1994). The age of subject was recorded according to information given by parents or elderly member(s) of the households. Efforts were made to cross-check data on age through school and church registers. Estimation of age could not be avoided in the case of children whose dates of birth were not available. For the purpose of present analysis, the age group was made at one year interval, *i.e.* age group 3 includes children of 2.50 to 3.49 years, age group 4 includes children of 3.50 to 4.49 years and so on (Sen, 1994). The absolute growth or increment per year was calculated by substracting the mean value of the lower age group from that of the next higher age group. It may be mentioned that none of the children, included in the present study, belongs to a household which is below poverty line (DRD, 1988).

RESULTS AND DISCUSSION

Table 1 gives the statistical constants for weight, height, sitting height, biacromial diameter and bi-iliac diameter of both boys and girls. It is found that there is a continuous increment in all these measurements from 3

Table 1 : Mean values and standard deviations of weight, height, sitting height, biacromial diameter and bi-illiac diameter or the War Khasi boys and girls

Age and Sex	*N*	*Weight*		*Height*		*Sitting height*		*Biacromial diameter*		*Bi-iliac diameter*	
		Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
3 years :											
Boys	25	12.91	1.64	90.68	4.80	52.94	2.40	20.44	0.87	14.92	0.92
Girls	20	12.21	1.79	90.20	4.38	51.92	2.47	20.02	0.65	14.38	0.94
4 years :											
Boys	22	13.86	2.10	96.72	5.69	54.96	2.89	21.74	0.92	15.35	0.78
Girls	20	13.25	2.07	96.19	4.61	54.28	2.86	21.34	0.87	14.97	0.98
5 years :											
Boys	23	15.89	2.21	102.78	5.75	56.96	2.15	22.72	1.03	16.27	0.84
Girls	19	15.42	2.02	102.12	5.33	56.24	3.25	22.10	1.06	15.84	1.13
6 years :											
Boys	20	17.83	2.48	107.98	6.63	58.75	2.92	23.83	1.24	16.90	0.97
Girls	22	17.00	3.13	107.24	5.53	57.78	3.48	23.06	1.27	16.39	1.20
7 years :											
Boys	20	19.69	3.18	113.86	6.58	60.60	3.42	24.69	1.23	17.58	1.20
Girls	23	18.82	3.18	111.23	6.08	59.36	4.02	23.98	1.43	16.85	0.95
8 years :											
Boys	22	21.25	5.25	118.96	5.84	63.08	3.46	25.27	1.28	18.46	0.76
Girls	20	20.27	3.29	116.02	6.40	61.60	2.48	24.82	1.44	17.39	1.14
9 years :											
Boys	20	23.48	4.15	124.20	6.28	65.09	3.44	25.92	1.30	19.20	0.95
Girls	22	22.65	4.28	121.27	6.44	63.47	3.14	25.57	1.53	18.28	1.26
10 years :											
Boys	21	25.40	4.16	127.52	6.37	66.60	4.16	26.44	1.25	19.88	1.27
Girls	20	24.74	5.15	127.15	5.80	65.88	3.63	26.59	1.74	19.32	1.09
11 years :											
Boys	23	27.71	3.78	132.44	6.63	68.28	4.18	27.48	1.38	20.29	1.36
Girls	24	27.98	5.35	133.17	5.20	68.84	4.03	27.72	1.62	20.47	1.74
12 years :											
Boys	18	30.36	5.33	137.75	7.12	70.62	4.28	29.10	1.40	21.37	1.48
Girls	16	31.58	4.25	139.80	6.39	72.09	4.26	29.34	1.68	22.19	1.88
13 years :											
Boys	15	33.67	5.54	142.85	7.24	73.55	3.95	30.25	1.47	22.46	0.98
Girls	15	33.54	5.20	142.36	7.39	73.24	3.13	30.34	1.50	22.53	1.37
14 years :											
Boys	16	37.26	6.48	149.87	6.28	77.26	4.12	32.80	1.33	23.97	1.33
Girls	14	35.38	4.33	143.42	5.36	74.27	3.83	31.47	1.23	23.04	1.53
15 years :											
Boys	19	40.49	6.73	153.11	6.40	78.96	4.10	33.96	1.54	24.62	1.35
Girls	15	37.22	5.62	144.38	5.42	74.98	4.24	32.35	1.44	23.48	1.68

