

CHAPTER-IV

RESULTS

GROWTH PATTERN

The anthropometric data have been analysed statistically to obtain the different results of measurements. The tabulated data and the graphic figures have been made in order to study and compare the variable values of growth. The graphs have been plotted together for both the sexes from age 8 to 18 years. These graphs depicted the mean course of growth of all the measurements. The mean, standard deviation, covariance, range and increment/year of various anthropometric variables have been presented in a tabulated form from table 2 to table 15, and the distance and velocity curves have also been drawn from figure 2 to 15.1.

Sex	Age Group	N	Mean	SD	CV	Range		Increment /Year
						MIN	MAX	
Boys	8	32	19.188	2.292	11.946	15.5	27.0	
	9	39	21.628	2.566	11.864	16.0	27.0	2.440
	10	34	22.485	2.589	11.516	18.0	28.5	0.857
	11	39	26.179	3.184	12.162	19.0	35.0	3.694
	12	43	29.000	5.093	17.561	22.5	40.0	2.821
	13	42	33.012	4.562	13.819	23.0	46.5	4.012
	14	41	38.073	5.686	14.935	27.0	51.0	5.061
	15	34	43.044	7.210	16.751	30.0	57.0	4.971
	16	46	47.772	7.442	15.579	30.0	69.0	4.728
	17	31	51.016	5.444	10.671	42.0	62.0	3.244
	18	38	51.211	5.472	10.685	39.5	63.0	0.195
Girls	8	41	18.939	2.396	12.650	15.0	24.5	
	9	45	21.436	2.904	13.545	14.0	29.0	2.497
	10	49	24.492	3.829	15.635	19.0	34.0	3.056
	11	64	28.348	5.331	18.804	20.0	47.0	3.856
	12	42	30.476	5.648	18.533	19.0	44.0	2.128
	13	52	36.615	5.755	15.718	22.0	48.0	6.139
	14	47	39.915	6.385	15.996	22.0	56.0	3.300
	15	41	43.829	5.023	11.461	32.0	62.0	3.914
	16	42	44.893	5.315	11.839	35.0	56.5	1.064
	17	40	45.050	4.842	10.748	35.0	56.0	0.157
	18	44	47.659	5.878	12.334	37.0	60.0	2.609

Table 2: Age Group Wise on Mean, SD, CV and Range for Weight in boys and girls

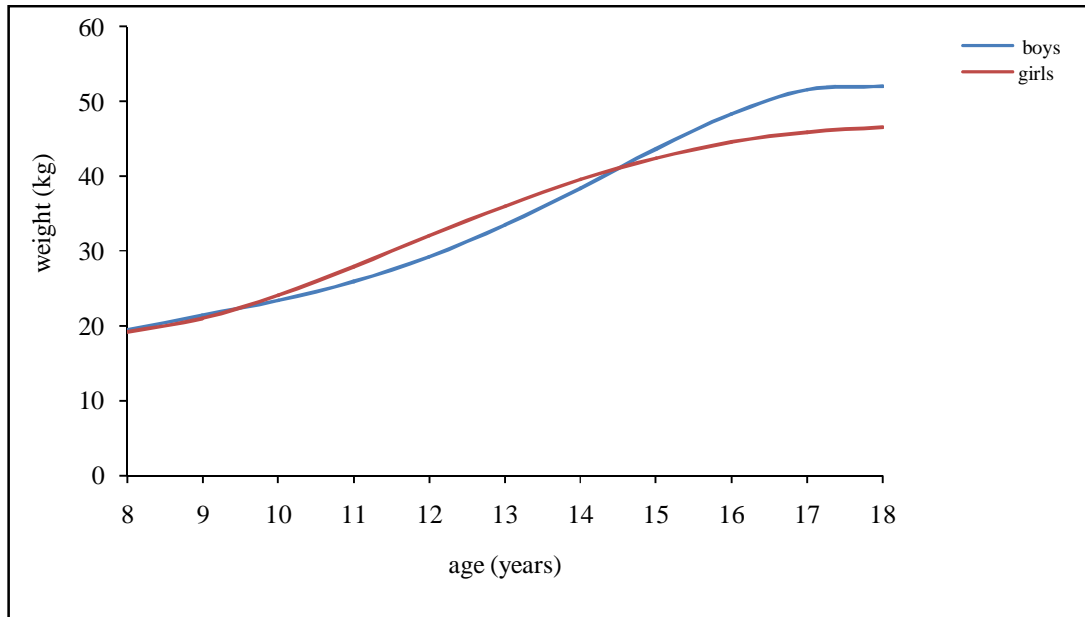


Figure 2: Smooth Distance curve of Weight of boys and girls

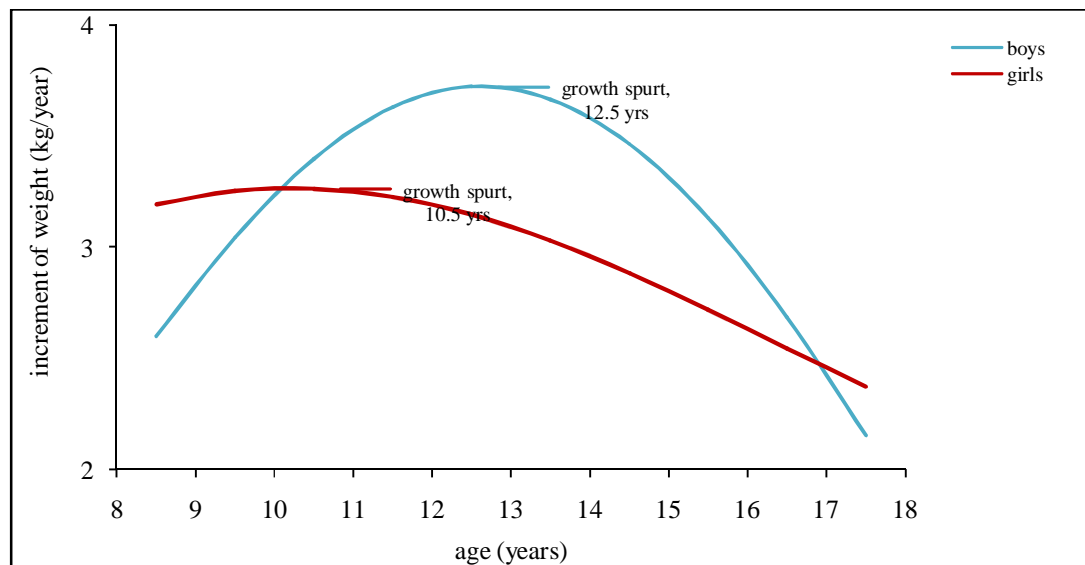


Figure 2.1: Smooth Velocity curve of Weight of boys and girls

Weight: The weight of the subjects had shown an increasing gain with increasing age groups from 8-18 years in both the sexes. In boys, the weight was slightly heavier than the girls in age groups 8-9 years then proceeded to be lighter from 10-15 years and started to be heavier again from 16-18 years. The maximum mean difference was observed at age group 14 years in boys and 13 years in girls and the maximum and minimum weight distributions in boys were 69.0 kg and 15.5 kg and in girls were 62.0

kg and 14.0 kg. The greatest increase of mean from age 8-18 years was 32.02 kg (62.53%) and 28.72 kg (60.26%) in both boys and girls respectively, the sample variability was observed at age group 12 years in boys and 11 years in girls (figure: 2 and table: 2).

The growth rate of weight in boys was reducing and gaining from age 9-12 years and proceeded to show a slight increment upto the age of 14 years, thereafter, the growth rate slows down as the age increases from the age 15-18 years. In girls the distribution of weight had shown a gaining growth from age groups 9-11 years, reducing from 11 years and started gaining again from age groups 12-13 years, but after the age of 13 years the growth rate ceased steeply except at the age of 15 and 18 years where the growth rate showed better increment. While comparing between the sexes, it can be seen from the figure: 2.1 and table: 2 that the growth rate of girls is better than the boys in the young ages that is 9-11 years, 13 years and also at later stage of 18 years, whereas in other ages the boys have better weight increment than the girls.

On smoothening the weight through the fourth degrees of polynomial and the first degree of its derivatives, the boys showed an adult weight of 51.30 kg, the peak weight of 33.43 kg at the age of 12.50 years with a velocity rate of 3.72 kg/years; where as in girls an adult weight of 47.04 kg, peak weight at 27.76 kg at the age of 10.50 years and the velocity rate of 3.26 kg/year, this predicted that, the boys (51.211 kg) have yet to achieve the adult weight and the girls (47.659 kg) have already achieved at the age of 18 years, it can also be said that the adolescent growth spurt of the weight shows respectively at the age of 12.5 years and 10.5 years in boys and girls (figure: 2.1).

Height: A similar growth pattern also occurred with the height, where the subjects have got an increasing height gradually with respect to age in both the sexes. The height of the boys was shorter from age groups of 8-13 years and started to be taller from age groups 14-18 years to the girls'. The maximum mean difference was observed at age group 14 years in boys and 11 years in girls. The maximum and minimum distributions of height were 173.5 cm and 104.9 cm in boys, and 161.5 cm and 104.1 cm in girls. The greatest increase of mean from age 8-18 years was 45.81 cm (28.58%) in

boys and 33.81 cm (22.48%) in girls and the sample variability was observed at age group 12 years in boys and 11 years in girls (figure: 3 and table: 3).

Sex	Age Group	N	Mean	SD	CV	Range		Increment /Year
						MIN	MAX	
Boys	8	32	114.488	4.594	4.013	104.9	124.0	
	9	39	120.390	4.667	3.877	113.3	130.9	5.902
	10	34	123.259	5.245	4.256	113.5	134.3	2.869
	11	39	129.851	6.201	4.782	117.5	147.1	6.592
	12	43	135.037	8.098	5.997	121.3	148.6	5.186
	13	42	140.710	7.395	5.256	121.2	156	5.673
	14	41	148.081	6.266	4.231	133.7	158.4	7.371
	15	34	154.000	7.972	5.177	133.6	171.2	5.919
	16	46	157.048	7.460	4.750	138.0	173.5	3.048
	17	31	159.045	4.977	3.129	149.7	172.2	1.997
	18	38	160.300	5.743	3.583	145.2	170.1	1.255
Girls	8	41	116.559	5.456	4.680	106.4	128.3	
	9	45	120.958	5.576	4.610	104.1	132.5	4.399
	10	49	126.469	7.114	5.625	114.0	146.5	5.511
	11	64	132.328	8.270	6.249	113.5	157.0	5.859
	12	42	136.757	7.217	5.277	120.4	158.0	4.429
	13	52	142.131	6.886	4.845	122.2	156.9	5.374
	14	47	145.096	5.715	3.939	130.0	155.7	2.965
	15	41	148.746	3.558	2.392	142.5	155.0	3.650
	16	42	148.843	3.816	2.564	139.7	157.0	0.097
	17	40	148.937	4.723	3.171	139.2	157.0	0.094
	18	44	150.364	5.755	3.828	136.8	161.5	1.427

Table 3: Age Group Wise on Mean, SD, CV and Range for Height in boys and girls

The increment has shown that (table: 3), the height in boys, is reducing and increasing from the age groups of 9-14 years, whereas, after the age of 14 years the rate of growth reduces as the age increases. In girls although it showed a gradual increase in younger ages (9-11 years) and older ages (16-18 years) but between the age groups of 12-15 years it fluctuated by decreasing and increasing in the height. In comparison between boys and girls, it can be seen that, the boys' growth rate is higher than the girls' in all the ages, except at the age groups 10 and 18 years where the girls' is slightly higher than the boys.

On smoothening the height through the model of Preece and Baines, it is predicted that, in boys, an adult height of 160.64 cm, peak height of 148.44 cm at the age of 14.08 years and velocity rate of 6.95 cm/year can be attained, this shows that, the boys' height (160.300 cm) at the age of 18 years has not yet reached the adult height

and the adolescent growth spurt occurred at 14.08 years; whereas in girls the model predicted an adult height of 150.22 cm, peak height of 139.43 cm at the age of 12.44 years and the velocity rate of 5.48 cm/year. This shown that the girls' height (150.36 cm) has reached the adult height by the age 18 years and the growth spurt occurred at the age of 12.44 years (figure: 3.1).

