CHAPTER V

RESULTS

A total of 509 boys ranging in age from 11 to 18 years have been measured for 10 anthropometric dimensions for the present study. After recording the measurements on the Heath-Carter Somatotype Rating Form, the three components of somatotype are calculated for each child. Thereafter, the entire data has been subjected to various statistical analysis as described in the preceding chapter. The results of these analyses are being presented in this chapter. First of all the somatotype distributions of urban and rural samples are presented, followed by age changes in somatotypes, and urban-rural comparisons.

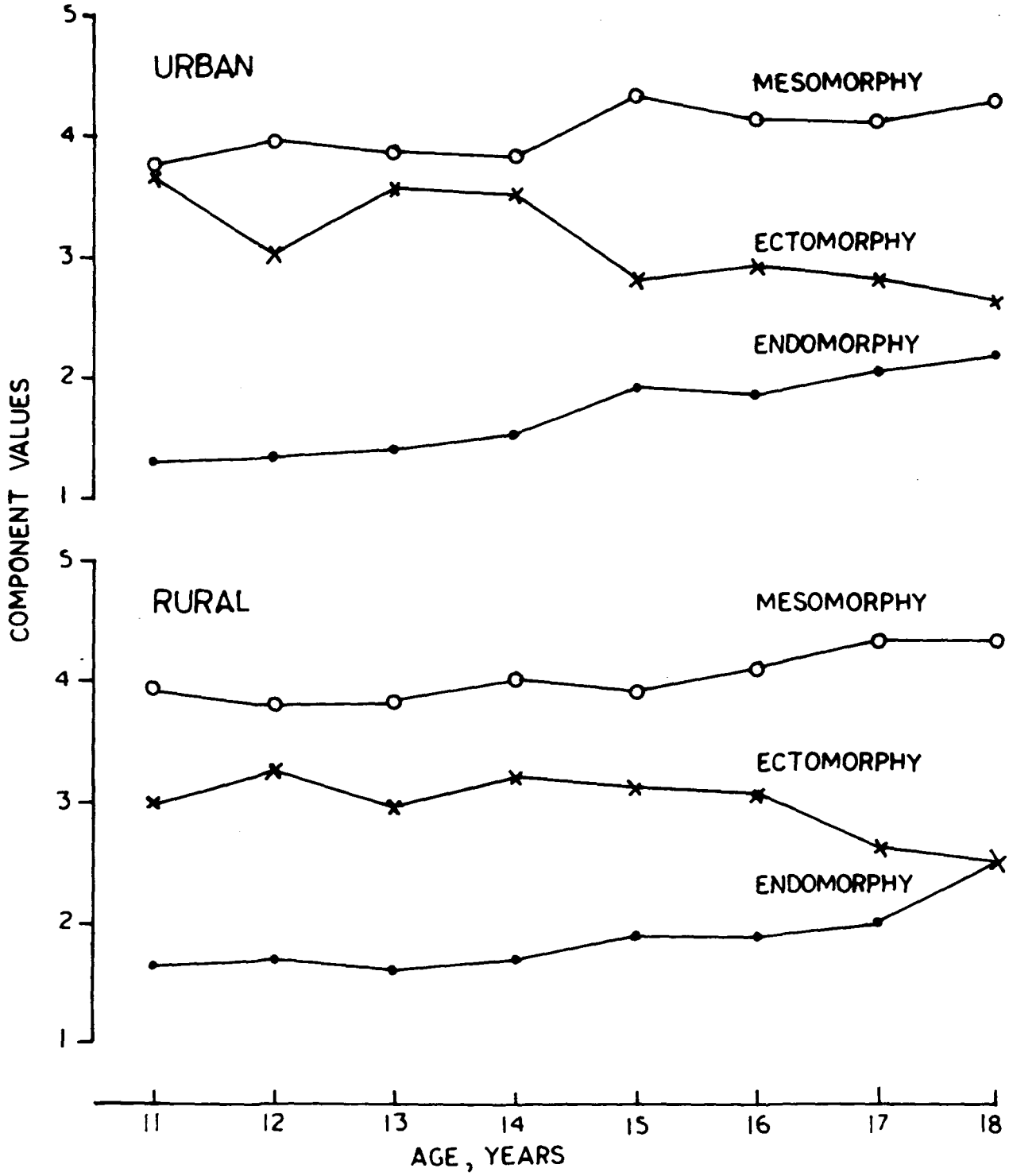
SOMATOTYPE DISTRIBUTION OF URBAN SAMPLE

Mean Somatotypes: Age-wise distribution of the mean somatotypes and other descriptive statistics for the urban sample of 253 Pnar boys is presented in Table 2. At the age of 11 years urban boys are mesomorph-ectomorph with almost equal values for the two components. However, at age 12 years they show a change in the component dominance, and are observed to be ecto-mesomorphic. The urban subjects remain ecto-mesomorphic at age 13 and 14 years as well, though the value for ectomorphy is higher at these ages as compared to that among 12 year old boys. From 14 upto 18

Table 2. Age-wise statistics for Somatotypes of urban Pnar boys.

