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Research Article

A CROSS-SECTIONAL STUDY ON THE GROWTH PATTERN OF THE SEKMAI CHILDREN OF MANIPUR

Jibonkumar H*

Department of anthropology, Presidency College, motbung, Manipur, india,

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ABSTRACT

The present proper/study attempts to access the growth patterns of 731 Sekmai children of Manipur comprising of 360 boys and 371 girls using anthropometric measurement such as weight, height vertex, Body weight, mid upper arm circumference, head circumference, chest growth etc. These were selected from tests of basic measurement (Weiner and Laurie 1969, Malina 1980, and Jelliffe 1966). The finding of study reveal that the boys are in average, taller and heavier than the girls from 4+ years onward up to 7+ years. But at 8+ years the girls overtake the boys, and at the age at 10+ years the girls clearly exceed the boys. It may be an indication of earlier onset of maturation of girls than the boys. But, the Sekmai children are, however, shorter and lighter even from the Indian Children.

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INTRODUCTION

The terms growth and development are, quite often used together to mean the changes in size and bodily characters that take place as a result of increasing age. In a strict sense, growth refers to increasing in size of the various parts and organs of the body by multiplication of cells and intracellular components since fertilization to physical maturity. Development emphasizes the increase in functional capacity of the organs and gradual appearances of bodily characters hitherto not expressed but are associated with growth. Study on growth and development is a powerful tool for assessing the general health and nutritional status of children in any population, because nutrition plays a big role in normal development of children.

Many studies have shown that the pattern of physical growth and development, though genetically determined, is strongly influenced by socio economic and nutritional status (Tanner 1966, Eveleth and Tanner 1976, Rao and Satyanarayan 1976, Takahashi 1978, Garn 1980, Bharati 1983 and Eveleth 1985).

Jelliffe (1966) shows that environmental influence especially nutrition are of greater importance than genetic back ground. Dugdale et al. (1970) shows that genetic factors set a limit on growth, but become maximally effective in manifestation only when nutritional and other factors reach an optimal level.

Frinsancho et al. (1980) suggested that the influence of environmental factors like nutrition has a greater role in producing difference in body size during childhood and the influence of genetic factor on body size is greater during adolescence. Worldwide observations have established the fact that inadequate diet and nutrition may produce stunted growth of body that is failure of full manifestation of genetic endowment of an individual. Malnutrition during childhood delays growth and malnutrition in the years preceding adolescence delays the appearance of the adolescent spurt. That's why Brown (1984) describes nutritional status as a physical reflection of the interaction between individual's nutritional intakes, the bio-availability of different nutrients, and his or her physiological requirements.

Anthropometry is widely known as the universally acceptable, economical and non invasive method used for accessing growth body dimensions composition and nutritional status of an individual or a population (Bhasin et al, 1990; WHO 1995) Physical growth and development as well as body dimensions of an individual or a population of all ages not only reflect the health, nutrition and well being of an individual or population but it is also acts as a strong predictor of the state of a nation's public health and the average nutritional status of its citizen (Eveleth and Tanner 1990; Basin and Sweta, 2007, and Choudhury and Gulrukh 2012. Apart from this, it also helps to understand the totality of human being which is enterprise of

*Corresponding author: **Jibonkumar H**

Department of anthropology, Presidency College, motbung, Manipur, india,

Anthropology (Choudhury and Gulrukh 2012). Several cross-sectional studies conducted world wide on the physical growth of children and adolescents during the last couple of decades have shown that there is a gradual increasing tendency in almost all the physical traits except skin fold and thickness (Deheeger et. Al 2002, Eiben and Mascie, 2004 Khalil and Khan 2004; Gultekin et. Al 2006; Suliga 2009; Busi and Rao 2003; Bhasin et. Al 2008; Chakraborty et. Al 2008; Saheb, S. Yaseen 2009. There is paucity of data regarding the physical growth studies conducted in North East Indian Population except few study has been reported. The Sekmai people under the present study, belongs to section called *chakpa* of the large Meitei community of Manipur. They were excluded from the mass proselytation of the Meiteis into Hindu religion during the early part of the 18th century. The Sekmai, therefore, still retain their traditional beliefs in sylvan deities. They are included in the scheduled caste list of the state. Their main occupation is agriculture and rice is the staple food. These are also known for their expertise in distillation of liquor of A-1 quality and this activity doubtlessly is the backbone of their economy. By and large, their physical appearance is homogeneous with typical mongoloid characteristics.