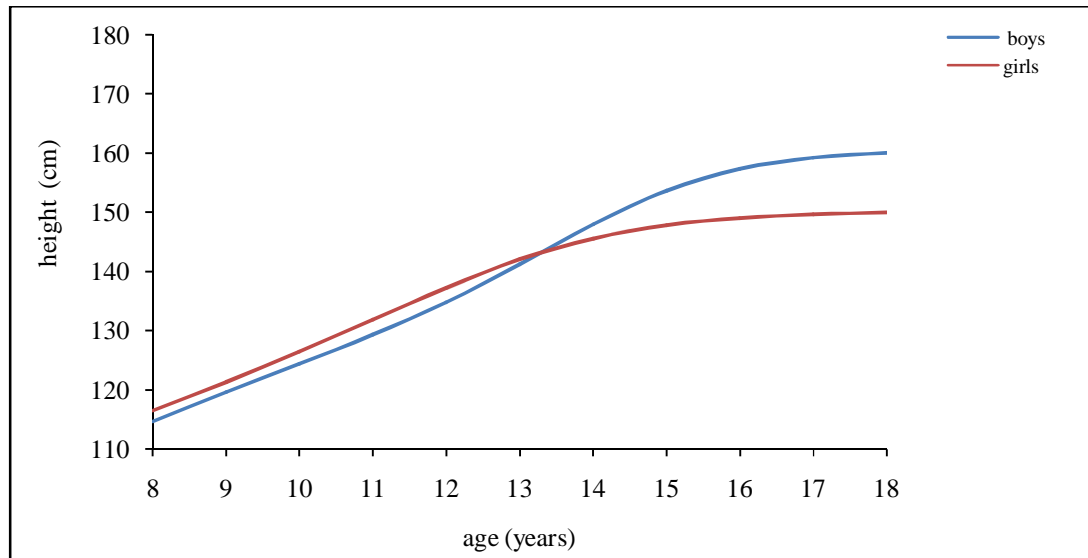


Figure 3: Smooth Distance curve of Height of boys and girls

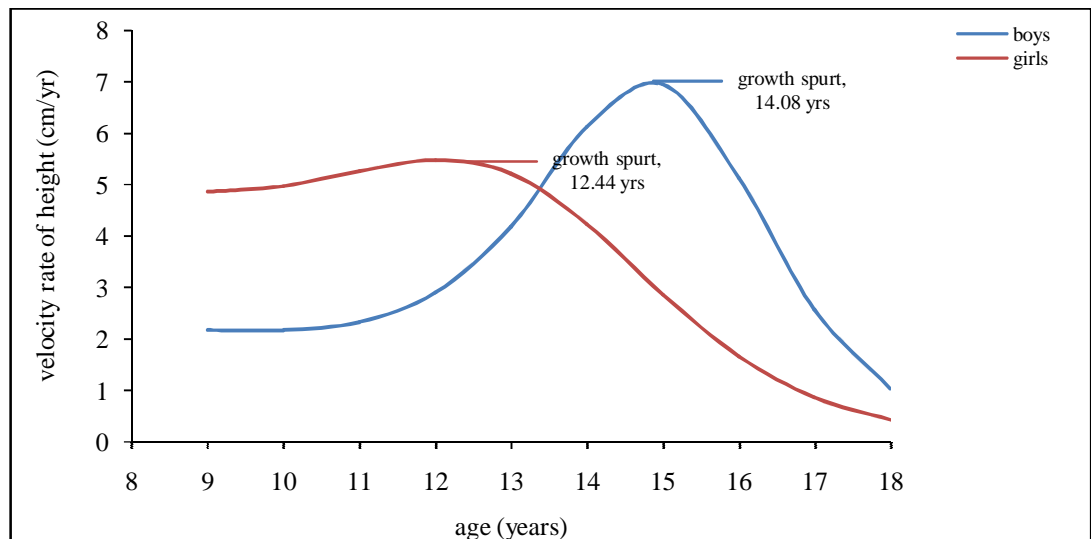


Figure 3.1: Smooth Velocity curve of Height of boys and girls

Sitting Height: Besides weight and height, sitting height also displayed an increasing growth gradually from age groups 8-18 years in both sexes. The sitting height

of boys was slightly shorter at the age group of 8 years and 10-14 years, however it was increasing in the age group of 9 years and 15-18 years when compared to that of the girls'. The maximum mean difference was observed at age group 14 years in boys and 13 years in girls. The maximum and minimum distributions of sitting height were 92.3 cm and 54.3 cm in boys and 89.5 cm and 47.3 cm in girls. The greatest increase of mean from age 8 to 18 years was 22.78 cm (26.84%) in boys and 17.57 cm (21.86%) in girls. The sample variability was observed at age group 15 years in boys and 9 years in girls (figure: 4 and table: 4).

Sex	Age Group	N	Mean	SD	CV	Range		Increment /Year
						MIN	MAX	
Boys	8	32	62.094	2.537	4.085	54.3	66.7	
	9	39	64.592	2.368	3.666	59.1	68.9	2.498
	10	34	65.141	2.297	3.527	61.5	70.9	0.549
	11	39	68.482	3.097	4.523	62.1	77.6	3.341
	12	43	69.988	3.746	5.353	62.2	77.3	1.506
	13	42	73.345	3.933	5.363	63.8	81.2	3.357
	14	41	76.841	3.814	4.964	69.0	84.9	3.496
	15	34	79.876	4.540	5.684	69.7	89.5	3.035
	16	46	82.178	4.145	5.044	71.0	92.3	2.302
	17	31	84.190	2.777	3.299	79.3	90.7	2.012
	18	38	84.874	2.853	3.361	78.4	90.3	0.684
Girls	8	41	62.834	3.119	4.963	57.5	72.6	
	9	45	63.469	4.482	7.061	47.3	70.1	0.635
	10	49	67.060	3.169	4.726	61.2	76.4	3.591
	11	64	69.980	4.276	6.111	59.9	84.0	2.920
	12	42	71.640	3.701	5.166	63.5	81.6	1.660
	13	52	75.271	3.655	4.856	65.6	81.7	3.631
	14	47	76.947	3.441	4.472	67.2	84.3	1.676
	15	41	78.995	2.308	2.921	73.3	83.9	2.048
	16	42	79.264	2.491	3.143	73.2	84.6	0.269
	17	40	79.313	2.435	3.070	74.3	83.9	0.049
	18	44	80.407	3.478	4.325	71.5	89.5	1.094

Table 4: Age Group Wise on Mean, SD, CV and Range for Sitting Height in boys and girls

The growth rate in sitting height of the boys fluctuated by decreasing and increasing at the respective age groups alternatively from 9-13 years, thereafter, decreasing slowly till the age groups of 18 years. However, in girls the growth rate was also fluctuated by increasing and decreasing at the respective age groups alternatively from 9-15 years then ceased down upto the age group of 17 years and it tended to increase again at the age group of 18 years. While comparing, the growth rate of the

boys was advanced in the age groups of 9 years, 12 years and 14 to 17 years where as in other age groups was decreasing to the girls’.

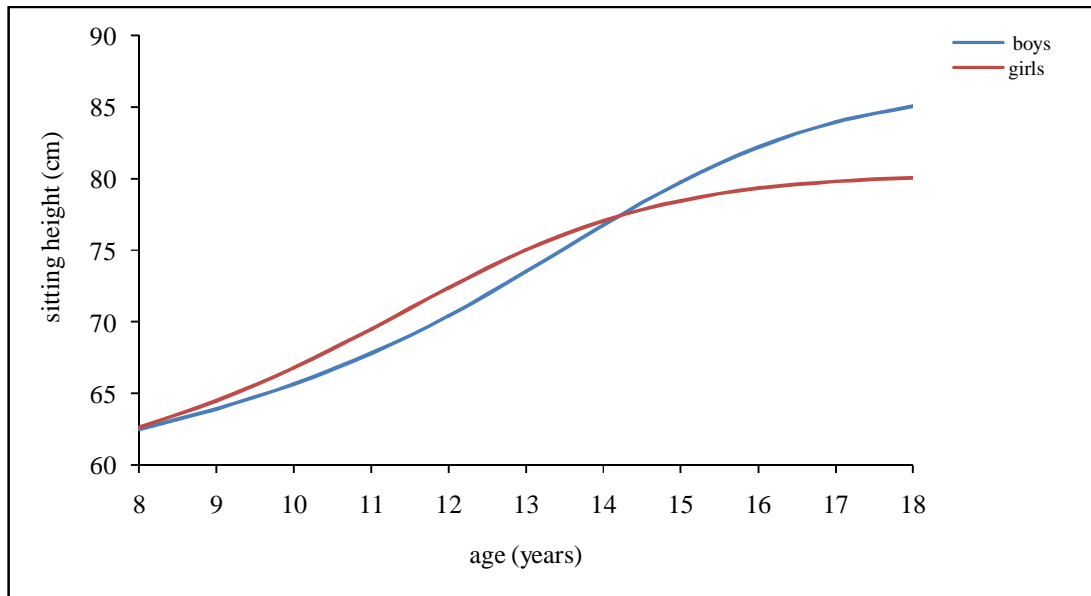


Figure 4: Smooth Distance curve of Sitting Height of boys and girls

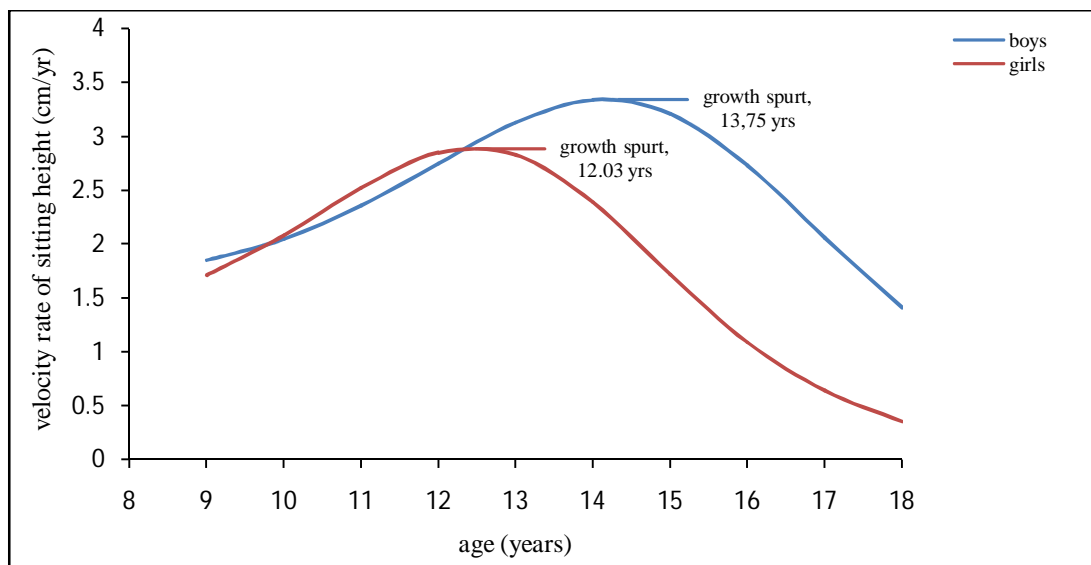


Figure 4.1: Smooth Velocity curve of Sitting Height of boys and girls

The sitting height of the boys predicted by the model that, the adult sitting height was 86.67 cm, the peak sitting height of 76.58 cm at the age of 13.75 years and the velocity rate of 3.34 cm/year, this shows that, the boy’s sitting height (84.874 cm) has not yet reached the adult sitting height by the age of 18 years and the growth spurt has

occurred before the age of 14 years. In girls, the predicted values shown by the model that, the adult sitting height was 80.37 cm, the peak sitting height of 72.48 cm at the age of 12.03 years and the velocity rate of 2.85 cm/year. This also shows that, the girls (80.407 cm) at the age of 18 years have reached the adult sitting height and the growth spurt has already occurred before the 13 years (figure: 4.1) of age.

Sex	Age Group	N	Mean	SD	CV	Range		Increment /Year
						MIN	MAX	
Boys	8	32	25.134	1.263	5.028	23.1	29.5	
	9	39	26.215	1.333	5.315	22.8	28.8	1.081
	10	34	26.621	0.896	3.367	25.4	28.4	0.406
	11	39	27.867	1.270	4.559	25.0	30.2	1.246
	12	43	29.015	1.748	6.023	25.2	33.1	1.148
	13	42	30.767	1.922	6.247	26.6	36.2	1.752
	14	41	32.744	2.006	6.127	28.7	37.0	1.977
	15	34	33.894	2.185	6.447	29.0	39.0	1.150
	16	46	35.298	2.104	5.960	28.3	40.2	1.404
17	31	36.223	1.359	3.753	33.5	39.8	0.925	
18	38	36.679	1.758	4.792	32.1	40.1	0.456	
Girls	8	41	25.124	1.143	4.550	23.2	28.6	
	9	45	26.173	1.334	5.096	22.4	29.4	1.049
	10	49	27.379	1.631	5.959	24.5	32.2	1.206
	11	64	28.913	2.032	7.029	23.3	34.1	1.534
	12	42	29.771	2.113	7.099	25.0	35.0	0.858
	13	52	31.463	1.899	6.036	26.4	35.2	1.692
	14	47	31.989	1.736	5.427	28.0	35.3	0.526
	15	41	33.539	1.274	3.798	30.5	36.6	1.550
	16	42	33.431	1.317	3.939	31.2	36.5	-0.108
	17	40	33.510	1.177	3.513	30.5	36.2	0.079
18	44	34.307	1.403	4.088	31.3	36.6	0.797	

Table 5: Age Group Wise on Mean, SD, CV and Range for Biacromial Diameter in boys and girls

Biacromial Diameter: The subjects had shown an increasing biacromial diameter gradually from 8-18 years of age except at the age group of 16 years and 17 years where the girls showed a slightly decreased biacromial diameter. In boys the biacromial diameter was slightly broader in the age groups of 8-9 years, smaller from age groups 10-13 years and broader again from the age groups 14-18 years to the girls'. The maximum mean difference was observed at age group 14 years in boys and 13 years in girls. The maximum and minimum distributions of biacromial diameter were 40.2 cm and 22.8 cm in boys, and 36.6 cm and 22.4 cm in girls. The greatest increase of mean from age 8-18 years was 11.55 cm (31.48%) in boys and 9.18 cm (26.77%) in girls. The

sample variability was observed at age group 15 years in boys and 12 years in girls (figure: 5 and table: 5).