Age	N	Statistics	Somatotypes			Two Dimensions		SDM	Three Dimensions
			Endomorphy	Mesomorphy	Ectomorphy	Plot Coordinates			SAM
						X	Y		
11	32	Mean	1.29	3.76	3.65	2.36	2.92	1.65	1.02
		Variance	0.12	0.28	0.39	0.61	2.04	0.95	0.41
		SD	0.34	0.53	0.62	0.78	1.43	1.01	0.64
12	31	Mean	1.31	3.98	3.01	1.69	3.63	2.27	1.66
		Variance	0.11	0.42	1.22	1.30	4.64	3.41	1.61
		SD	0.33	0.65	1.10	1.14	2.15	1.85	1.27
13	33	Mean	1.37	3.87	3.55	2.18	2.83	2.25	1.35
		Variance	0.07	0.45	0.74	0.80	3.89	1.41	2.04
		SD	0.26	0.67	0.86	0.89	1.97	1.19	1.43
14	31	Mean	1.52	3.82	3.51	1.98	2.63	2.55	1.66
		Variance	0.12	0.57	0.96	1.21	5.57	2.58	0.59
		SD	0.35	0.76	0.98	1.10	2.36	1.61	0.77
15	33	Mean	1.94	4.31	2.80	0.80	3.86	2.33	1.49
		Variance	0.15	0.54	0.55	1.12	3.54	1.55	0.77
		SD	0.39	0.74	0.74	1.06	1.88	1.24	0.88
16	30	Mean	1.86	4.12	2.92	1.09	3.43	2.90	1.72
		Variance	0.31	0.80	1.12	2.23	5.61	4.05	1.25
		SD	0.56	0.90	1.06	1.49	2.37	2.01	1.12
17	30	Mean	2.02	4.10	2.79	0.80	3.37	2.56	1.58
		Variance	0.24	0.58	1.12	1.89	4.96	3.81	0.66
		SD	0.49	0.76	1.06	1.38	2.23	1.95	0.81
18	33	Mean	2.17	4.26	2.63	0.46	3.71	2.24	1.42
		Variance	0.15	0.52	0.56	0.88	3.93	1.68	0.81
		SD	0.38	0.72	0.75	0.94	1.98	1.30	0.90

FIG. 4 AGE WISE SOMATOTYPE COMPONENT VARIATION IN URBAN AND RURAL PNAR BOYS



years the ectomorphy component decreases, while the mesomorphy component increases. The endomorphy component reveals a steady increase from 11 to 18 years. On the whole, it can be said that the urban Pnar boys are ecto-mesomorphic from 11 to 18 years of age. Of the three components of somatotype, the lowest values are observed for endomorphy and the highest for mesomorphy. In other words, these boys show a high musculo-skeletal development with relatively least fat in their physique.

Between 11 and 18 years of age, an overall increase of 0.88 units in endomorphy, 0.50 units increase in mesomorphy, and 1.02 unit decrease in ectomorphy is observed in the mean component ratings. The values for somatotype dispersion means and somatotype attitudinal means (Table 2) indicate that the somatotypes at different ages considered do not differ in the dispersion about their means.

Fig. 4 presents age-wise component variation in the somatotypes of urban and rural boys. It is clear from the figure that from 11 to 18 years though the urban boys of the present study are generally ecto-mesomorphic, they reveal a change in the values of the three components of their physique.