to 15 years of age for both boys and girls. The table shows that boys are heavier and taller than girls at all ages, except at 11 and 12 years of age, when the boys are surpassed by the girls. The difference between means of the two succeeding age groups, which shows an absolute growth per year, are given in table 3. It shows that girls grow faster than boys from 3 to 5 years of age with respect to weight. The boys grow faster than girls from 6 to 8 years of age, then they are surpassed again by the girls from the age of 9 to 12 years. With regard to stature, table 3 shows that boys have higher velocities than girls from 3 to 8 years. In turn, the growth velocities are higher in girls than in boys from 9 to 12 years of age.

The maximum gain in weight and height occurs at the age between 11 and 12 years for girls and between 13 and 14 years for boys. So, it indicates that adolescent growth spurt takes place between 11 and 12 years in the case of girls and between 13 and 14 years in the case of boys. It can also be noticed that the velocity tends to decline after 12 years of age for girls and 14 years for boys. Similar pattern of growth has been observed in the case of sitting height. It is found that boys have higher mean values of sitting height than girls at all ages, except at the age between 11 and 12 years when the mean values are higher in girls than in boys. As far as absolute growth is concerned, table 3 indicates that it is higher in girls than in boys from 3 to 4 years as well as from 5 to 6 years of age. Thereafter, the growth velocity is higher in boys than in girls at all ages, except during girls' adolescent period, which shows that girls grow faster than boys. The girls begin their adolescent growth spurt at the age of 10 and gain the maximum growth velocity of 3.25 cm at 12 years of age. In the case of boys, the peak velocity of 3.17 cm is found to have occured at 14 years of age.

With respect of biacromial diameter, table 1 shows that the mean values are higher in boys than in girls from 3 to 9 years of age. The girls have higher mean values than boys from 10 to 13 years, and they are surpassed again by the boys from 13 to 15 years of age. The annual increment in biacromial diameter shows that girls have gained their maximum growth spurt at the age of 12, whereas the peak velocity for boys takes place between 13 and 14 years of age. With regard to bi-iliac diameter, it is found that boys have higher mean values than girls from 3 to 10 years, whereas the girls show their broader shoulder from the age of 11 to 13 years. Thereafter, the boys are more advanced till the terminal age of 15 years. Table 3 indicates that in boys the maximum growth spurt occurs at the age of 14 years. The velocity tends to slow down after 12 years in the case of girls and 14 years in the case of boys.

Statistical constants for head circumference, chest girth, mid upper arm circumference and log of skinfold thickness at biceps and triceps are given in table 2. It can be seen that there is a continuous increment in all these measurements with the advancing age of both boys and girls. The table shows that the mean values of head circumference are slightly higher in boys than in girls at all ages, except at the age of 11 to 12 years, when the girls have higher mean values than boys. The maximum growth velocity in girls takes place at 12 years of age, whereas in boys it occurs at the age of 14 years. With respect to mid upper arm circumference, table 2 shows that the mean values are higher in girls than in boys at the age of 9, and it continues to remain higher until 13 years of age. Thereafter, it is higher in boys till the terminal age group of 15 years. It can also be noticed that the maximum gain in mid upper arm circumference occurs at the age of 12 in girls and 14 years in boys (Table 3). Similar trend is observed with respect to chest girth. Table 3 shows that the highest growth velocity in chest girth occurs at the age of 12 years in girls and 14 years in boys.

Table 2 : Mean values and standard deviations of log of skinfold thickness, head circumference, chest girth and mid upper arm circumference of War Khasi boys and girls