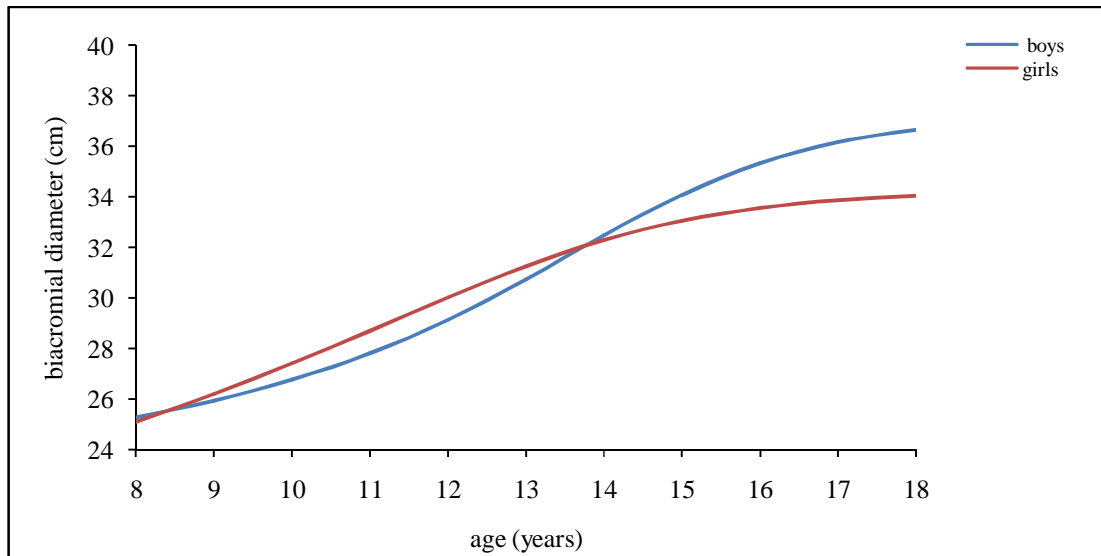


Figure 5.1: Smooth Distance curve of Biacromial Diameter of boys and girls

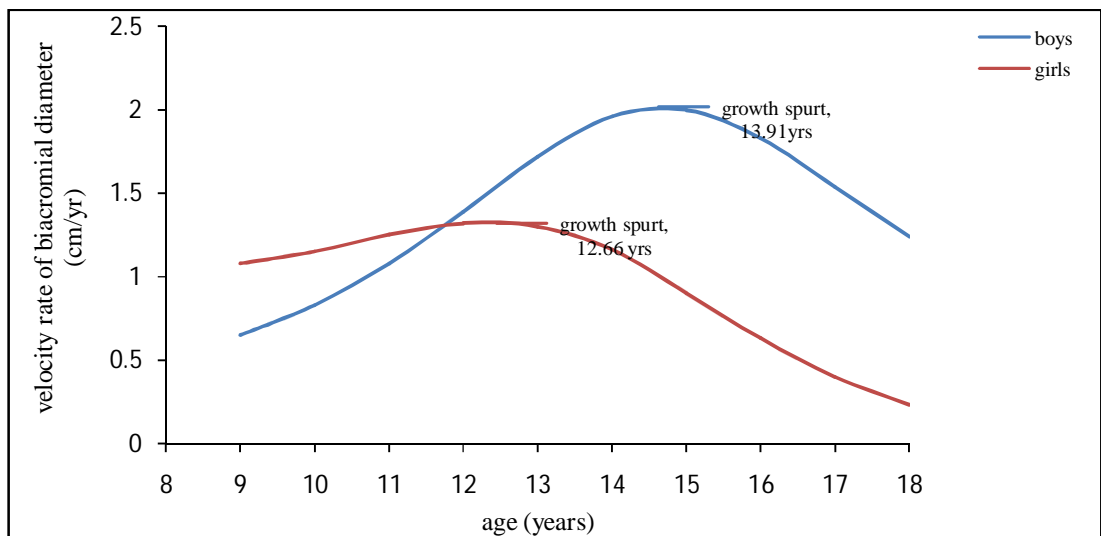


Figure 5.2: Smooth Velocity curve of Biacromial Diameter of boys and girls

The increment of growth (table: 5) had shown that, the rate of biacromial diameter in boys was increasing gradually in age groups from 9-14 years except at 10 and 12 years of age, thereafter decreasing slowly till the age groups of 18 years, except 15 years of age where the growth rate has increased slightly. However, in girls the growth rate was increasing from age groups of 9-11 years, thereafter it fluctuated by

decreasing and increasing at the respective age groups alternatively from 12-16 years and started increasing till age group 18 years. While comparing, the growth rate of the boys was advanced in the age groups of 9 years, 12 to 14 years and 16 to 17 years whereas in other age groups was decreasing to the girls'.

The biacromial diameter of the boys predicted by the model revealed that, the adult biacromial diameter of 37.30 cm, the peak biacromial diameter of 32.34 cm at the age of 13.91 years and the velocity rate at 2.00 cm/year can be attained. This shows that, the boys (36.679 cm) have not reached the adult biacromial diameter by the age of 18 years and the growth spurt has reached before the 14 years of age, whereas in girls, the model predicted the adult biacromial diameter of 34.27 cm, peak biacromial diameter of 30.86 cm at the age of 12.66 years and the velocity rate of 1.32 cm/years. This shown that the girls (34.307 cm) have reached the adult biacromial diameter by the age of 18 years and the growth spurt occurred before reaching the 13 years of age (figure: 5.1).

Chest Circumference: The chest circumference of the subjects has shown a broader chest girth gradually in both the sexes except at the age group of 18 years in boys. In boys, the chest circumference was broader in the younger age groups of 8-9 years and also at the age group of 17 years, whereas, the girls had a broader chest girth in all the other age groups studied. The maximum and minimum distributions of chest circumference were 95.0 cm and 52.0 cm in boys and 94.5 cm and 52.0 cm in girls. The greatest increase of mean from age 8-18 years was 24.25 cm (29.70 %) in boys and 26.43 cm (31.98 %) in girls. The sample variability was observed at age group 15 years in boys and 12 years in girls (figure: 6 and table: 6).

Velocity curve (figure: 6.1) also showed that, the growth rate of chest circumference in boys fluctuated by decreasing and increasing at the respective age groups alternatively from 9-13 years thereafter, slows down upto 15 years and tended to raise slightly to the age of 17 years but went down to decrease sharply at the age group of 18 years. However, in girls the growth rate increased from the age groups of 9-11 years thereafter, fluctuated by decreasing and increasing at the respective age groups alternatively from 12-17 years and started increasing again at the age group of 18 years. When compared, the growth rate of the boys was advanced in the later age groups of 14-

17 years where as in the other age groups was decreased to the girls'. It was observed from figure: 6.1 and table: 6 that the peak growth occurred at the age groups of 13 years in both boys and girls.

Sex	Age Group	N	Mean	SD	CV	Range		Increment /Year
						MIN	MAX	
Boys	8	32	57.406	2.313	4.030	53.7	64.3	
	9	39	59.513	2.489	4.182	55.0	64.0	2.107
	10	34	59.818	2.396	4.006	52.0	63.9	0.305
	11	39	62.979	2.875	4.565	55.5	68.3	3.161
	12	43	64.939	3.917	6.032	59.6	74.5	1.960
	13	42	68.643	3.451	5.027	62.0	76.1	3.704
	14	41	72.085	4.869	6.755	62.0	84.1	3.442
	15	34	75.300	5.383	7.148	66.2	87.0	3.215
	16	46	78.850	4.934	6.257	65.8	94.3	3.550
17	31	82.342	4.484	5.446	74.5	95.0	3.492	
18	38	81.655	3.760	4.604	74.0	88.2	-0.687	
Girls	8	41	56.220	2.298	4.088	52.6	63.5	
	9	45	58.482	2.830	4.839	52.5	65.0	2.262
	10	49	61.635	4.148	6.730	52.0	73.0	3.153
	11	64	65.052	4.863	7.475	56.1	85.0	3.417
	12	42	67.074	5.800	8.648	57.3	79.5	2.022
	13	52	73.850	5.701	7.719	57.5	83.0	6.776
	14	47	75.885	6.133	8.082	61.7	89.8	2.035
	15	41	79.349	3.899	4.913	68.0	89.0	3.464
	16	42	80.093	4.747	5.927	69.7	89.1	0.744
	17	40	80.588	5.269	6.538	68.2	94.5	0.495
	18	44	82.652	6.464	7.821	59.9	94.5	2.064

Table 6: Age Group Wise on Mean, SD, CV and Range for Chest Circumference in boys and girls

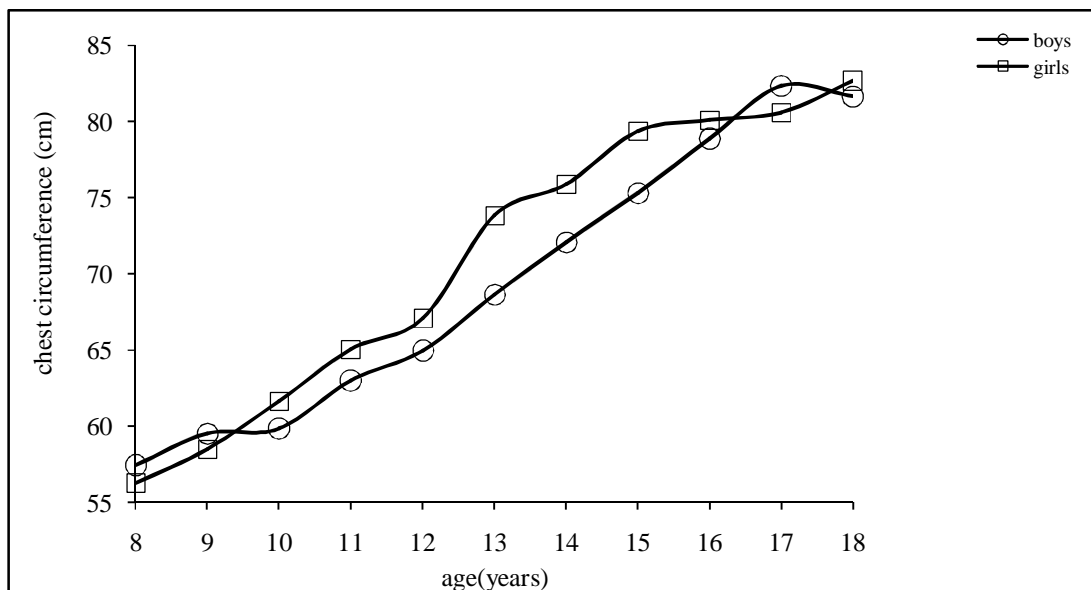


Figure 6.1: Distance curve of Chest Circumference of boys and girls

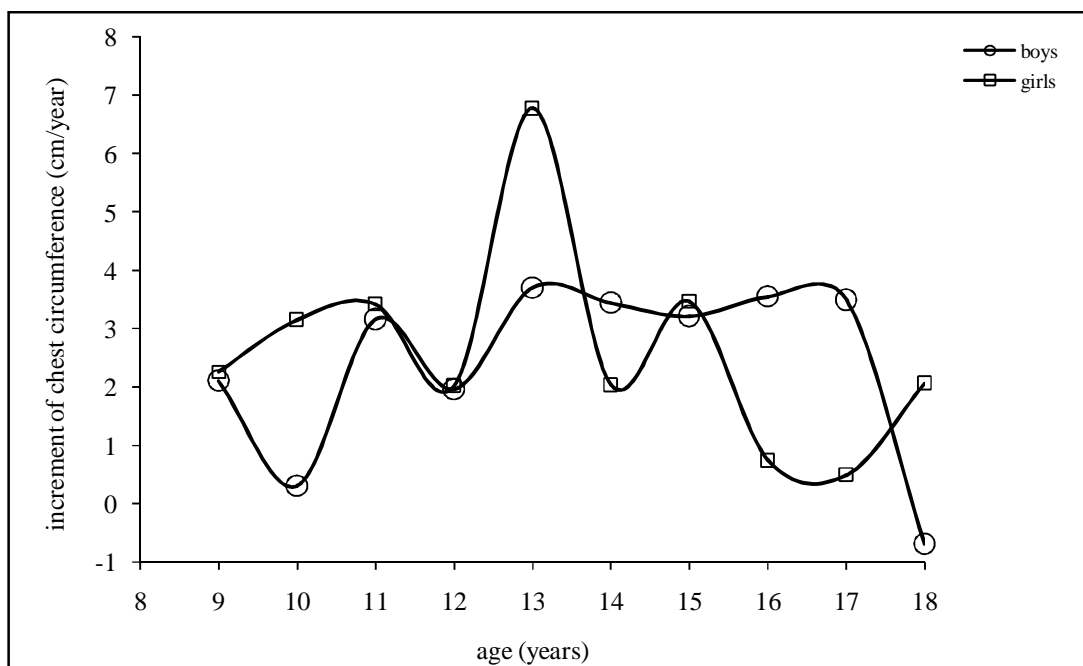


Figure 6.2: Velocity curve of Chest Circumference of boys and girls

Waist Circumference: The waist circumference of the subjects was shown broader in both the sexes gradually, except at age groups of 10 and 18 years where the boys show a slightly decreased circumference. While comparing in both sexes, it is evident from the table and figure (table: 7 and figure : 7) that, the boys showed a broader circumference in all the age groups from 8-18 years, except at the age groups of 10 and 13 years, where the girls had a better broader waist circumference than the boys. The maximum and minimum distributions of waist circumference were 81.0 cm and 47.1 cm in boys, and 76.7 cm and 42.6 cm in girls. The greatest increase of mean from age 8-18 years was 13.743 cm (20.61%) in boys and 14.321 cm (21.81%) in girls. The sample variability was observed at age group 15 years in boys and 17 years in girls.

Velocity curve (figure: 7.1) in both the sexes had shown that, the growth rate of waist circumference in boys fluctuated by decreasing and increasing at the respective age groups alternatively from 9-13 years thereafter, started increasing slowly upto the age group of 15 years and slightly increase from 15-16 years of age then, cease down sharply towards the age groups of 17-18 years. However, in girls the growth rate was also shown to have fluctuated by increasing and decreasing at the respective age groups alternatively from 9-17 years and tended to increase at the age group of 18 years. When

compared, the growth rate of the boys was advanced in age groups of 11 years and 14-17 years, whereas in other age groups was decreasing to the girls'. It was observed from figure: 7.1 and table: 7 that the peak growth occurred at the age group of 16 years in boys and 13 years in girls.