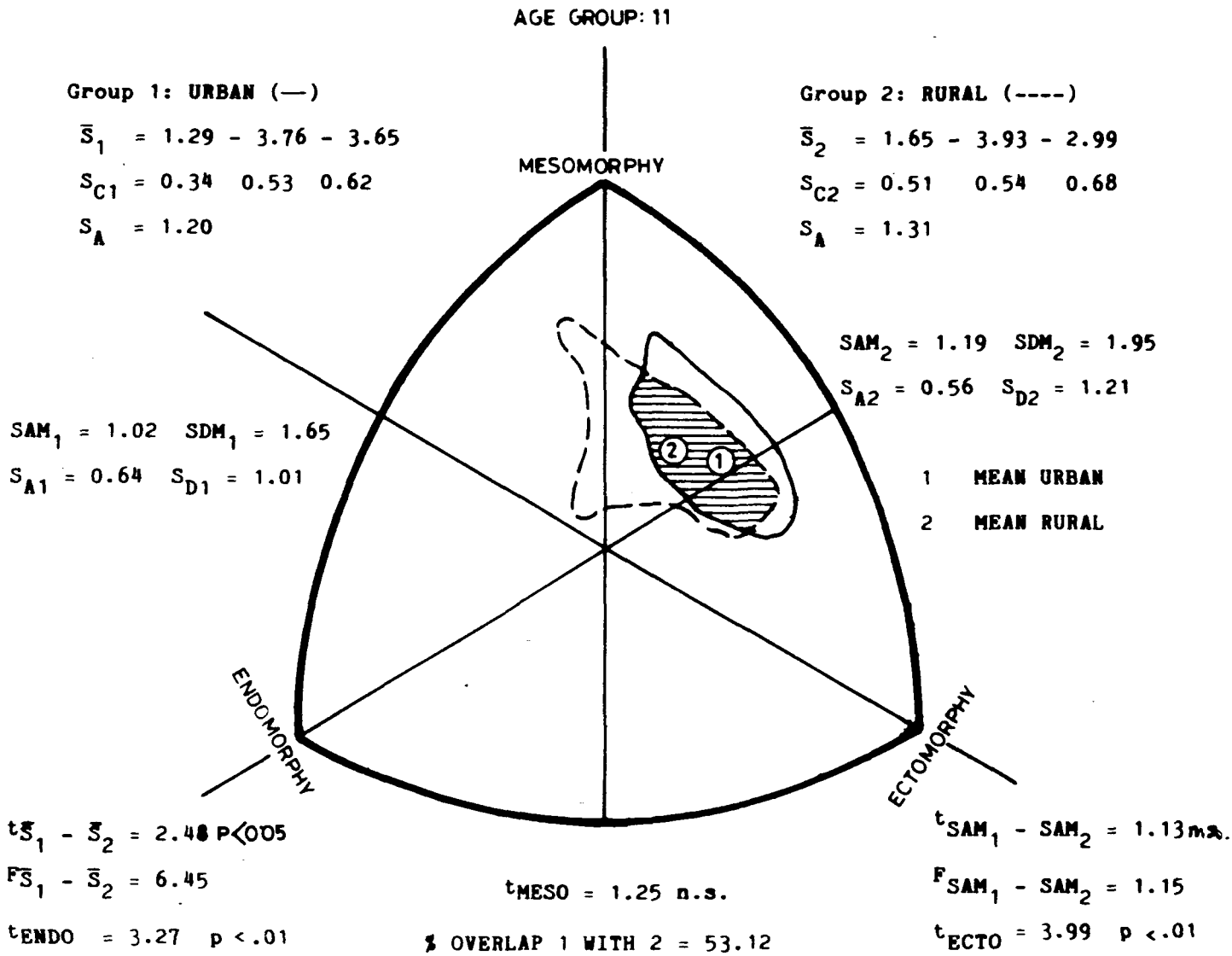


FIG. 5 DESCRIPTIVE AND COMPARATIVE SOMATOTYPE STATISTICS IN URBAN AND RURAL SAMPLES.