MATERIALS AND METHODS

The present study is based on cross sectional data of 731 children. 360 boys and 371 girls belonging to 4⁺ to 10⁺ years of age. The sample was drawn from Awang Sekmai village which is about 20 kms towards the north from proper Imphal, the capital of Manipur. Being located just by the side of N.H. 39 and not very far from the Imphal city, the village enjoys a peaceful semi-urban way of life.

In the present study, five anthropometric measurements were taken on the subject. These were selected from lists of basic measurement. (Weiner and Laurie, 1969; Malina, 1980; and Jelliffe, 1966). The standard anthropometric methods and techniques were employed for taking the following measurements. The five chosen anthropometric measurements are Height vertex or stature, Body weight, mid upper arm circumference, Head circumference and Chest girth.

Ascertainment of age of the Sekmai children was not easy but not very difficult too. Though they do not maintain birth record, they are very conscious of an individual's age, which is, as per their tradition, determined by the number of New Year that an individual has passed through since birth. Traditional New Year's Day usually falls on sometime in the middle of April. A child is said to be two years old on the day of New Year even though it was born just a month or a day before the New Year. For conversion of the traditional age into biological (Gregorian) age, it was essential to enquire if child was born before or after a New Year event and the time gap from the New Year in month and days if possible to recollect. Conversion into decimal age has not been done because of uncertainty of exact date of birth in a number of cases. Assignment of the children into appropriate age group is the first and foremost important step to be taken up in any age - dependent investigation, like growth and nutrition. In the present study the children belonging to 4 to 5 years of age, e.g. those who have completed 4 years and more but not attained 5, have been grouped together as 4⁺ year, and so on.

RESULT AND DISCUSSION

Tables 1 and 2 display the age wise mean value and other statistical constants of stature among the Sekmai boys and girls of 4+ to 10+ years. Average height of 4+ years old boys is 100.27cm while that of the girls is 98.88 cm. Height gradually increases with every addition of one year and thus at the age of 10+ years average height of the boys attains 133.12 cm . The total gain of height from 4+ to 10+ years among the boys is therefore 32.85 cm .The average height of the girls at 10+ years is 135.06 cm and the total gain during 4+ to 10+ years among them is 36.18 cm. It is learned that the boys are, on average, taller than the girls from 4+ years onwards up to 7+ years. But at 8+ years the girls overtake the boys, and at the age of 10+ years the girls clearly exceed the boys .This tendency of girls dominancy over the boys around the age of 10+ years may be an indication of earlier maturation of the girls than the boys. Velocity curves, as shown in (fig1A) exhibit peak growth spurt during 4+ and 5+ years in both the sexes. Absolute growth during this period is 8.89 cm for the boys and 9.09 cm for the girls. The growth gradient at this stage is 82.00% for the boys and 79.94% for the girls. (Table 1&2). Growth spurt occurs repeatedly thereafter, i.e. during 7+ to 8+ years and again during 9+ to 10+ years, in both the sexes. But in all these spurts, the girls clearly supersede the boys in term of the intensities of the spurts. For example, absolute growth during 7+ to 8+ years of the girls is 7.72 cm. and that of boys is 5.1 cm only. Similarly, the absolute growth during 9+ to 10+ years for the girls is 8.09 cm and that of the boys is 5.97cm.

It is observed from the values of growth gradients that in the boys the stature attains 75.32 per cent of its mature size (i.e.10+years) at 4+ years and by 7+ years it completes 89.93 per cent and remaining 10.07 per cent of growth takes place in between 8+ to 10+ years ; while in girls, the stature attains 73.21 per cent of its mature size at 4+ years and 87.51 per cent at 7+ years and remaining 12.49 per cent is completed in between 8+ and 10+ years.