Sex	Age Group	N	Mean	SD	CV	Range		Increment /Year
						MIN	MAX	
Boys	8	32	52.925	2.856	5.396	48.6	61.2	
	9	39	54.338	2.949	5.427	47.1	60.1	1.413
	10	34	54.226	2.436	4.492	48.5	60.0	-0.112
	11	39	57.346	2.947	5.139	51.2	63.2	3.120
	12	43	57.946	3.589	6.193	52.9	69.8	0.600
	13	42	59.998	2.817	4.695	54.8	67.0	2.052
	14	41	61.773	3.623	5.866	54.3	68.0	1.775
	15	34	63.568	4.750	7.473	53.2	74.1	1.795
	16	46	65.915	4.558	6.915	57.6	81.0	2.347
	17	31	67.045	3.619	5.398	60.6	75.0	1.130
18	38	66.668	3.392	5.087	60.4	74.2	-0.377	
Girls	8	41	51.334	3.285	6.399	42.6	62.0	
	9	45	53.444	2.710	5.071	48.0	59.5	2.110
	10	49	54.715	3.467	6.337	49.2	63.5	1.271
	11	64	56.614	3.674	6.489	50.1	67.7	1.899
	12	42	57.621	3.978	6.903	47.2	69.9	1.007
	13	52	61.075	3.763	6.161	51.4	68.6	3.454
	14	47	61.706	4.504	7.298	48.9	70.3	0.631
	15	41	63.407	4.133	6.519	55.9	76.7	1.701
	16	42	63.845	3.935	6.163	55.1	73.4	0.438
	17	40	64.130	5.083	7.926	55.4	76.4	0.285
18	44	65.655	4.826	7.353	57.7	76.1	1.525	

Table 7: Age Group Wise on Mean, SD, CV and Range for Waist Circumference in boys and girls

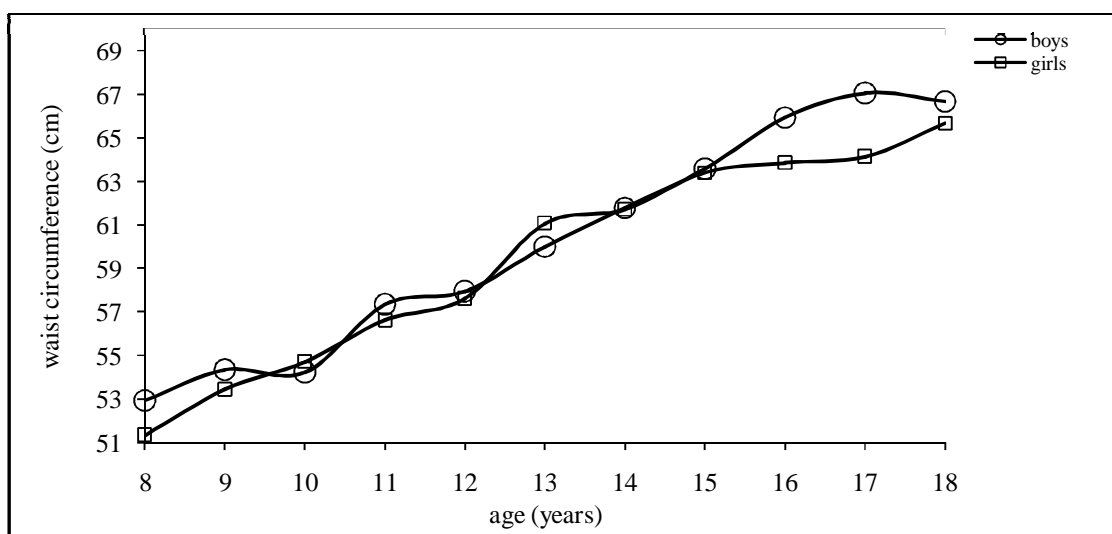


Figure 7.1: Distance curve of Waist Circumference of boys and girls

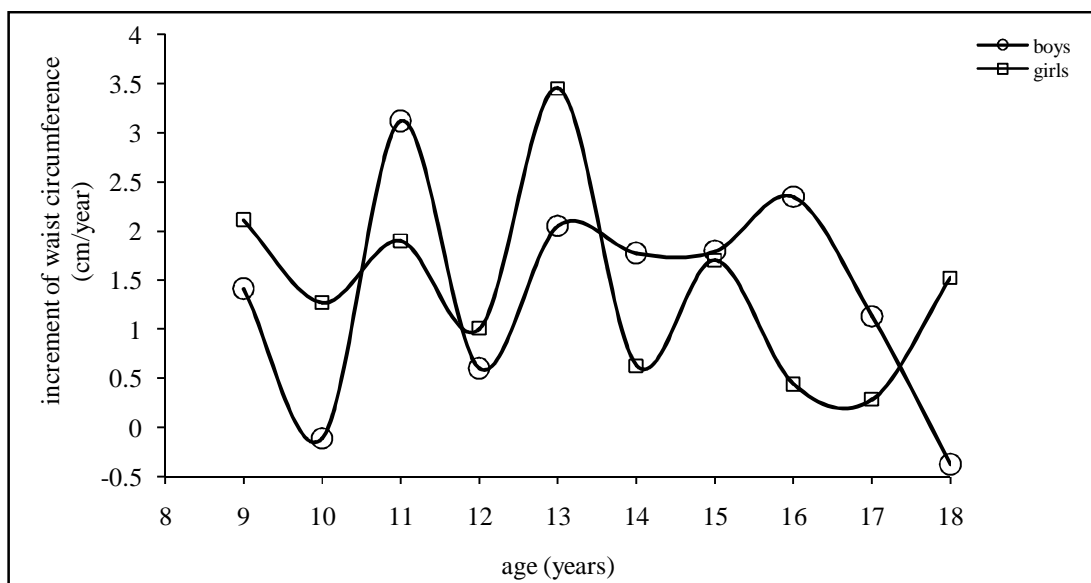


Figure 7.2: Velocity curve of Waist Circumference of boys and girls

Sex	Age Group	N	Mean	SD	CV	Range		Increment /Year
						MIN	MAX	
Boys	8	32	57.772	3.014	5.218	52.0	64.4	
	9	39	60.192	3.576	5.941	54.6	67.0	2.420
	10	34	60.503	2.600	4.297	56.7	67.9	0.311
	11	39	64.249	3.797	5.910	53.0	73.7	3.746
	12	43	67.222	4.254	6.329	61.0	76.2	2.973
	13	42	70.817	4.015	5.670	62.0	81.8	3.595
	14	41	74.698	4.951	6.627	63.8	85.0	3.881
	15	34	78.741	5.859	7.440	68.0	91.6	4.043
	16	46	81.961	4.747	5.792	73.8	95.5	3.220
17	31	83.984	3.717	4.426	78.0	92.2	2.023	
18	38	84.616	3.147	3.720	76.8	91.7	0.632	
Girls	8	41	58.012	3.711	6.397	50.3	64.9	
	9	45	60.904	3.355	5.509	51.3	68.6	2.892
	10	49	64.623	4.632	7.167	55.8	77.6	3.719
	11	64	67.902	5.993	8.826	54.8	86.7	3.279
	12	42	70.593	6.124	8.675	57.4	84.0	2.691
	13	52	77.360	6.573	8.496	57.5	89.3	6.767
	14	47	79.551	5.663	7.119	66.4	88.3	2.191
	15	41	83.585	3.333	3.987	74.7	89.6	4.034
	16	42	84.871	4.037	4.757	76.5	94.0	1.286
17	40	84.810	4.242	5.001	77.8	94.4	-0.061	
18	44	87.409	4.318	4.940	79.0	98.0	2.599	

Table 8: Age Group Wise on Mean, SD, CV and Range for Hip Circumference in boys and girls

Hip Circumference: The subjects had shown a broader hip circumference gradually in both sexes, except a slight decrease in age group 17 years of the girls. In

girls, the hip circumference was broader than the boys in all the age groups from 8 to 18 years. The maximum and minimum distributions of hip circumference were 95.5 cm and 52.0 cm in boys and 98.0 cm and 50.3 cm in girls. The greatest increase of mean from age 8 to 18 years was 26.84 cm (31.72%) in boys and 29.40 cm (33.63%) in girls. The sample variability was observed at age group 15 years in boys and 11 years in girls (figure: 8 and table: 8).

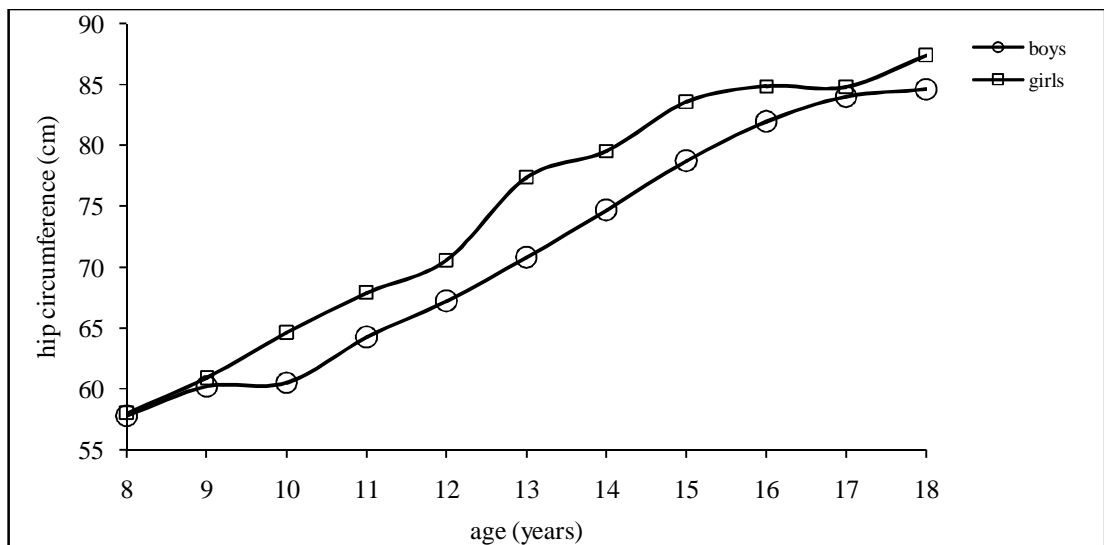


Figure 8.1: Distance curve of Hip Circumference of boys and girls

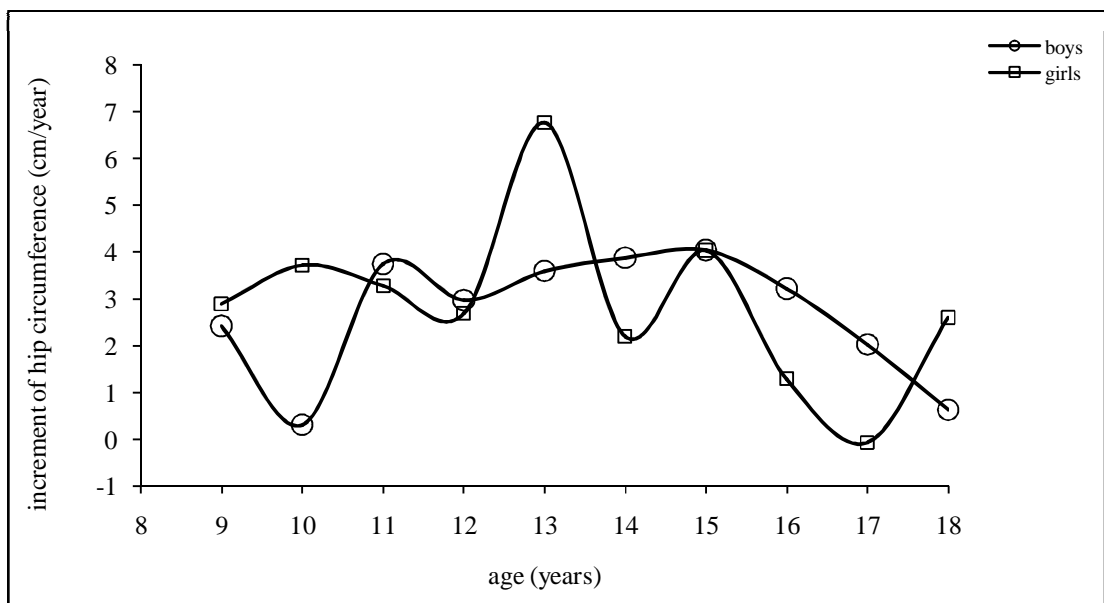


Figure 8.2: Velocity curve of Hip Circumference of boys and girls

Velocity curve (figure: 8.1) has shown that, the hip circumference of the boys is increasing in age groups of 8-9, 10-11 and 12-15 years, decreasing in age groups of 9-10, 11-12 and 15-18 years, whereas in girls, it is increasing in the age groups of 8-9, 12-13, 14-15 and 17-18 years, decreasing in age groups of 10-12, 13-14 and 15-17 years. It has appeared that the peak growth of boys and girls occurred at the age group of 15 and 13 years respectively.

Sex	Age Group	N	Mean	SD	CV	Range		Increment /Year
						MIN	MAX	
Boys	8	32	16.059	1.055	6.569	13.6	18.4	
	9	39	16.523	1.222	7.396	13.5	19.0	0.464
	10	34	16.529	1.087	6.575	14.6	18.5	0.006
	11	39	18.087	2.048	11.324	14.8	28.0	1.558
	12	43	18.461	2.250	12.185	15.2	28.2	0.374
	13	42	19.181	1.835	9.567	13.7	23.0	0.720
	14	41	20.346	2.381	11.701	16.6	29.5	1.165
	15	34	21.515	2.803	13.026	17.2	33.0	1.169
	16	46	22.807	1.773	7.773	20.0	29.1	1.292
	17	31	24.197	1.509	6.237	21.0	28.3	1.390
18	38	23.784	1.580	6.645	19.9	27.5	-0.413	
Girls	8	41	16.127	1.147	7.112	14.0	18.4	
	9	45	16.742	1.305	7.795	12.6	19.1	0.615
	10	49	17.658	1.476	8.359	15.0	22.0	0.916
	11	64	18.683	1.610	8.617	15.5	23.0	1.025
	12	42	19.014	1.790	9.414	14.7	23.8	0.331
	13	52	21.131	1.748	8.273	17.5	25.0	2.117
	14	47	21.611	2.144	9.920	16.7	25.7	0.480
	15	41	22.783	1.917	8.416	17.9	27.8	1.172
	16	42	22.752	2.304	10.126	16.2	26.8	-0.031
	17	40	22.983	1.559	6.782	20.4	26.2	0.231
18	44	23.902	1.829	7.652	20.4	29.5	0.919	

Table 9: Age Group Wise on Mean, SD, CV and Range for Mid-Upper Arm Circumference in boys and girls

Mid-Upper Arm Circumference (MUAC): A bigger mid-upper arm circumference in both the subjects occurred gradually in all age groups, excepting at the age of 18 years and 16 years in boys and girls respectively. It was also evident from the table and figure that, the girls had bigger arm circumferences than the boys in younger age groups i.e., from 8-15 years and also at the age group of 18 years; at the age of 16 and 17 years the boys had surpassed by having a bigger arm circumference than the girls'. The maximum and minimum distributions of mid-upper arm were 33.0 cm and 13.5 cm in boys and 29.5 cm and 12.6 cm in girls. The greatest increase of mean from

age 8-18 years was 7.73 cm (32.48%) in boys and 7.78 cm (32.53%) in girls. The sample variability was observed at age group 15 years in boys and 16 years in girls (figure. 9 and table. 9).