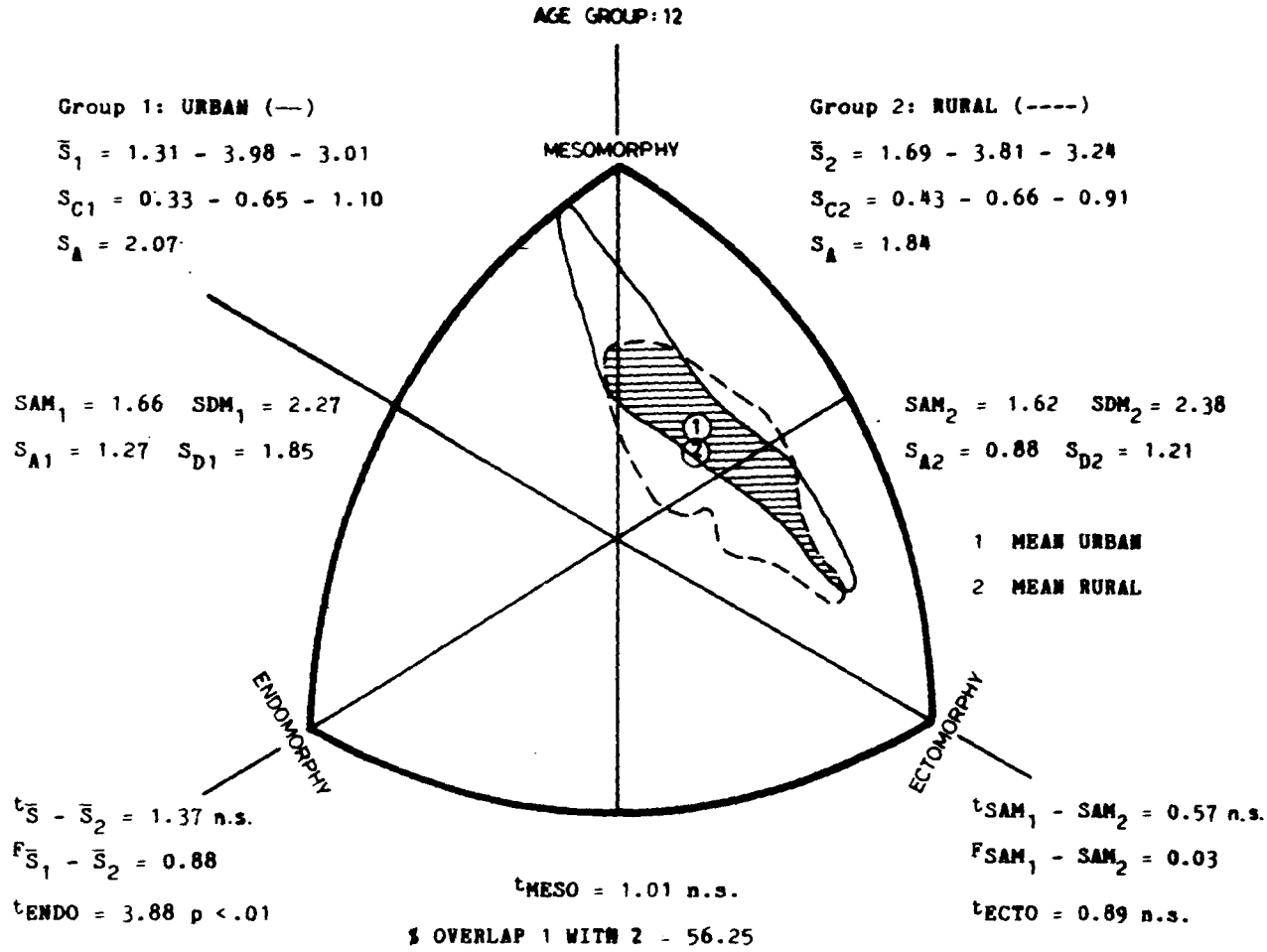


FIG. 6 DESCRIPTIVE AND COMPARATIVE SOMATOTYPE STATISTICS IN URBAN AND RURAL SAMPLES