It is learned from tables 3& 4 that mean values of body weight of the boys are greater than those of the girls at all age groups except at 8+ and 10+ years. The mean values of 9+ years old boys and girls are almost the same. It appears that the boys dominate over the girls from 4+ to 7+ years. But from 8+ years onwards the girls overtake the boys. It may be an indication of earlier onset of maturation of girls than the boys. Among the boys the mean value at 4+ years is 13.94 kg, the growth gradient of which is 51.44%. At the age of 10+ years the boys achieved an average weight of 27.1 kg and, therefore, the total gain of weight during 4+ to 10+ years is 13.16 kg. The girls exhibit 13.62 kg as the mean weight of 4+ years, growth gradient being 48.50 %, and 28.08 kg at 10+ years. Therefore, the total gain of weight during 4+ to 10+ years is 14.46 kg, which is greater than that of the boys.

The velocity curves exhibit an early spurt of growth between 4+ and 5+ years in both. Thereafter, the rate of growth declines gradually up- till 8+ years among the boys and regains momentum from 9+ years onwards. The picture is different among the girls. There is, of course, retardation in the rate of growth during 5+ to 6+ years. But after retaining the growth rate up to 7+ years a distinct spurt is shown during 7+ to 8+ years. It declines in the following 8+ to 9+ years to regain it

further in the following year. (9+ to 10+year). In the Sekmai boys, the mean value of horizontal circumference of head at 4+ years is 48.87cm and at 10+ years it is 51.3cm. While in girls, the mean value at 4+ years is 48.77cm and 51.64 cm at 10+ years. The total increments during 4+ years and 10+ years are 2.43cm and 2.87cm for the boys and girls respectively (Tables 5& 6). There is a continuous increase in the mean values along with every addition of one year among the girls. But the boys show quite an uneven trend of growth. Continuous increase in head circumference is seen up to 9+ years.

The mean value of 10+ years is, however, smaller than those of its preceding 9+ and 8+ years. That's why the growth gradients at the age of 8+ and 9+ years have crossed 100. Smaller mean value of 10+ years than those of 8+ and 9+ years is unusual. It may be due to certain technical errors, like mistaken age ascertainment, inclusion of a few individuals who have exceptionally narrow head circumference, etc. but not a biological phenomenon. But the difference among the above mentioned age groups is too little to take it as a matter of concern. It can be asserted that the increase in circumference of head along with addition of one year is relatively fast during 4+ to 7+ years among the boys. Thereafter, the speed is retarded and shows more or less a similar circumference during 8+ to 10+ years.

In the Sekmai boys, the mean value of chest circumference at 4+ yrs is 51.69 cm and at 10+ yrs it is 61.06, cm while in the girls, the mean value at 4+yrs is 51.43 cm and 61.59 cm at 10+ yrs (Table 7 & 8). The total increments during 4+ yrs to 10+yrs are 9.37 cm and 10.16 cm for the boys and the girls respectively. There is continuous increase in the mean values of both the samples. It is learned from the value of growth gradients that in the Sekmai boys, the chest circumference attains 84.65 per cent of its mature size (i.e. 10+ years) at 4+ yrs and by 7+ yrs it completes 94.38 per cent, and remaining 5.62 per cent is accomplished during 7+ yrs to 10+ yrs. In the girls, the chest circumference attains 83.50 per cent of its mature size at 4+ yrs and by 7+yrs it completes 90.70 per cent and the remaining 9.30 per cent growth takes place between 7+ and 10+ yrs of age.

It is learned from the velocity curve that maximum increase in the chest circumference takes place during 4+ to 6+ years among the boys. Maximum annual increase has been achieved during 4+ to 5+ years with an intensity of 2.43 cm, which is just followed by 2.24 cm during 5+ to 6+ yrs. Thereafter, the momentum of growth becomes slower. The picture is different among the girls. Of course, an early spurt is occurred during 4+ to 5+ years with an intensity of 2.37 cm per annum. The most distinct second spurt is observed during 7+ and 8+ with an intensity of 3.04 cm. It is abruptly declined in the succeeding 9+ years, the absolute gain being -0.12 cm. Interestingly, the momentum of growth is regained just after the great fall in the preceding 9+ yrs. That is, the absolute growth during 9+ to 10+ years i.e. 2.81 cm. This momentum of growth spurt during 9+ to 10+ years has also been observed in other measurements too, the reason of which is attributable to pubertal growth.