Age and Sex	*N*	*Head circumference*		*Chest girth*		*Arm circumference*		*Log of skinfold thickness at*			
								Biceps		*Triceps*	
		Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
3 years :											
Boys	25	48.16	1.39	49.30	3.02	14.54	1.35	0.7242	0.0899	0.8954	0.0719
Girls	20	47.27	2.36	48.29	2.91	13.80	0.76	0.7340	0.0645	0.9212	0.1139
4 years :											
Boys	22	48.63	1.92	50.46	3.28	15.20	1.48	0.6628	0.0934	0.8727	0.0755
Girls	20	47.98	2.73	49.66	3.23	14.75	0.98	0.6721	0.0755	0.8837	0.0607
5 years :											
Boys	23	48.97	2.02	52.70	4.37	15.84	1.75	0.6201	0.0719	0.8351	0.0828
Girls	19	48.40	1.78	50.79	4.27	15.28	1.36	0.7076	0.019	0.9180	0.0720
6 years :											
Boys	20	49.37	2.05	54.80	3.48	16.10	2.03	0.6345	0.0969	0.8573	0.0682
Girls	22	48.68	1.88	53.34	5.87	15.63	1.45	0.6776	0.0792	0.8893	0.0792
7 years :											
Boys	20	49.89	3.12	56.58	5.36	16.44	2.11	0.6590	0.0682	0.8669	0.0793
Girls	23	49.08	2.33	54.99	5.11	16.50	1.66	0.6955	0.0899	0.8998	0.0899
8 years :											
Boys	22	50.13	1.39	58.94	4.28	16.86	1.63	0.6721	0.0864	0.8820	0.0864
Girls	20	49.68	3.03	57.87	3.17	16.97	1.93	0.7243	0.0969	0.9117	0.0934
9 years :											
Boys	20	50.71	1.74	60.36	4.39	17.38	1.74	0.7093	0.0934	0.8976	0.0899
Girls	22	50.41	1.74	59.75	4.14	17.83	2.48	0.7582	0.0719	0.9370	0.0645
10 years :											
Boys	21	51.16	1.84	61.75	5.12	17.97	1.80	0.7259	0.1106	0.9175	0.1004
Girls	20	50.86	1.74	60.83	3.36	18.23	2.20	0.7482	0.0755	0.9325	0.1003
11 years :											
Boys	23	51.62	1.92	63.08	5.29	18.67	2.15	0.7324	0.1106	0.9238	0.0935
Girls	24	51.78	1.93	63.26	4.45	19.05	1.64	0.7731	0.0828	0.9465	0.1072
12 years :											
Boys	18	51.96	2.25	65.44	5.32	19.28	2.24	0.6920	0.0934	0.8887	0.0683
Girls	16	52.88	2.11	66.11	4.84	20.25	1.78	0.7760	0.0899	0.9513	0.1038
13 years :											
Boys	15	52.94	2.10	68.32	4.22	20.29	2.11	0.7110	0.1004	0.9074	0.0969
Girls	15	53.27	2.35	68.25	4.36	20.89	2.42	0.8122	0.1038	0.9890	0.0969
14 years :											
Boys	16	54.16	2.05	71.56	4.94	21.52	2.28	0.7574	0.1139	0.9410	0.1038
Girls	14	53.64	1.72	70.14	5.20	21.16	2.33	0.7903	0.1106	0.9647	0.1106
15 years :											
Boys	19	54.57	3.10	73.98	5.25	22.14	2.62	0.7364	0.1038	0.9269	0.1106
Girls	15	54.00	2.84	71.37	5.26	21.69	2.48	0.7980	0.0935	0.9745	0.1173

Table 3 : Absolute growth per year in respect of 10 body measurements of the War Khasi boys and girls