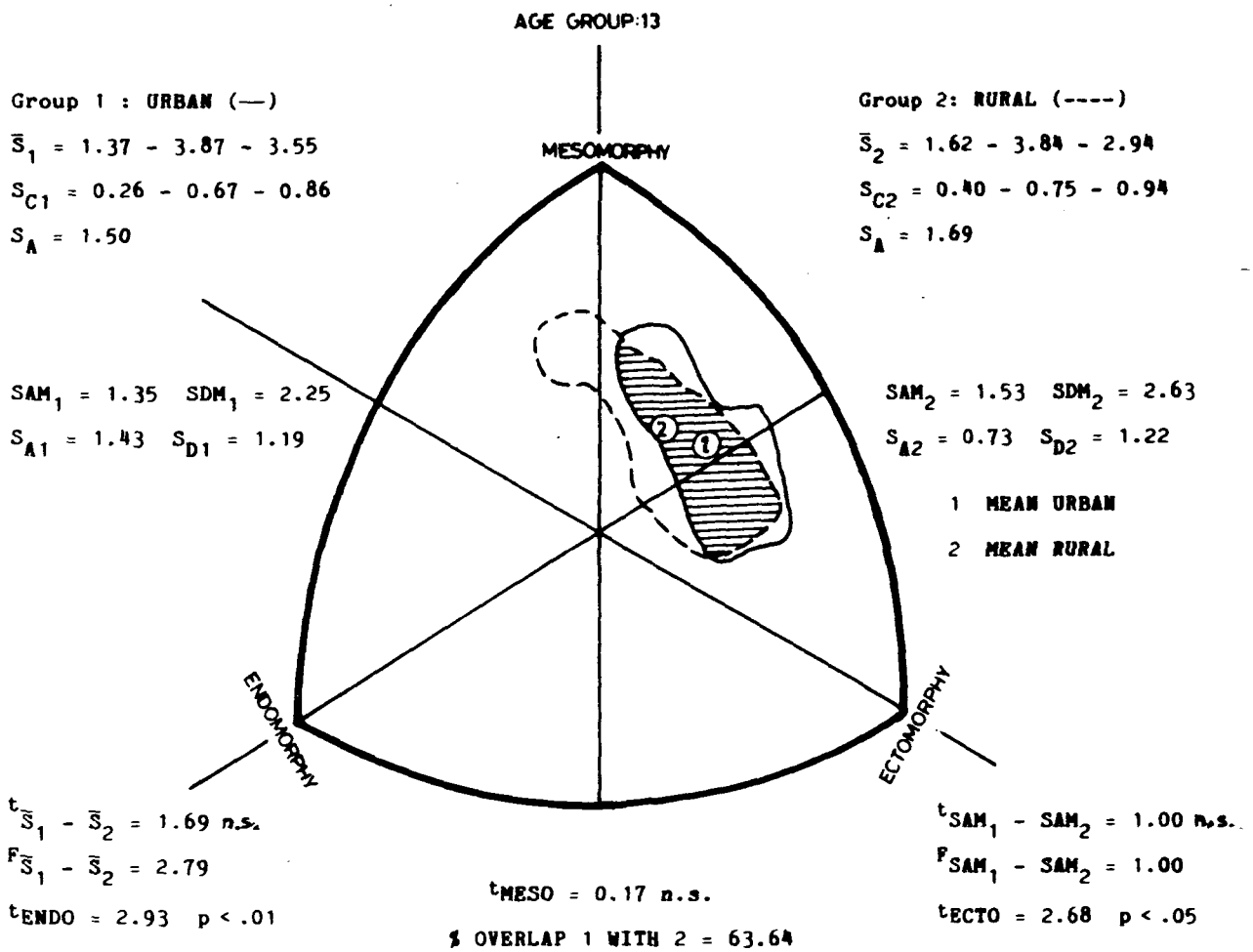


FIG. 7 DESCRIPTIVE AND COMPARATIVE SOMATOTYPE STATISTICS IN URBAN AND RURAL SAMPLES.