The mean values of mid upper arm circumference at 4+ yrs are 14.85 cm and 14.96 cm among the Sekmai boys and girls respectively. There is a total gain of 2.3 cm and 2.61 cm in the boys and girls respectively during 4+ to 10+ years of age

(Table 9 & 10). The growth gradients indicate that the girth of mid upper arm of Sekmai boys attain 86.59 per cent of its mature size at 4+ years. While in the girls it attains 85.15 per cent growth of its mature size at 4+ years. At 7+ years 93.24 per cent growth is completed and remaining 6.76 per cent of growth is achieved during 4+ and 10+ years in the boys. In the girls the girth of mid upper arm attains 88.84 per cent at 7+ years and remaining 17.16 per cent is completed during 7+ to 10+ years.

Distance and velocity curves display a very uneven trend of increase in the circumference of mid upper arm. Velocity curve of the boys exhibits two distinct spurts, the first one at 6+ (during 5+ to 6+) years with an intensity of 0.53 cm (absolute growth) and the second one at 10+ years with an intensity of 0.62 cm. Velocity curve of the girls is serrated like a saw with three very distinct alternate spurts. The first spurt occurs at 6+ years with an intensity of 0.66 cm, the second one, which is the highest (1.18 cm) occurs at 8+ years and the third one is at the end. i.e. at 10+ years (0.88 cm). Regain of spurts at 10+ years is seen in both the sexes. This may be related with the onset of pubertal growth.

Table 11 displays the comparative 50th percentile values of height of National Child Health Statistics (NCHS), Indian as well as the Sekmai children of 4⁺ to 10⁺ years of age. It appears that the American children, representing National Child Health Statistics (NCHS), are taller than the Indian children in all the age groups with a few exceptions of 5⁺ and 6⁺ year groups, during which the 50th percentile values of Indian girls are narrowly greater than those of NCHS girls. The Sekmai children are, however, shorter even from the Indian children. This is true in both the sexes as well as in all the age groups. Median height (i.e. 50th percentile) of NCHS boys ranges from 106.6 cm. at 4⁺ years of age to 140.3 cm. at 10⁺ years. This height for the Indian boys of 4⁺ years is 104.8 cm. and that of the Sekmai boys is 100.0 cm. At the age of 10⁺ years the height of the Indian boys increases up to 138.0 cm. and the Sekmai boys' up to 132.00 cm. This height among the NCHS girls ranges from 105.0 cm. at 4⁺ year to 141.5 cm. at 10⁺ years. Indian girls show the picture as 104.0 cm. at 4⁺ year and 138.2 at 10⁺ years. For the Sekmai girls it ranges from 99.4 cm. at 4⁺ years to 135.8 cm. at 10⁺ years.

Table 12 exhibits the 50th percentile values of weight of these children. Almost the same picture is observed in case of weight too. The Indian children are lighter than those of NCHS and the Sekmai children represent the lightest of the three groups in all the age groups. The weight of 4⁺ years old NCHS boys is 17.7 kg. While that of the girls is 16.8 kg. The weights for Indian children of this age group are 17.0 kg. for boys and 15.7 kg. for girls. The respective median weights of the Sekmai boys and girls of the same age group are 14.1 kg. and 14.0 kg. At the age of 10⁺ years the weights of NCHS is 31.4 kg. and 32.6 kg. for Indians girls. The weight for 10⁺ years old Sekmai boys is 28.2 kg. and 28.9 kg. for the girls. It is noteworthy that in all the data of NCHS, India and the present study, the girls of 10⁺ year's group overtake their counterpart boys in both the height

and weight. This is an indication of early maturation of the girls than the boys. Generally the boys are heavier than the girls. But by virtue of earlier onset of maturation of the girls, they may overtake the boys in size and weight during certain period of growth. In table 12 and 13 of the present study, dominance of the girls over the boys in height and weight is seen from 8+ years onwards among the Sekmai children.