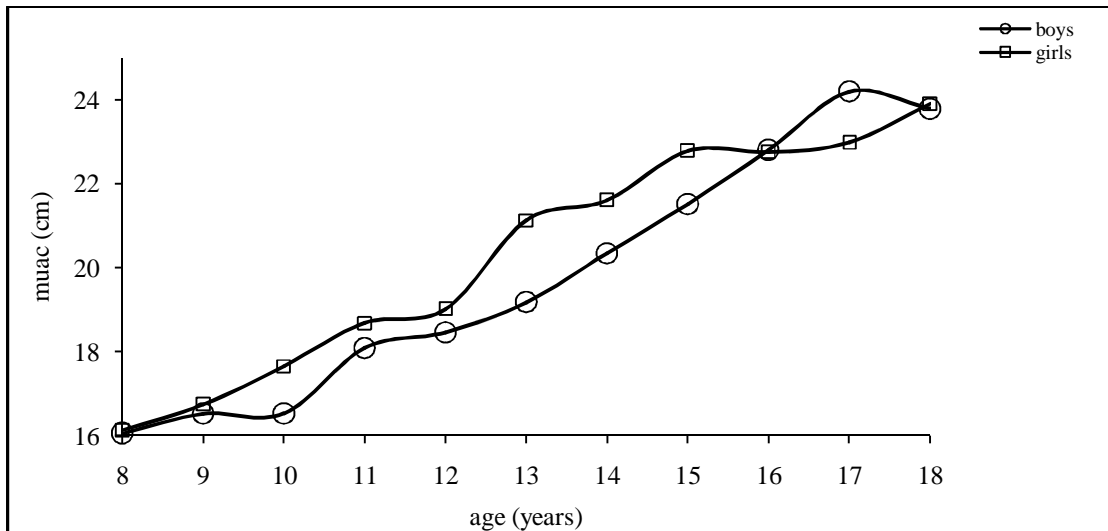


Figure 9.1: Distance curve of Mid-Upper Arm Circumference of boys and girls

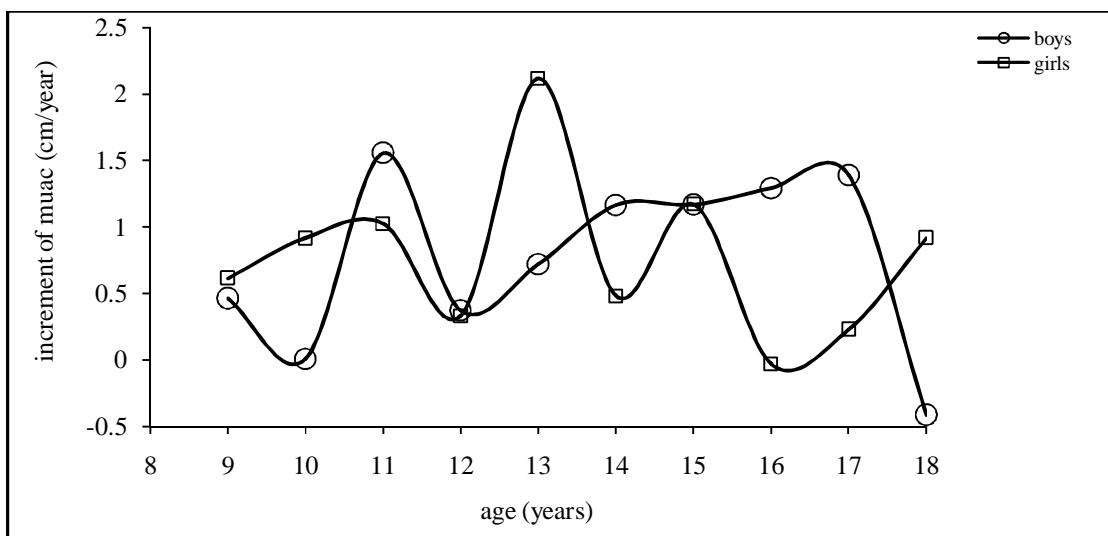


Figure 9.2: Velocity curve of Mid-Upper Arm Circumference of boys and girls

Velocity curve (figure: 9.1) of the mid-upper arm circumference displayed that, the growth rate in boys fluctuated by decreasing and increasing at the respective age groups alternatively from 9-12 years, thereafter started increasing gradually till the age group of 17 years and slowing down sharply to the age groups 18 years . However, in girls the growth rate was increasing from 9-11 years, and from 12-16 years a fluctuated

growth rate occurred by decreasing and increasing at the respective age groups alternatively and tended to increase upwards to 18 years. While comparing, the growth rate of boys was advanced only in age groups of 11-12, 14 and 16-17 years where as in other age groups was decreasing to the girls'. It was observed from figure: 9.1 and table: 9 that the peak growth occurred at the age groups of 11 and 13 years in the boys and girls respectively.

Sex	Age Group	N	Mean	SD	CV	Range		Increment /Year
						MIN	MAX	
Boys	8	32	22.503	1.737	7.720	19.9	28.5	
	9	39	23.585	1.766	7.489	20.8	27.7	1.082
	10	34	23.794	1.651	6.939	21.3	29.0	0.209
	11	39	25.677	1.598	6.224	22.3	28.6	1.883
	12	43	26.468	2.285	8.632	23.2	31.6	0.791
	13	42	27.681	2.586	9.341	17.3	33.0	1.213
	14	41	29.322	2.273	7.750	24.6	34.6	1.641
	15	34	30.379	2.472	8.137	23.6	35.7	1.057
	16	46	31.826	2.097	6.590	27.8	37.4	1.447
17	31	32.732	1.790	5.468	29.5	36.6	0.906	
18	38	32.205	2.435	7.561	23.0	38.5	-0.527	
Girls	8	41	22.654	1.291	5.700	20.4	25.4	
	9	45	23.822	1.468	6.160	19.5	26.7	1.168
	10	49	24.738	1.744	7.048	21.5	29.3	0.916
	11	64	26.830	2.156	8.037	22.3	34.0	2.092
	12	42	26.795	2.364	8.824	21.0	31.1	-0.035
	13	52	29.063	2.357	8.111	23.5	33.5	2.268
	14	47	29.574	3.012	10.186	22.0	37.3	0.511
	15	41	31.507	2.102	6.673	27.0	36.9	1.933
	16	42	31.336	2.696	8.603	23.4	39.4	-0.171
	17	40	31.342	2.076	6.625	27.3	35.0	0.006
18	44	31.854	1.917	6.018	28.5	38.0	0.512	

Table 10: Age Group Wise on Mean, SD, CV and Range for Calf Circumference in boys and girls

Calf Circumference: The subjects had shown a bigger calf circumference gradually in both sexes as the age increases, except the age group of 18 years in boys, 12, 16 and 17 years in girls. It is also seen that, the boys had a smaller calf circumference than the girls, but after the age of 16 years onward the boys showed bigger calf circumference than the girls. The maximum and minimum distributions of calf circumference were 38.5 cm and 17.3 cm in boys and 39.4 cm and 19.5 cm in girls. The greatest increase of mean from age 8-18 years was 9.70 cm (30.13%) in boys and 9.20 cm (28.88%) in girls. The sample variability was observed at age group 13 years in boys and 14 years in girls (figure: 10 and table: 10).

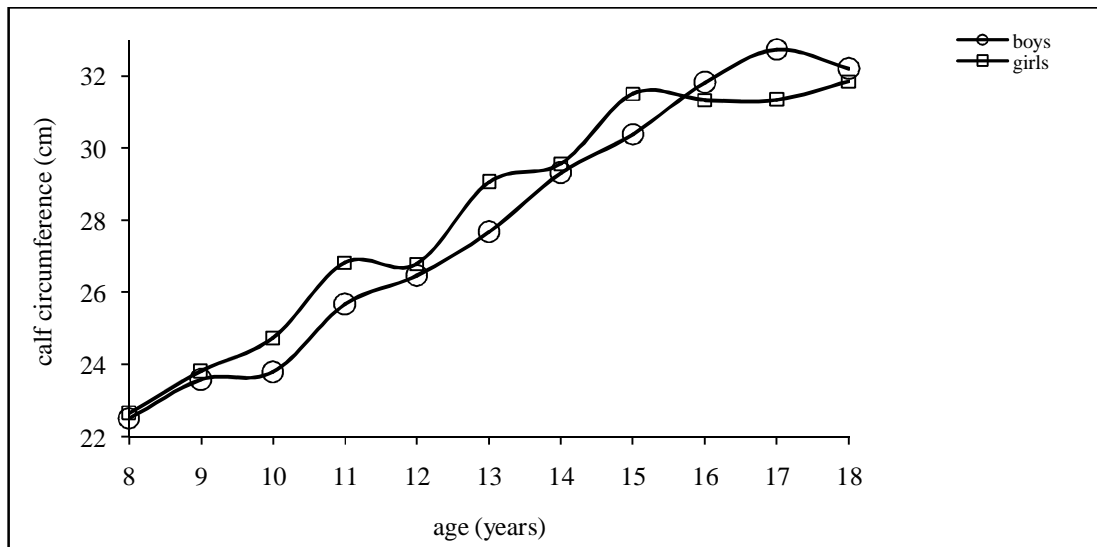


Figure 10.1: Distance curve of Calf Circumference of boys and girls

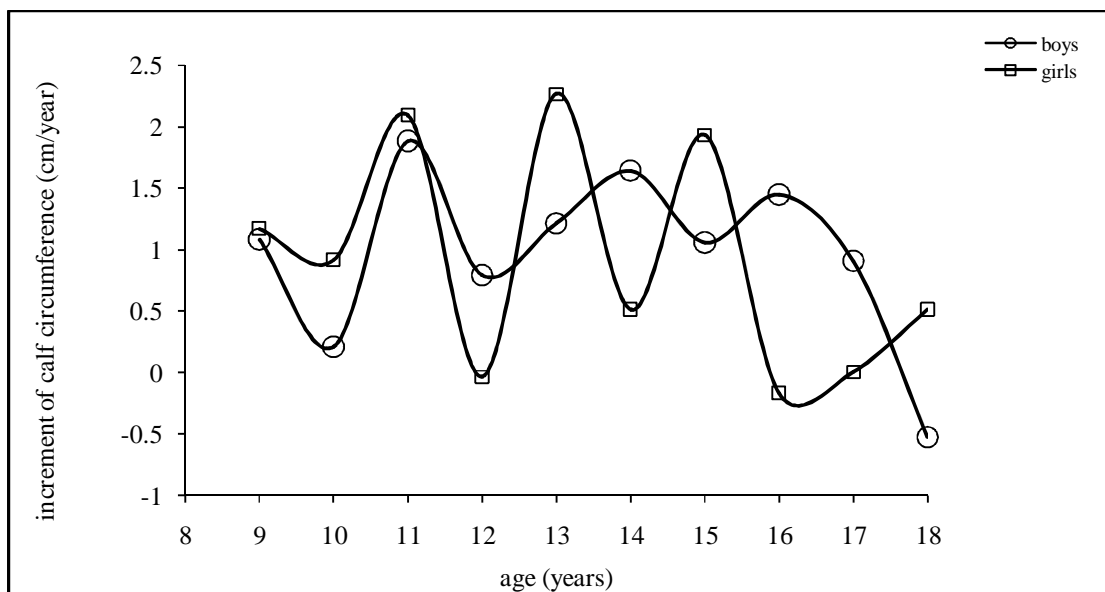


Figure 10.2: Velocity curve of Calf Circumference of boys and girls

The growth rate (velocity curve figure: 10.1) of calf circumference in boys was found to have fluctuated by decreasing and increasing at the respective age groups alternatively from 9-12 years, thereafter started increasing upto age group of 14 years, decreasing and increasing upto 16 years thereafter a slope of decreasing downward occurred from 17-18 years. However, in girls the growth rate also fluctuated by decreasing and increasing at the respective age groups alternatively from 9-16 years,

thereafter, it started increasing from 17-18 years. While comparing, the growth rate of the boys was advanced only in age groups of 12, 14, 16 and 18 years where as in other age groups was decreasing to the girls'. It was observed from figure: 10.1 and table: 10 that the peak growth occurred at the age groups of 11 and 13 years in boys and girls respectively.

Sex	Age Group	N	Mean	SD	CV	Range		Increment /Year
						MIN	MAX	
Boys	8	32	3.834	0.870	22.686	2.0	5.6	
	9	39	3.841	0.923	24.030	2.4	6.8	0.007
	10	34	3.503	0.851	24.288	2.0	5.8	-0.338
	11	39	4.154	1.517	36.507	2.2	11.0	0.651
	12	43	3.820	0.955	24.995	2.4	6.6	-0.334
	13	42	3.519	0.794	22.563	2.0	5.0	-0.301
	14	41	3.693	1.031	27.907	2.0	7.2	0.174
	15	34	3.491	0.831	23.793	2.4	5.8	-0.202
	16	46	3.943	1.425	36.148	2.6	9.0	0.452
	17	31	3.874	1.180	30.454	2.6	9.0	-0.069
18	38	3.503	0.517	14.759	2.6	5.2	-0.371	
Girls	8	41	4.688	1.208	25.757	2.6	8.4	
	9	45	4.640	1.030	22.200	3.0	7.8	-0.048
	10	49	4.712	1.538	32.642	2.4	10.4	0.072
	11	64	4.575	1.269	27.731	2.6	7.8	-0.137
	12	42	4.464	1.458	32.661	1.4	8.0	-0.111
	13	52	5.565	1.743	31.328	3.0	11.0	1.101
	14	47	5.830	1.816	31.148	2.6	10.0	0.265
	15	41	5.215	1.291	24.756	2.8	8.4	-0.615
	16	42	6.588	2.403	36.471	4.0	13.4	1.373
	17	40	6.030	2.145	35.569	3.4	12.2	-0.558
18	44	6.355	1.926	30.299	4.0	12.4	0.325	

Table 11: Age Group Wise on Mean, SD, CV and Range for Biceps Skinfold in boys and girls

Biceps Skinfold: The accumulation of biceps skinfold was shown to be different in both sexes in all the age groups, in which the deposition of fat is not increasing as the age increases, and in boys were shown to have a lesser deposition of fat whereas an increasing fat deposition in girls at the higher age groups. The maximum and minimum distributions of biceps skinfold were 11.0 mm and 2.0 mm in boys and 13.4 mm and 1.4 mm in girls. The mean skinfold from age groups of 8-18 years showed decrease in boys by -0.33 mm (-9.45 %), whereas in girls the mean increases by 1.67 mm (26.23%). The sample variability was observed at age group 11 years in boys and 16 years in girls (figure: 11 and table: 11).