Age and Sex	*Weight*	*Height*	*Sitting height*	*Biacromial diameter*	*Biiliac diameter*	*Head circumference*	*Chest girth*	*Arm circumference*	*Biceps*	*Triceps*
3 years :										
Boys	-	-	-	-	-	-	-	-	-	-
Girls	-	-	-	-	-	-	-	-	-	-
4 years :										
Boys	0.95	6.04	2.02	1.30	0.43	0.47	1.16	0.66	-0.0614	-0.0227
Girls	1.04	5.99	2.36	1.32	0.59	0.71	1.37	0.95	-0.0619	-0.0375
5 years :										
Boys	2.03	6.06	2.00	1.02	0.92	0.34	2.24	0.64	-0.0427	0.0376
Girls	2.17	5.93	1.96	0.76	0.87	0.42	1.13	0.53	0.0355	0.0343
6 years :										
Boys	1.94	5.20	1.79	1.11	0.63	0.40	2.10	0.26	0.0144	0.0222
Girls	1.58	5.12	1.90	0.96	0.55	0.28	2.55	0.35	-0.0300	-0.0287
7 years :										
Boys	1.86	5.88	1.85	0.86	0.68	0.52	1.78	0.34	0.0245	0.0096
Girls	1.82	3.99	1.58	0.92	0.46	0.40	1.65	0.87	0.0179	0.0105
8 years :										
Boys	1.56	5.10	2.48	0.58	0.88	0.24	2.36	0.42	0.0131	0.0151
Girls	1.45	4.79	2.24	0.84	0.54	0.60	2.88	0.47	0.0288	0.0119
9 years :										
Boys	2.23	5.24	2.01	0.65	0.74	0.58	1.42	0.52	0.0372	0.0156
Girls	2.38	5.25	1.87	0.75	0.89	0.73	1.88	0.86	0.0339	0.0253
10 years :										
Boys	1.92	3.32	1.51	0.52	0.68	0.45	1.39	0.59	0.0166	0.0199
Girls	2.09	5.88	2.41	1.02	1.04	0.45	1.08	0.40	-0.0100	-0.0045
11 years :										
Boys	2.31	4.92	1.68	1.04	0.41	0.46	1.33	0.70	0.0065	0.0063
Girls	3.24	6.02	2.96	1.13	1.15	0.92	2.43	0.82	0.0249	0.1040
12 years :										
Boys	2.65	5.31	2.34	1.62	1.08	0.34	2.36	0.61	-0.0404	-0.0357
Girls	3.60	6.63	3.25	1.62	1.72	1.10	2.85	1.20	0.0029	0.0048
13 years :										
Boys	3.31	5.10	2.93	1.15	1.09	0.98	2.88	1.01	0.0190	0.0187
Girls	1.96	2.56	1.15	1.00	0.34	0.39	2.14	0.64	0.0362	0.0377
14 years :										
Boys	4.00	7.02	3.71	2.55	1.51	1.22	3.24	1.23	0.0464	0.0336
Girls	1.84	1.06	1.03	1.13	0.51	0.37	1.89	0.27	-0.0219	-0.0248
15 years :										
Boys	3.23	3.24	1.70	1.13	0.65	0.41	2.42	0.62	-0.0210	-0.0141
Girls	1.84	0.96	0.70	0.88	0.44	0.36	1.23	0.53	0.0077	0.0098

With regard to skinfold thickness, table 2 shows that boys lose a considerable amount of fat deposit at biceps from 4 to 5 years of age. From 6 to 11 years, they begin to putting on fat, but the loss of fat from 4 to 5 years could not be recouped even for the next four subsequent years. It is, however, observed that a large deposit of fat at biceps occurs at the age of 14 years. In the case of girls, table 2 shows that there is a loss of fat at 4 and 6 years of age. At 7 years of age, there is a gain of fat at biceps, but it is not equal to that amount lost at 4 and 6 years of age. At 10 years, there is again a loss of fat, but it is compensated in the next subsequent year, and a large amount of fat accumulation takes place at the age of 13.

The increment of fat per year is shown in table 3 for both boys and girls. In boys, there are two periods of fat accumulation at biceps, one at the age of 9 and the other at the age of 14 years. Similarly, there are two peak velocities of fat accumulation in girls, one at the age of 9 years and the other at the age of 13 years (Table 3).

The growth pattern of boys and girls with respect to log of skinfold thickness at triceps is found to be similar to that with regard to biceps skinfold thickness. In the case of boys, a large deposit of fat at triceps is lost at 4 and 5 years and there is an increase in fat accumulation at the age of 6 years and it continues to increase till the age of 11. It can also be noticed that the loss of fat at 4 and 5 years of age is recouped until about the age of 9 years. The loss in fat deposit is also found to occur at the age of 12. Thereafter, it starts increasing and reaches its peak at the age of 14 years. In the case of girls, a considerable amount of fat is lost at 4 and 6 years of age. In can be seen that the loss of fat at 4 and 6 years is not compensated till the age of 9 years. At 10 years of age, a little amount of fat deposit is lost, and thereafter it starts increasing until about the age of 13 years, when a large quantity of fat deposit takes place at triceps region.

The pattern of increment in fat deposit at triceps is presented in table 3. It can be noticed that the maximim gain in fat occurs at the age of 14 years for boys and 13 years for girls.

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