CONCLUSION

It is learned from the present study the boys are on average, taller than the girls from 4+ years onwards up to 7+ years But at 8+ years the girls overtake the boys and at the age of 10+ years the girls clearly exceed the boys, on the other hand, Again the boys are heavier than the girls from 4+ years up to 7+ years and from 8+ years onwards the girls overtake the boys. It may be an indication of earlier onset of maturation of girls than the boys. However the Sekmai children are shorter(statures) and lighter than the NCHS and Indian children, The main reason may be due to the difference in the genetic potential, low socio economic condition or due to nutritional constraints. Hence there is need of further study and making awareness about nutrition and health to improve the health status of the Sekmai children.

Table 1 Statistical constant of height (Cm) of Sekmai boys

Age in years	No	Mean + S.E	SD	GROWTH		Growth Gradient
				Absolute	% per annum	
4+	41	100.27	0.76	4.89	0	75.32
5+	56	109.16	0.68	5.11	8.89	82
6+	54	115.55	0.81	5.96	6.39	86.8
7+	53	119.71	0.84	6.08	4.16	89.93
8+	51	124.81	0.72	5.13	5.1	93.76
9+	51	127.15	0.69	4.91	2.34	95.52
10+	54	133.12	0.67	4.9	5.97	100

Table 2 Statistical constant of height (Cm) of Sekmai girls

Age in years	No	Mean + S.E	SD	GROWTH		Growth Gradient
				Absolute	% per annum	
4+	45	98.88	0.7	4.67	0	73.21
5+	50	107.97	0.68	4.79	9.09	79.94
6+	53	113.45	0.73	5.33	5.48	84
7+	55	118.19	0.71	5.26	4.74	87.51
8+	55	125.91	0.62	4.59	7.72	93.23
9+	61	126.97	0.58	4.54	1.06	94.01
10+	52	135.06	0.77	5.56	8.09	100

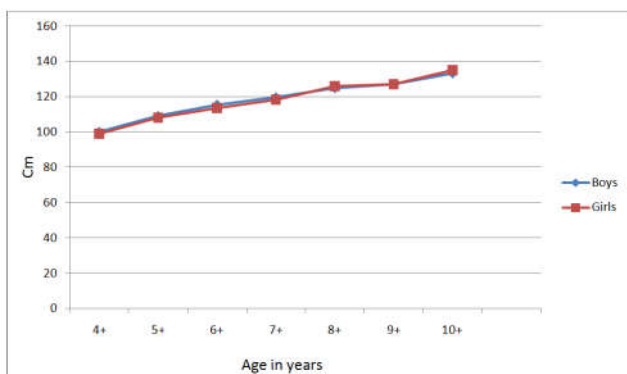


Fig 1 A Velocity Curve (Height)

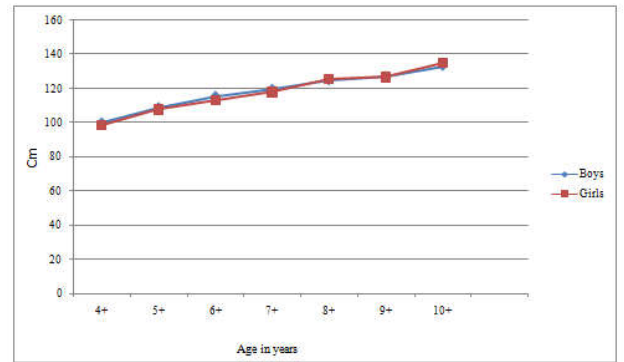


Fig 1B Distance Curve (Height)

Table 3 Statistical constant of body weight (Kg) of Sekmai boys

Age in years	No	Mean + S.E	SD	GROWTH		Growth Gradient
				Absolute	% per annum	
4+	41	13.94	0.23	1.46	0	51.44
5+	56	17.1	0.29	2.17	3.16	63.1
6+	54	19.64	0.33	2.43	2.54	72.47
7+	53	21.69	0.35	2.51	2.05	80.04
8+	51	23.25	0.34	2.44	1.56	85.79
9+	51	25.04	0.38	2.72	1.79	92.4
10+	54	27.1	0.37	2.67	2.06	100