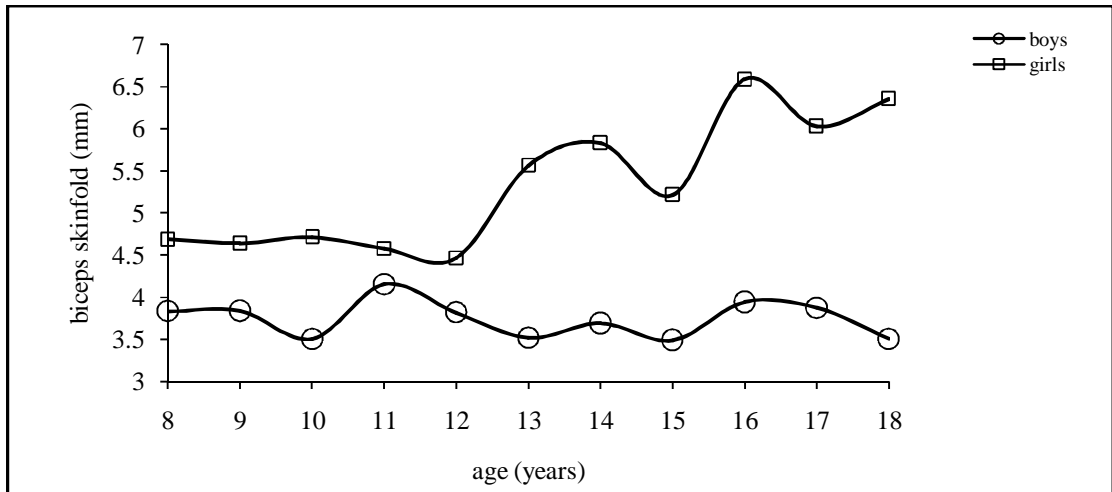


Figure 11.1: Distance curve of Biceps Skinfold of boys and girls

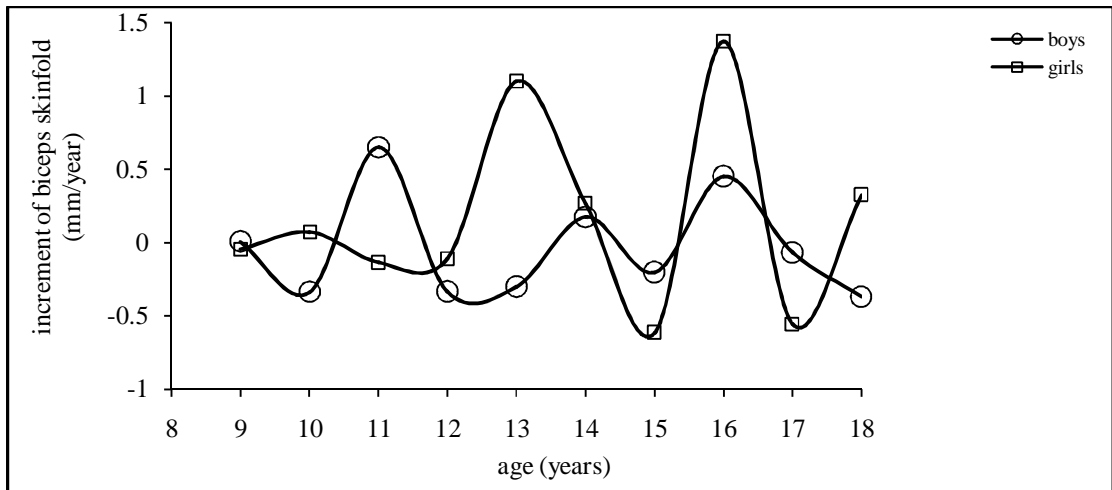


Figure 11.2: Velocity curve of Biceps Skinfold of boys and girls

Velocity curve figure: 11.1, was the growth rate of biceps skinfold where the boys produced a fluctuated growth rate by lesser and more accumulation of fat at the respective age groups alternatively from 9-12 years, thereafter increasing again upto age group of 16 years, except the age group of 15 years, and lesser fat till the age group of 18 years. However, in girls the growth rate showed the gain in deposition of fat from 9-10 years, after that lesser fat towards 12 years and the deposition started again by increasing and decreasing at the respective age groups alternatively from 13-18 years. While comparing, the growth rate of the boys was advanced only in the age groups of 9, 11, 15, and 17 years, whereas in the other age groups was lesser to the girls'. It was

observed from figure: 11.1 and table: 11 that the peak accumulation of fat occurred at age groups of 11 and 16 years in boys and girls respectively.

Sex	Age Group	N	Mean	SD	CV	Range		Increment /Year
						MIN	MAX	
Boys	8	32	5.975	1.390	23.265	3.0	8.8	
	9	39	6.164	1.659	26.914	3.0	9.8	0.189
	10	34	5.091	1.272	24.979	3.0	8.4	-1.073
	11	39	6.605	2.658	40.245	3.2	17.4	1.514
	12	43	6.043	1.428	23.629	3.4	9.8	-0.562
	13	42	5.629	1.189	21.123	3.6	10.0	-0.414
	14	41	5.932	1.608	27.116	3.4	10.0	0.303
	15	34	5.488	1.447	26.374	3.0	9.8	-0.444
	16	46	6.413	2.059	32.105	4.0	14.0	0.925
17	31	6.510	2.712	41.657	3.8	17.8	0.097	
18	38	6.237	1.342	21.515	4.0	9.0	-0.273	
Girls	8	41	7.195	1.851	25.729	3.2	12.2	
	9	45	7.662	1.589	20.740	5.2	12.6	0.467
	10	49	7.825	2.515	32.135	4.6	12.6	0.163
	11	64	8.356	2.642	31.622	3.4	15.2	0.531
	12	42	7.695	2.087	27.122	3.2	11.6	-0.661
	13	52	9.919	2.738	27.604	5.0	16.4	2.224
	14	47	11.653	3.846	33.002	4.8	27.2	1.734
	15	41	12.612	3.232	25.626	6.2	19.0	0.959
	16	42	13.081	3.473	26.553	4.8	21.8	0.469
	17	40	12.860	2.799	21.765	7.6	19.4	-0.221
18	44	14.034	3.273	23.321	7.0	20.6	1.174	

Table 12: Age Group Wise on Mean, SD, CV and Range for Triceps Skinfold in boys and girls

Triceps Skinfold: The subjects had shown that, the accumulation of triceps skinfold was also going differently in both the sexes in all age groups, in which the boys were showing more or less a similar deposition of fat in all age groups from 8-18 years. In case of girls, there was a gain in deposition of fat from 8-18 years of age, except at the age groups of 12 and 17 years where a lesser fold was deposited. The maximum and minimum distributions of triceps skinfold were 17.8 mm and 3.0 mm in boys and 27.2 mm and 3.2 mm in girls. The greatest increase of mean from age 8-18 years was 0.26 mm (4.20 %) in boys and 6.84 mm (48.73 %) in girls. The sample variability was observed at age group 17 years in boys and 14 years in girls (figure: 12 and table: 12).

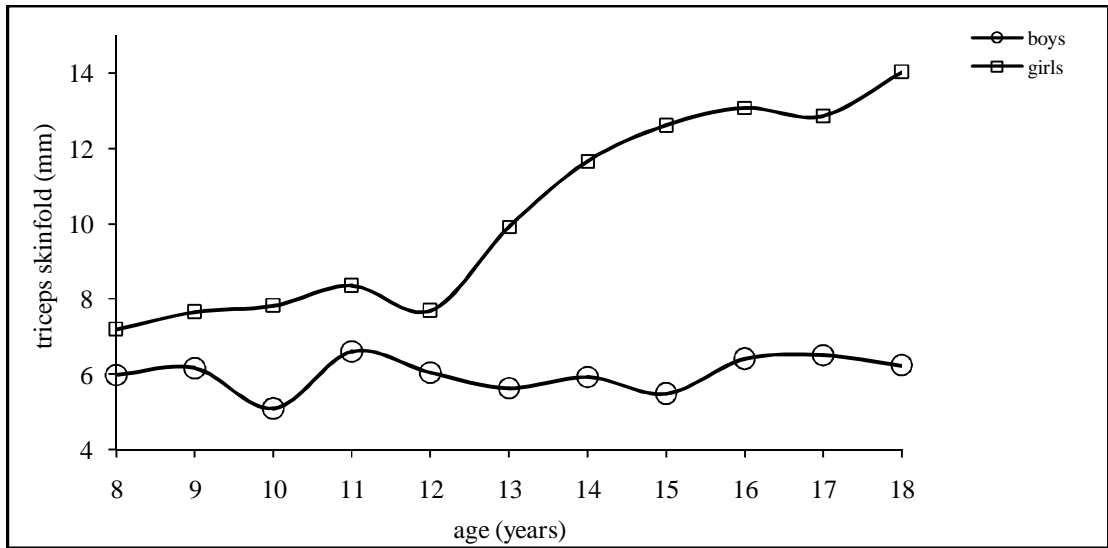


Figure 12.1: Distance curve of Triceps Skinfold of boys and girls

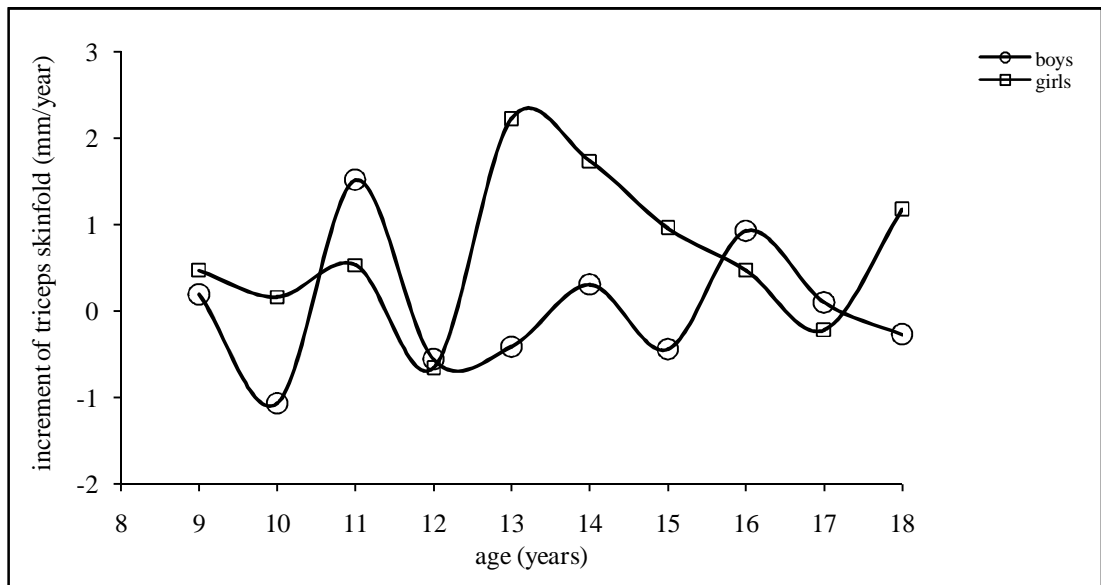


Figure 12.2: Velocity curve of Triceps Skinfold of boys and girls

The velocity curve (figure: 12.1) has shown that, the rate of accumulation of fat in boys fluctuated by a lesser and more deposition at the respective age groups alternatively from 9-12 years, thereafter started to gain in fat deposition from 13-16 years except the 15 years, and started reducing again in age groups 16-18 years. However, in girls the rate of fat accumulation was shown to be lesser from 9-12 years except at 11 years, thereafter increase in gaining steeply at 13 years and reducing gradually till 17 years but tended to raise again to 18 years. While comparing, the rate of

fat accumulation in boys was advanced only in age groups of 11-12 and 16-17 years where as in the other age groups was lesser to the girls'. It was observed from figure: 12.1 and table: 12 that the peak accumulation of fold occurred at age groups 11 and 13 years in boys and girls respectively.

Sex	Age Group	N	Mean	SD	CV	Range		Increment /Year
						MIN	MAX	
Boys	8	32	4.369	0.643	14.713	3.2	5.8	
	9	39	4.805	0.849	17.669	3.4	7.2	0.436
	10	34	4.294	0.639	14.872	3.4	6.0	-0.511
	11	39	4.831	1.178	24.390	3.0	9.6	0.537
	12	43	4.812	0.859	17.845	3.2	6.8	-0.019
	13	42	5.029	0.691	13.736	3.4	6.6	0.217
	14	41	5.463	0.961	17.586	3.8	7.8	0.434
	15	34	6.141	1.286	20.946	4.2	10.6	0.678
	16	46	6.883	1.564	22.720	4.4	12.6	0.742
	17	31	7.716	2.356	30.535	4.8	17.0	0.833
	18	38	7.668	1.293	16.862	5.6	10.6	-0.048
Girls	8	41	5.141	1.129	21.959	3.6	9.8	
	9	45	5.284	1.108	20.973	3.2	9.2	0.143
	10	49	5.783	1.801	31.145	4.0	14.6	0.499
	11	64	6.284	1.905	30.320	3.4	13.2	0.501
	12	42	6.405	1.658	25.892	3.2	11.0	0.121
	13	52	8.335	2.411	28.926	4.4	15.6	1.930
	14	47	9.498	2.546	26.800	4.6	15.0	1.163
	15	41	10.337	3.135	30.326	5.8	21.0	0.839
	16	42	10.848	3.299	30.408	5.0	24.0	0.511
	17	40	10.970	2.949	26.885	7.2	20.6	0.122
	18	44	12.273	2.863	23.328	6.0	22.0	1.303

Table 13: Age Group Wise on Mean, SD, CV and Range for Subscapular Skinfold in boys and girls

Subscapular Skinfold: The accumulation of fat in subscapular of the subjects was going differently in both the sexes with an increasing age groups, the girls have got high thickness to that of the boys at the higher age groups. The maximum and minimum depositions of subscapular skinfold were 17.0 mm and 3.0 mm in boys and 24.0 mm and 3.2 mm in girls. The greatest increase of mean from age 8-18 years was 3.30 mm (43.02%) in boys and 7.13 mm (58.11%) in girls. The sample variability is observed at age group 9 years in boys and 10 years in girls (figure: 13 and table: 13).