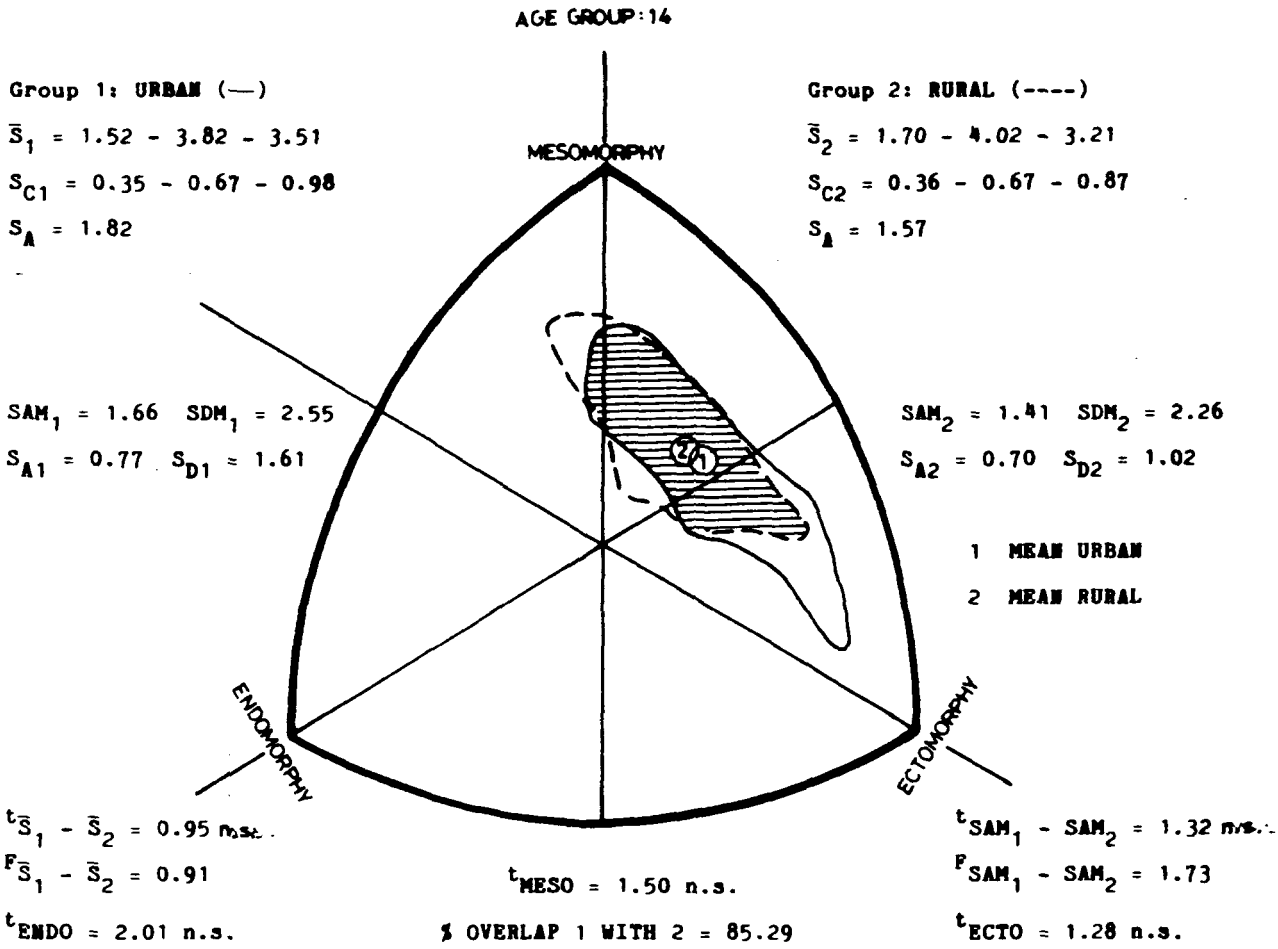


FIG. 8 DESCRIPTIVE AND COMPARATIVE SOMATOTYPE STATISTICS IN URBAN AND RURAL SAMPLES

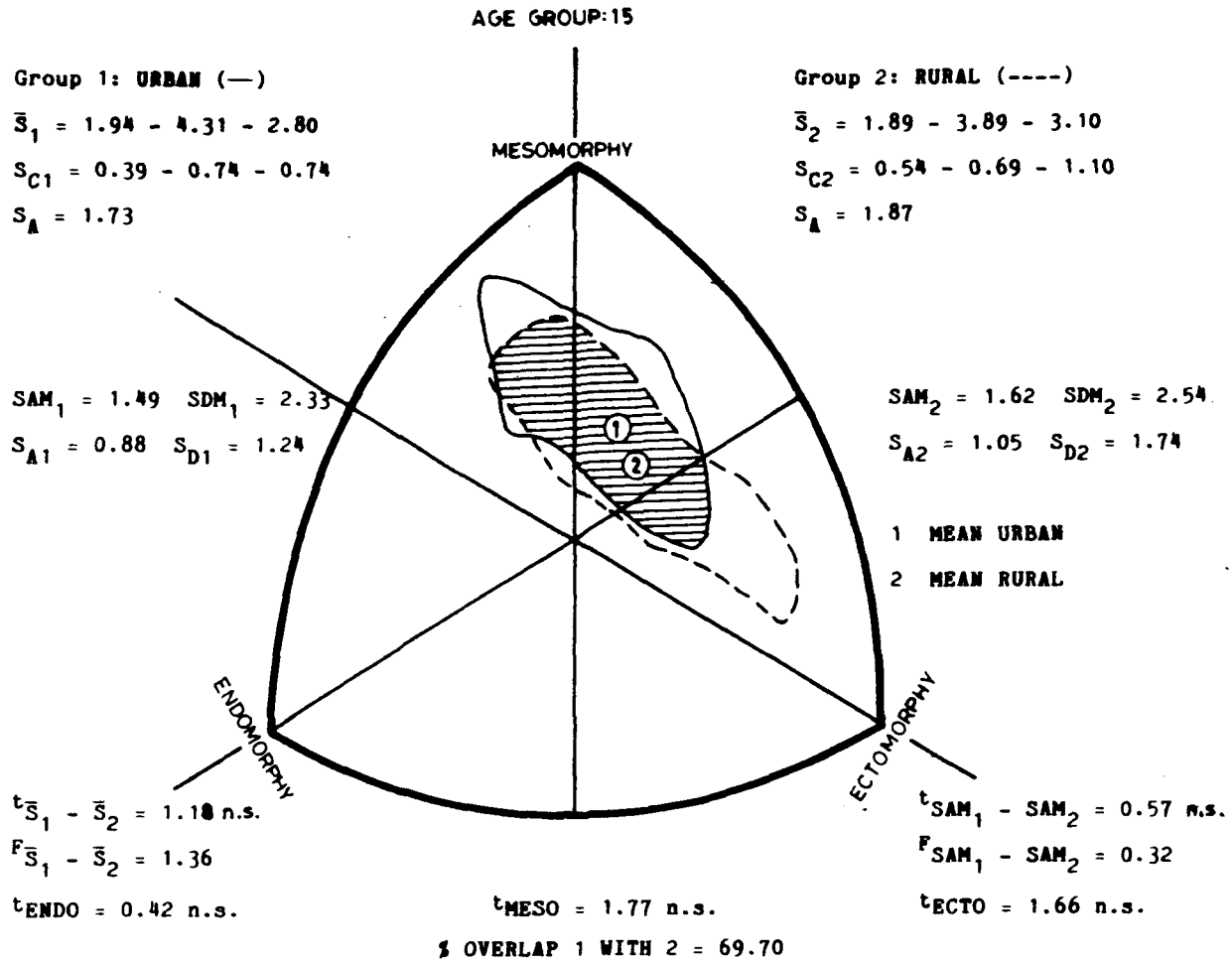
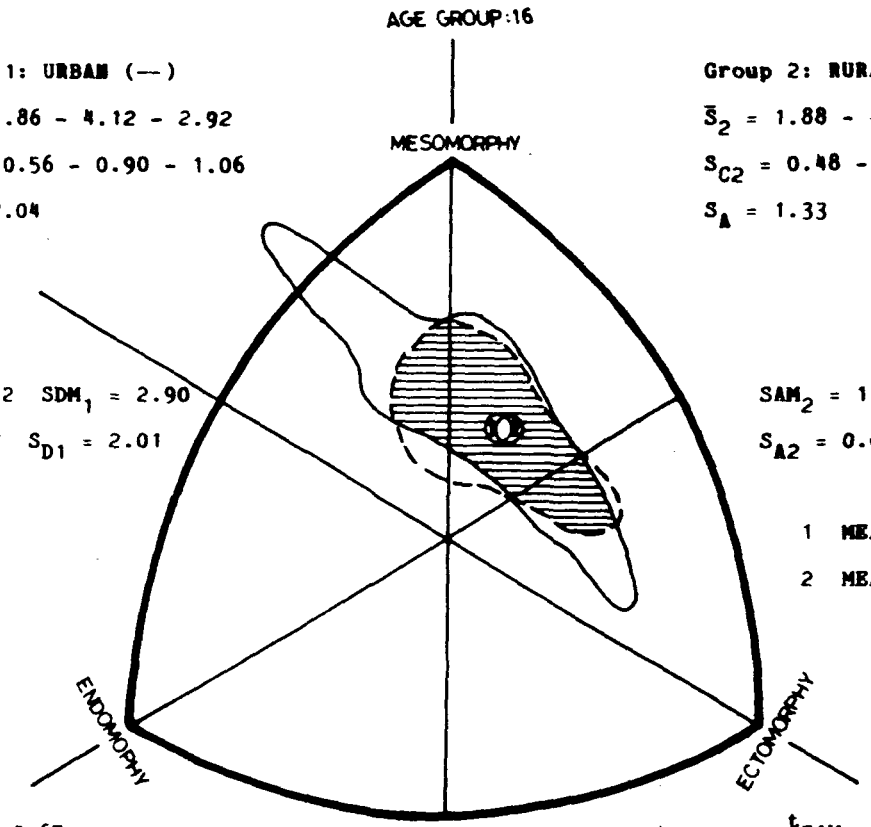


FIG. 9 DESCRIPTIVE AND COMPARATIVE SOMATOTYPE STATISTICS IN URBAN AND RURAL SAMPLES.



Group 1: URBAN (—)

$\bar{S}_1$ = 1.86 - 4.12 - 2.92

S_{C1} = 0.56 - 0.90 - 1.06

S_A = 2.04

Group 2: RURAL (----)

$\bar{S}_2$ = 1.88 - 4.10 - 3.06

S_{C2} = 0.48 - 0.60 - 0.77

S_A = 1.33

SAM_1 = 1.72 SDM_1 = 2.90

S_{A1} = 1.12 S_{D1} = 2.01

SAM_2 = 1.24 SDM_2 = 2.25

S_{A2} = 0.63 S_{D2} = 1.11

1 MEAN URBAN

2 MEAN RURAL

$t_{\bar{S}_1 - \bar{S}_2}$ = 0.67 n.s.