Table 4 Statistical constant of body weight (Kg) of Sekmai Girls

Age in years	No	Mean + S.E	SD	GROWTH		Growth Gradient
				Absolute	% per annum	
4+	45	13.62	0.21	1.42	0	48.5
5+	50	16.29	0.28	1.99	2.67	58.01
6+	53	18.34	0.32	2.34	2.05	65.31
7+	55	20.40	0.32	2.4	2.06	72.65
8+	55	24.03	0.38	2.85	3.63	85.58
9+	61	25.03	0.29	2.32	1	89.14
10+	52	28.08	0.40	2.9	3.05	100

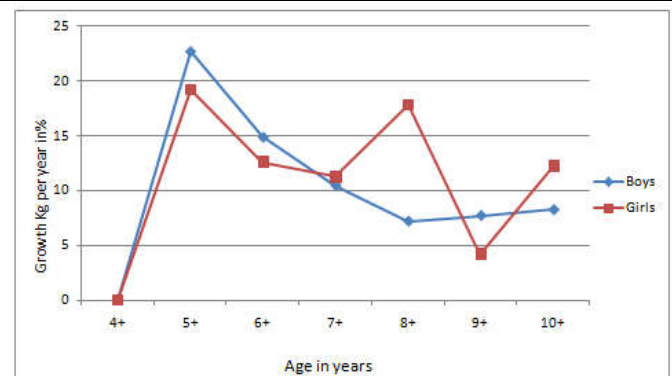


Fig 2 A Velocity Curve (weight)

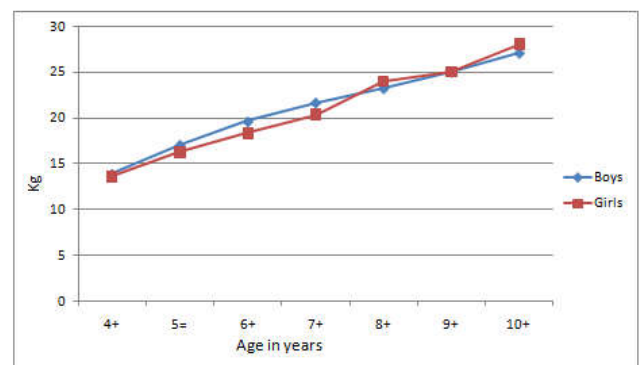


Fig 2 B Distance Curve (Weight)

Table 5 Statistical constant of constant of head circumference (Cm) of Sekmai boys

Age in years	No	Mean + S.E	SD	GROWTH		Growth Gradient	
				Absolute	% per annum		
				4+	41		48.87
5+	56	49.65	0.15	1.14	0.78	1.6	96.78
6+	54	50.16	0.2	1.48	0.51	1.03	97.78
7+	53	51.22	0.18	1.34	1.06	2.11	99.84
8+	51	51.4	0.22	1.54	0.18	0.35	100.19
9+	51	51.58	0.15	1.08	0.18	0.35	100.55
10+	54	51.3	0.16	1.18	-0.28	-0.54	100

Table 6 Statistical constant of head circumference (Cm) of Sekmai girls

Age in years	No	Mean + S.E	SD	GROWTH		Growth Gradient	
				Absolute	% per annum		
				4+	45		48.77
5+	50	49.18	0.15	1.04	0.41	0.84	95.25
6+	53	49.67	0.2	1.45	0.49	1	96.19
7+	55	50.08	0.26	1.94	0.41	0.83	96.98
8+	55	50.72	0.16	1.22	0.64	1.28	98.22
9+	61	51.24	0.16	1.26	0.52	1.03	99.23
10+	52	51.64	0.18	1.32	0.4	0.78	100

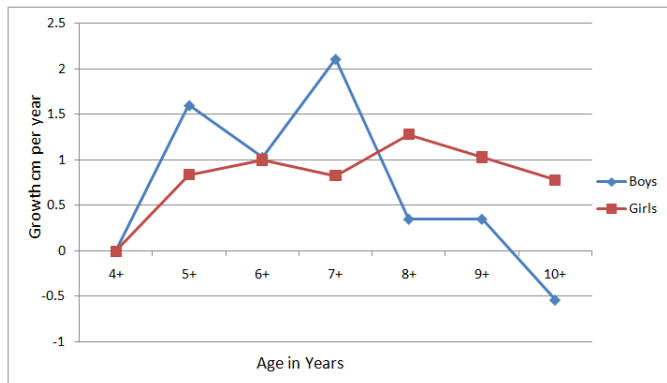


Fig 3A Velocity Curve (Head Circumference)