Velocity curve (figure: 13.1) showed that, the accumulation of subscapular skinfold in boys was higher in age groups 8-9, 10-11, and 12-17 years, lesser in age groups 9-10, 11-12 and 17-18 years, where as in girls, it was gaining in age groups 9-10, 12-13 and 17-18 years, reducing in age groups 8-9, 11-12 and 13-17 years. It appeared

that, the peak accumulation of fat in boys and girls occurred at age groups 17 and 13 years respectively.

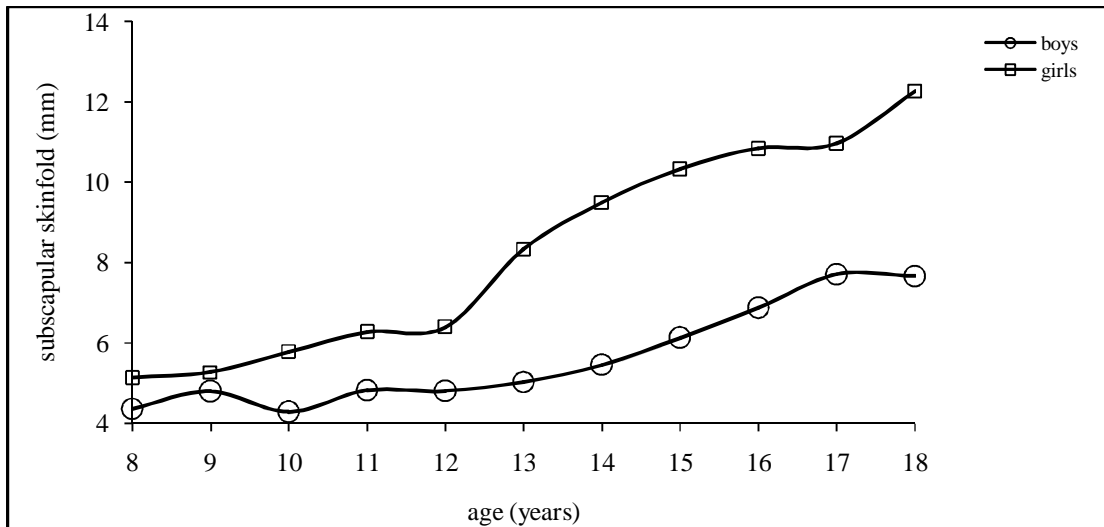


Figure 13.1: Distance curve of Subscapular Skinfold of boys and girls

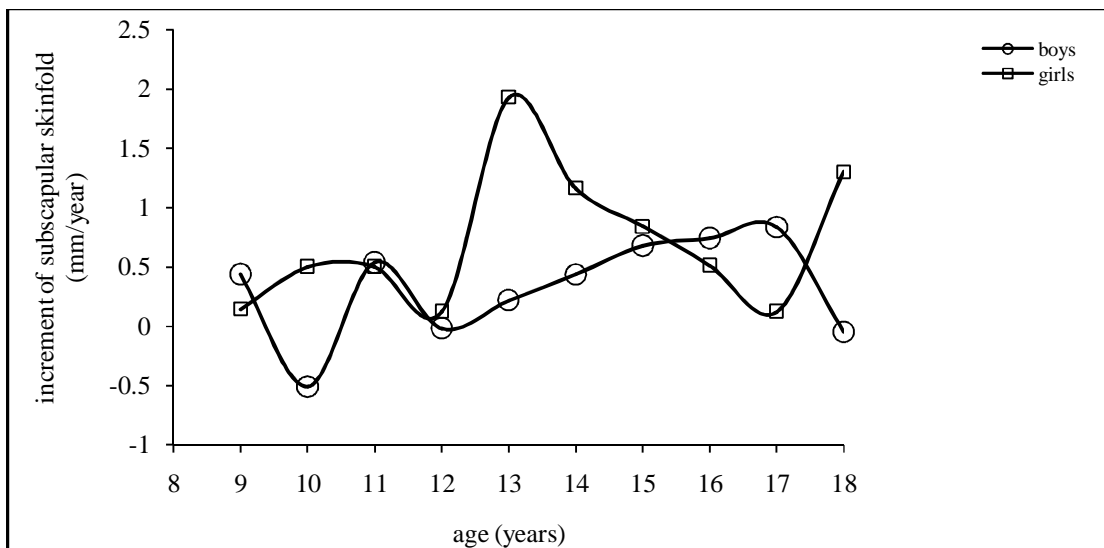


Figure 13.2: Velocity curve of Subscapular Skinfold of boys and girls

Suprailiac Skinfold: The subjects had shown the accumulation of suprailiac skinfold was going differently in both sexes but with gaining of fold as the age goes on increasing except age groups 10 and 18 years among the boys, where there was a slight reducing in the fold, and the girls have got higher fold to that of the boys in all age groups. The maximum and minimum distributions of suprailiac skinfold were 17.2 mm

and 2.2 mm in boys and 26.2 mm and 2.4 mm in girls. The greatest increase of mean from age 8-18 years was 2.74 mm (42.11%) in boys and 8.77 mm (68.28%) in girls. The sample variability was observed at age group 15 years in boys and 9 years in girls (figure: 14 and table: 14).

Sex	Age Group	N	Mean	SD	CV	Range		Increment /Year
						MIN	MAX	
Boys	8	32	3.769	0.944	25.038	2.6	6.2	
	9	39	3.908	1.068	27.329	2.4	6.8	0.139
	10	34	3.382	0.787	23.264	2.4	5.8	-0.526
	11	39	4.005	1.430	35.708	2.2	9.6	0.623
	12	43	4.293	1.207	28.111	2.4	8.8	0.288
	13	42	4.600	1.103	23.967	3.0	7.8	0.307
	14	41	4.795	1.179	24.596	2.8	7.6	0.195
	15	34	5.600	2.527	45.130	3.4	17.2	0.805
	16	46	6.130	2.432	39.675	4.0	16.6	0.530
	17	31	6.600	2.926	44.336	4.0	15.8	0.470
18	38	6.511	1.942	29.839	3.8	13.6	-0.089	
Girls	8	41	4.073	1.000	24.547	2.6	7.0	
	9	45	4.542	2.350	51.733	2.6	18.8	0.469
	10	49	4.758	1.612	33.871	2.8	9.4	0.216
	11	64	5.494	2.325	42.319	2.6	14.4	0.736
	12	42	5.786	2.128	36.775	2.4	11.2	0.292
	13	52	7.956	3.022	37.980	4.0	14.6	2.170
	14	47	9.260	3.623	39.129	4.0	20.0	1.304
	15	41	9.829	3.123	31.770	4.2	21.2	0.569
	16	42	10.310	3.942	38.238	5.8	26.2	0.481
	17	40	9.755	2.888	29.603	5.4	20.0	-0.555
18	44	12.841	4.225	32.906	3.2	20.0	3.086	

Table 14: Age Group Wise on Mean, SD, CV and Range for Suprailiac Skinfold in boys and girls

Velocity curve (figure: 14.1) had shown that the rate of fat accumulation in boys fluctuated by reducing and gaining at the respective age groups alternatively from 9-12 years, thereafter tending to reduce slowly towards 14 years and started gaining at 15 years but reducing again from age groups 16-18 years. In girls, the rate of fat accumulation also fluctuated by reducing and gaining from 9-13 years, thereafter reducing gradually towards the age of 17 years and raise again at 18 years. While comparing, the growth rate of boys was advanced only in the age groups of 15-17 years, whereas in other age groups was reducing to the girls'. It was observed from figure: 14.1 and table: 14 that the peak accumulation occurred at the age groups of 15 and 18 years in boys and girls respectively.

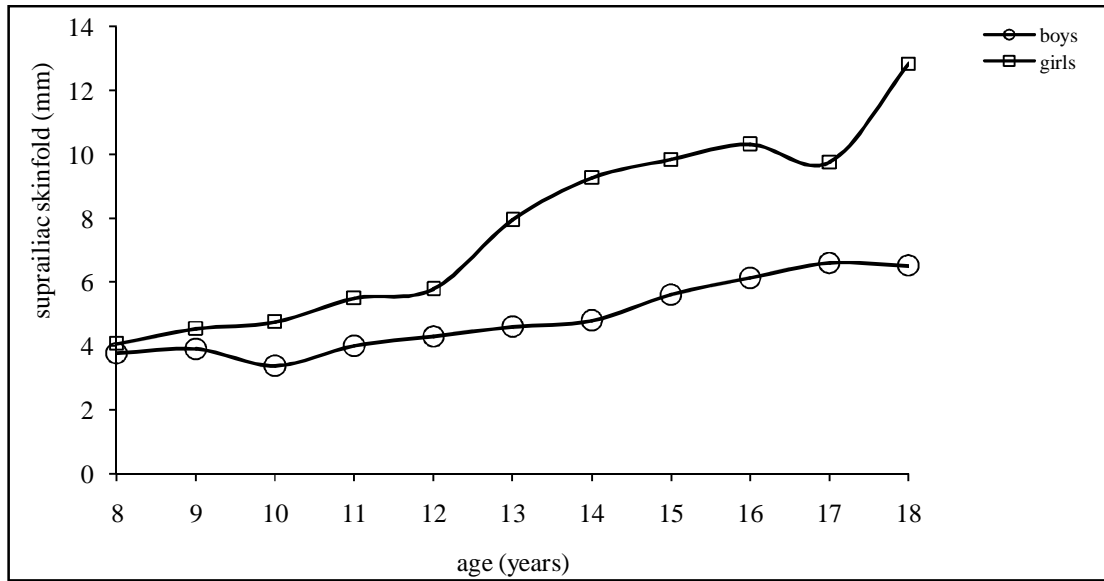


Figure 14.1: Distance curve of Suprailiac Skinfold of boys and girls

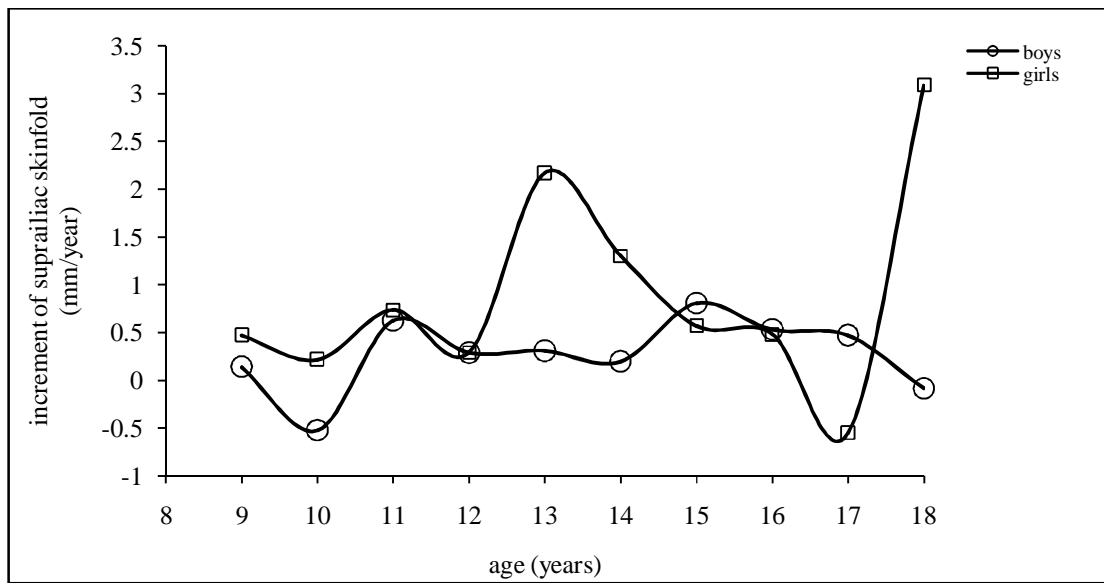


Figure 14.2: Velocity curve of Suprailiac Skinfold of boys and girls

Calf Skinfold: The subjects had shown that the accumulation of calf skinfold was going apart in both sexes. In girls, it was gaining with increasing age groups except at age 12 and 17 years, where the skinfold was slightly reducing. However, in boys a little gaining and reducing in calf skinfold from 8-18 years of age was observed. The maximum and minimum distributions of calf skinfold were 17.0 mm and 3.0 mm in boys and 25.0 mm and 3.8 mm in girls. The mean from age 8-18 years was shown

decreasing by -0.09 mm (-1.56%) in boys and increasing 5.27 mm (41.92%) in girls. The sample variability was observed at age group 8 years in boys and 16 years in girls (figure: 15 and table: 15).