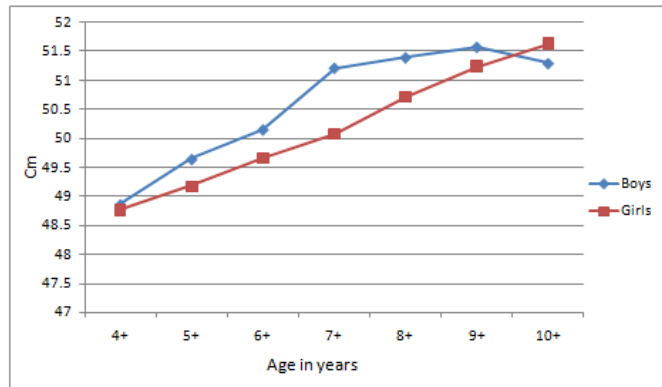


Fig 3 B Distance Curve (Head Circumference)

Table 7 Statistical constant of chest circumference (Cm) of Sekmai boys

Age in years	No	Mean + S.E	SD	Growth		Growth gradient	
				Absolute	% per annum		
				4+	41		51.69
5+	56	54.12	0.3	2.19	2.43	4.7	88.63
6+	54	56.36	0.36	2.61	2.24	4.14	92.3
7+	53	57.63	0.35	2.57	1.27	2.25	94.38
8+	51	58.88	0.28	2.03	1.25	2.17	96.43
9+	51	60.07	0.34	2.42	1.19	2.02	98.38
10+	54	61.06	0.46	3.41	0.99	1.65	100

Table 8 Statistical constant of chest circumference (cm) of Sekmai girls

Age in years	No	Mean + S.E	SD	GROWTH		Growth Gradient	
				Absolute	% per annum		
				4+	45		51.43
5+	50	53.8	0.34	2.4	2.37	4.61	87.35
6+	53	54.81	0.32	2.33	1.01	1.88	88.99
7+	55	55.86	0.33	2.42	1.05	1.92	90.7
8+	55	58.90	0.45	3.35	3.04	5.44	95.63
9+	61	58.78	0.40	3.15	-0.12	-0.2	95.44
10+	52	61.59	0.51	3.69	2.81	4.78	100

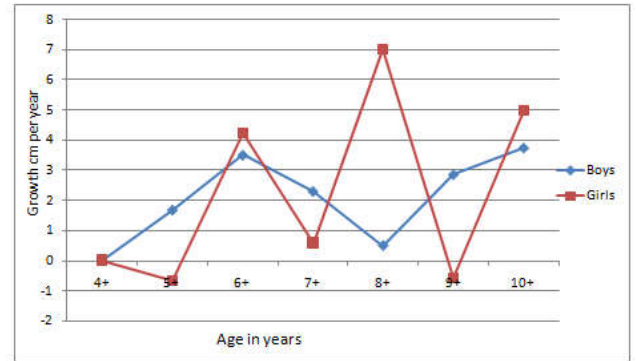


Fig 4 A Velocity Curve (Chest Circumference)

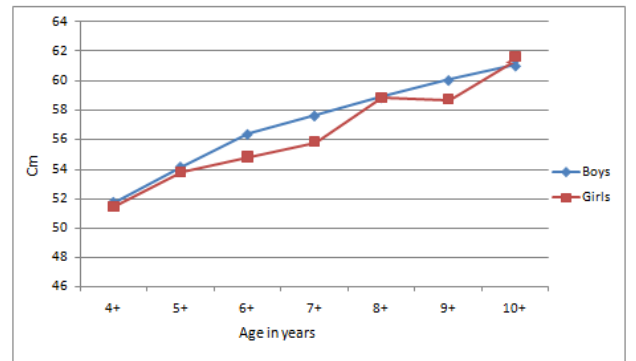


Fig 4 B Distance Curve (Chest Circumference)

Table 9 Statistical constant of mid upper arm circumference (Cm) of Sekmai boys

Age in years	No	Mean + S.E	SD	GROWTH		Growth Gradient	
				Absolute	% per annum		
				4+	41		14.85
5+	56	15.1	0.12	0.91	0.25	1.68	88.05
6+	54	15.63	0.11	0.77	0.53	3.51	91.14
7+	53	15.99	0.14	1.02	0.36	2.3	93.24
8+	51	16.07	0.10	0.74	0.08	0.5	93.7
9+	51	16.53	0.14	0.96	0.46	2.86	96.38
10+	54	17.15	0.13	0.99	0.62	3.75	100

Table 10 Statistical constant of mid upper arm circumference (Cm) of Sekmai girls

Age in years	No	Mean + S.E	SD	GROWTH		Growth Gradient	
				Absolute	% per annum		
				4+	45		14.96
5+	50	14.86	0.12	0.88	-0.1	-0.67	84.58
6+	53	15.52	0.12	0.86	0.66	4.25	88.33
7+	55	15.61	0.15	1.09	0.09	0.58	88.84
8+	55	16.79	0.17	1.26	1.18	7.03	95.56
9+	61	16.69	0.12	0.96	-0.1	-0.6	94.99
10+	52	17.57	0.19	1.37	0.88	5.01	100

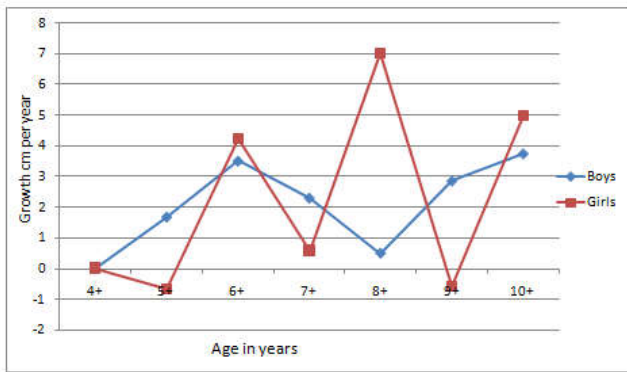


Fig 5 A Velocity Curve (Mid Upper Arm Circumference)

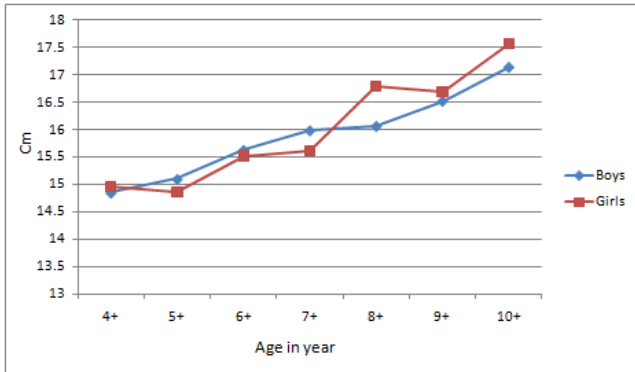


Fig 5 B Distance Curve (Mid Upper Arm Circumference)

Table 11 comparative figures of 50th percentile values of height (cm.) of nchs, indian boys & girls and present study.

Age	NCHS		India		Present Study	
	Male	Female	Male	Female	Male	Female
4+	106.6	105	104.8	104	100.8	99.4
5+	113.1	111.6	112.4	112.5	109.45	107.85
6+	119	117.6	118.8	117.8	115.55	113.9
7+	124.4	123.5	123.2	123.2	118.5	117.8
8+	129.6	129.3	127.9	127.2	125.6	126.2
9+	134.8	135.2	133.3	132.5	127.4	128
10+	140.3	141.5	138	138.2	132	135.8

Table 12 Comparative Figures of 50th Percentile Values of weight (kg.) of nchs, indian boys & girls and present study.

Age	NCHS		India		Present Study	
	Male	Female	Male	Female	Male	Female
4+	17.7	16.8	17	15.7	14.1	14
5+	19.7	18.6	19.2	18.6	16.9	16.2
6+	21.7	20.6	21.9	20.5	19.1	18.3
7+	24	23.3	24.3	23.8	20.9	20.1
8+	26.7	26.6	26.1	26	23.2	24.1
9+	29.7	30.5	29.2	29	25.1	25.1
10+	33.3	34.7	31.4	32.6	28.2	28.9

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