Sex	Age Group	N	Mean	SD	CV	Range		Increment /Year
						MIN	MAX	
Boys	8	32	5.938	2.357	39.700	3.2	16.4	
	9	39	5.987	1.532	25.589	3.2	10.0	0.049
	10	34	5.429	1.629	29.998	3.0	10.2	-0.558
	11	39	6.397	1.990	31.105	3.0	13.6	0.968
	12	43	6.151	2.070	33.658	3.4	13.0	-0.246
	13	42	6.679	1.858	27.820	3.8	11.0	0.528
	14	41	6.410	1.676	26.151	3.6	12.6	-0.269
	15	34	6.183	1.230	19.900	4.0	9.4	-0.227
	16	46	6.804	1.945	28.583	4.2	15.0	0.621
17	31	6.665	2.541	38.117	3.6	17.0	-0.139	
18	38	5.847	1.112	19.010	3.6	9.2	-0.818	
Girls	8	41	7.300	1.702	23.312	3.8	11.2	
	9	45	7.489	1.636	21.841	4.4	11.0	0.189
	10	49	7.637	1.911	25.018	4.4	13.8	0.148
	11	64	8.331	2.471	29.660	4.4	17.2	0.694
	12	42	8.110	2.118	26.117	4.0	15.2	-0.221
	13	52	10.527	3.172	30.131	5.6	21.0	2.417
	14	47	11.196	2.807	25.074	5.4	17.0	0.669
	15	41	11.600	3.268	28.175	5.2	20.4	0.404
	16	42	12.167	3.844	31.590	6.4	25.0	0.567
	17	40	12.112	3.300	27.246	7.0	20.6	-0.055
	18	44	12.568	2.915	23.195	7.4	21.2	0.456

Table 15: Age Group Wise on Mean, SD, CV and Range for Calf Skinfold in boys and girls

The velocity curve (figure: 15.1) in the accumulation rate of calf skinfold, in boys, fluctuated by reducing and gaining at the respective age groups alternatively from 9-14 years, thereafter tending to gain slowly towards 16 years and started reducing sharply till age group 18 years. However, in girls, the rate of fat accumulation was gaining from 9-13 years excepting at 10 and 12 years, thereafter reducing gradually from 14-17 years, except 15 years which showed a slightly gain in deposition of fat and tended to gain again at 18 years of age. While comparing, the rate of accumulation in boys was advanced only in age groups of 11-12 years and slightly in 16-17 years where as in other age groups was decreasing to the girls'. It was observed from figure: 15.1 and table: 15 that the peak accumulation of fat occurred at the age groups of 11 and 13 years in boys and girls respectively.

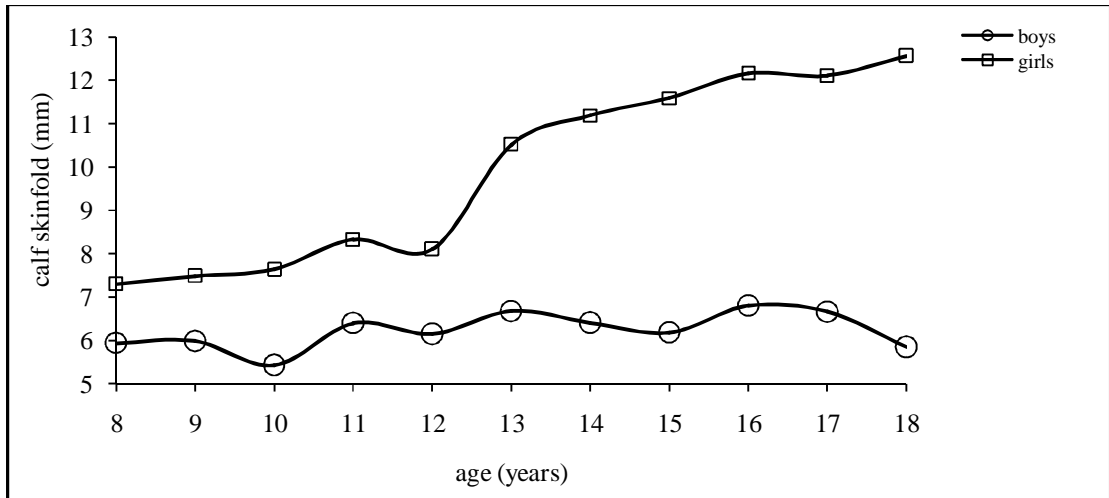


Figure 15.1: Distance curve of Calf Skinfold of boys and girls

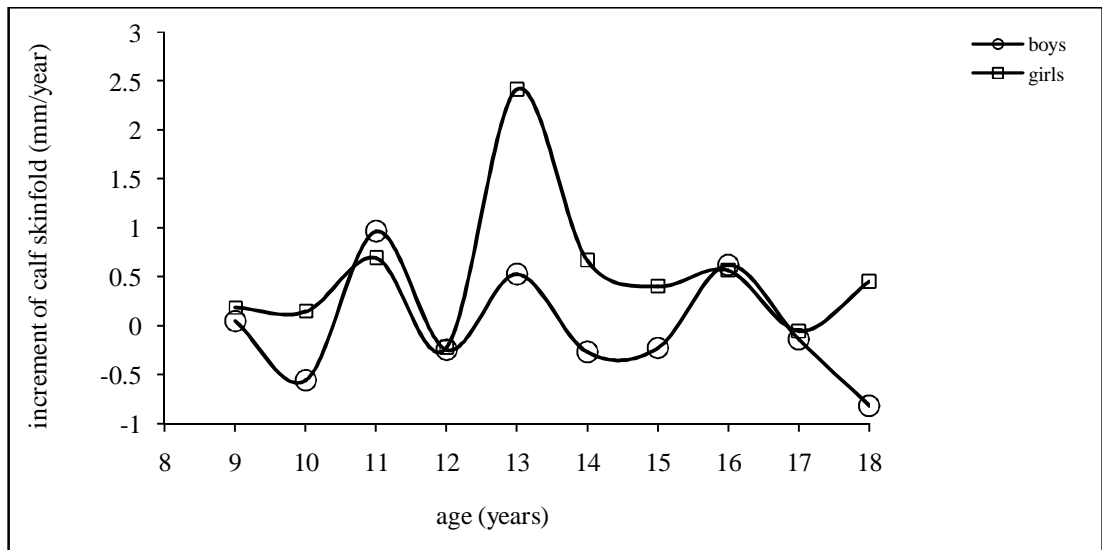


Figure 15.2: Velocity curve of Calf Skinfold of boys and girls

NUTRITIONAL STATUS

In this section, nutritional anthropometric indices such as BMI for age, height for age and weight for age were used for assessing the nutritional status of the adolescents. BMI for age was considered as a good indicator of fatness or thinness and/or wasting due to chronic energy deficiency (CED), where as height for age was taken as an indicator of growth retardation or stunting, while weight for age was considered as a measure of underweight.

Table 16.1, had shown that, the BMI for age has a high normal condition (88.73% and 91.50%) than the wasting conditions (11.27% and 8.50%) in all the age groups of boys and girls respectively. The wasting conditions has shown more in boys (11.27%) than in girls (8.50%) and the severe condition (2.64% and 1.38%) was less than the moderate condition (8.63% and 7.12%) and showed no significant differences between the boys and girls ($\chi^2=2.690$, $df=2$, $p>0.05$). In higher age groups from 16-18 years in boys and 15-18 years in girls no severe condition has occurred and in 16-17 years all the girls were in normal condition.

Age	Boys				Girls			
	Normal >-2	Moderate <-2 to -3	Severe <-3	Total	Normal >-2	Moderate <-2 to -3	Severe <-3	Total
8	30(93.75)	1(3.13)	1(3.12)	32	29(70.73)	11(26.83)	1(2.44)	41
9	35(89.74)	2(5.13)	2(5.13)	39	35(77.78)	9(20.00)	1(2.22)	45
10	28(82.35)	4(11.77)	2(5.88)	34	43(89.58)	4(8.34)	1(2.08)	48
11	34(87.18)	4(10.26)	1(2.56)	39	60(93.75)	3(4.69)	1(1.56)	64
12	35(85.37)	5(12.20)	1(2.43)	41	38(90.48)	2(4.76)	2(4.76)	42
13	37(88.10)	4(9.52)	1(2.38)	42	48(92.31)	4(7.69)	0(0.00)	52
14	35(85.37)	5(12.20)	1(2.43)	41	45(95.74)	1(2.13)	1(2.13)	47
15	29(85.20)	3(8.82)	2(5.88)	34	40(97.56)	1(2.44)	0(0.00)	41
16	43(93.48)	3(6.52)	0(0.00)	46	42(100.00)	0(0.00)	0(0.00)	42
17	28(90.32)	3(9.68)	0(0.00)	31	40(100.00)	0(0.00)	0(0.00)	40
18	36(94.74)	2(5.26)	0(0.00)	38	43(97.73)	1(2.27)	0(0.00)	44
Total	370(88.73)	36(8.63)	11(2.64)	417	463(91.50)	36(7.12)	7(1.38)	506
Grand Total	417				506			

$$\chi^2=2.690 \text{ df}=2, p>0.05$$

Table 16.1: z-score distribution on BMI for age and its percentage with respect to age groups in boys and girls

Table 16.2, had shown that, most of the boys were stunted in the age groups of 8-12 and 17 years and an equal prevalence of normal and stunting categories in the age groups of 15 and 18 years, the moderate stunting (39.09%) was higher than the severe stunting (14.63%) and in overall the boys were more prone to the stunting condition than the normal condition (53.72% and 46.28%). In girls the subjects were stunted in the age groups of 8-9 and 13-17 years, the prevalence of moderate condition (36.16%) was higher than the severe condition (13.64%) of stunting and the age group of 15 years was free from the severe condition of stunting, in overall almost half of the girls were subjected to stunting condition (49.80%) than the normal condition (50.20%). The stunting condition in boys was higher than the girls, the height for age of the boys and girls showed no significant difference ($\chi^2=1.373$, $df=2$, $p>0.05$) between them.

Age	Boys				Girls			
	Normal >-2	Moderate <-2 to -3	Severe <-3	Total	Normal >-2	Moderate <-2 to -3	Severe <-3	Total
8	9(28.13)	13(40.62)	10(31.25)	32	19(46.34)	15(36.59)	7(17.07)	41
9	15(38.46)	19(48.72)	5(12.82)	39	20(44.44)	19(42.22)	6(13.34)	45
10	11(32.35)	17(50.00)	6(17.65)	34	26(54.17)	14(29.17)	8(16.66)	48
11	19(48.72)	15(38.46)	5(12.82)	39	39(60.94)	17(26.56)	8(12.50)	64
12	20(48.78)	11(26.83)	10(24.39)	41	27(64.29)	11(26.19)	4(9.52)	42
13	22(52.38)	14(33.33)	6(14.29)	42	25(48.08)	16(30.77)	11(21.15)	52
14	22(53.65)	14(34.15)	5(12.20)	41	15(31.91)	23(48.94)	9(19.15)	47
15	17(50.00)	15(44.12)	2(5.88)	34	20(48.78)	21(51.22)	0(0.00)	41
16	24(52.17)	17(36.96)	5(10.87)	46	20(47.62)	18(42.86)	4(9.52)	42
17	15(48.39)	14(45.16)	2(6.45)	31	18(45.00)	16(40.00)	6(15.00)	40
18	19(50.00)	14(36.84)	5(13.16)	38	25(56.82)	13(29.54)	6(13.64)	44
Total	193(46.28)	163(39.09)	61(14.63)	417	254(50.20)	183(36.16)	69(13.64)	506
Grand Total	417				506			
$\chi^2=1.373, df=2, p>0.05$								

Table 16.2: Z-Score distribution on height for age and its percentage with respect to age groups in boys and girls

Age	Boys				Girls			
	Normal >-2	Moderate <-2 to -3	Severe <-3	Total	Normal >-2	Moderate <-2 to -3	Severe <-3	Total
8	10(31.25)	10(31.25)	12(37.50)	32	16(39.02)	13(31.71)	12(29.27)	41
9	19(48.72)	12(30.77)	8(20.51)	39	24(53.34)	15(33.33)	6(13.33)	45
10	11(32.35)	14(41.18)	9(26.47)	34	26(54.17)	16(33.33)	6(12.50)	48
11	20(51.28)	15(38.46)	4(10.26)	39	40(62.50)	15(23.44)	9(14.06)	64
12	15(36.58)	14(34.15)	12(29.27)	41	25(59.52)	10(23.81)	7(16.67)	42
13	21(50.00)	17(40.48)	4(9.52)	42	38(73.08)	10(19.23)	4(7.69)	52
14	27(65.85)	8(19.52)	6(14.63)	41	33(70.21)	10(21.28)	4(8.51)	47
15	22(64.71)	7(20.59)	5(14.70)	34	35(85.37)	3(7.32)	3(7.31)	41
16	32(69.57)	8(17.39)	6(13.04)	46	30(71.43)	8(19.05)	4(9.52)	42
17	20(64.52)	10(32.25)	1(3.23)	31	24(60.00)	12(30.00)	4(10.00)	40
18	23(60.53)	10(26.32)	5(13.15)	38	31(70.45)	10(22.73)	3(6.82)	44
Total	220(52.76)	125(29.97)	72(17.26)	417	322(63.64)	122(24.11)	62(12.25)	506
Grand Total	417				506			
$\chi^2=10.582, df=2, p<0.01$								

Table 16.3: Z-Score distribution on weight for age and its percentage with respect to age groups in boys and girls

Table 16.3, had shown that in boys, the subjects were underweight in the age groups of 8-10 and 12 years, an equal prevalence of normal and underweight condition in the age groups of 13 years and from the age groups of 14-18 years the normal condition was higher than the underweight condition. The moderate underweight (29.97%) was higher than the severe condition (17.27%) in all the age groups except the age group of 8 years and in overall the normal condition was a little high than the underweight conditions (52.76% and 47.24%). In girls, the subjects were underweight

only in age groups of 8 years and from 9-18 years the normal condition was higher than the underweight condition, and the moderate underweight was higher than the severe condition in all the age groups except the 15 years which showed an equal condition of underweight categories, in overall, the girls were in a normal weight (63.64%) than the underweight conditions (36.36%) and the underweight condition in boys (47.25%) was higher than the girls (36.36%). The weight for age of the boys and girls showed a significant difference ($\chi^2=10.582$, $df=2$, $p<0.01$) between them.

CLINICAL NUTRITIONAL STATUS:

The clinical signs of the nutritional status of the subjects have been observed on each and every boy and girl taken for the measurements, they are apparently observed to have no deficiency signs on some clinical deficiencies signs like oedema, keratomalacia, bitot's spot, pale conjunctiva, epiphyseal enlargement, rickets and ichthyosis included in the study, which are the signs of deficiencies of vitamin A, vitamin D, vitamin C and iron.