$F_{\bar{S}_1 - \bar{S}_2}$ = 0.10

t_{ENDO} = 0.15 n.s.

t_{MESO} = 0.10 n.s.

% OVERLAP 1 WITH 2 = 83.87

$t_{SAM_1 - SAM_2}$ = 2.00 P<.05

$F_{SAM_1 - SAM_2}$ = 4.44

t_{ECTO} = 0.58 n.s.

FIG.10 DESCRIPTIVE AND COMPARATIVE SOMATOTYPE STATISTICS IN URBAN AND RURAL SAMPLES.

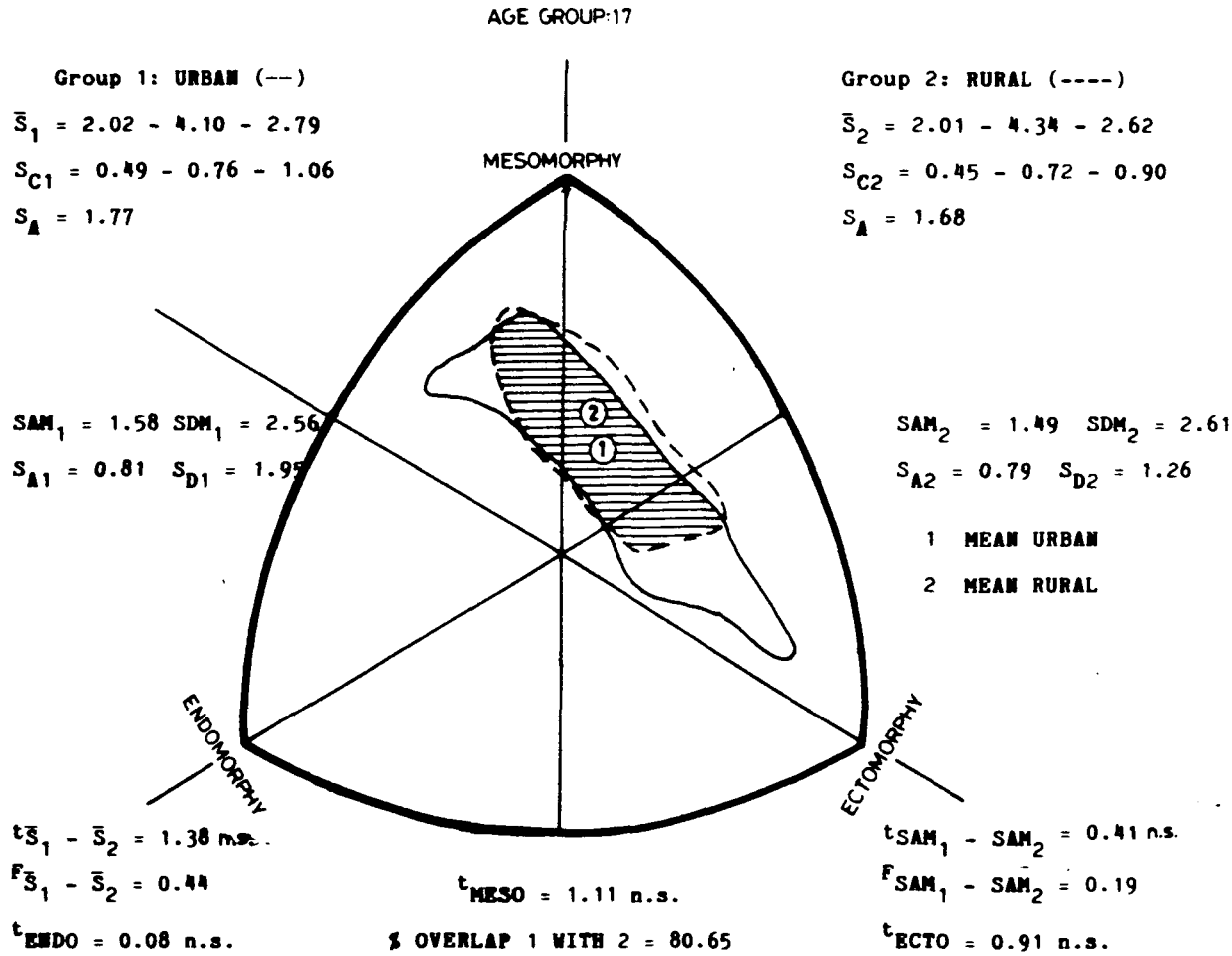


FIG. 11 DESCRIPTIVE AND COMPARATIVE SOMATOTYPE STATISTICS IN URBAN AND RURAL SAMPLES.

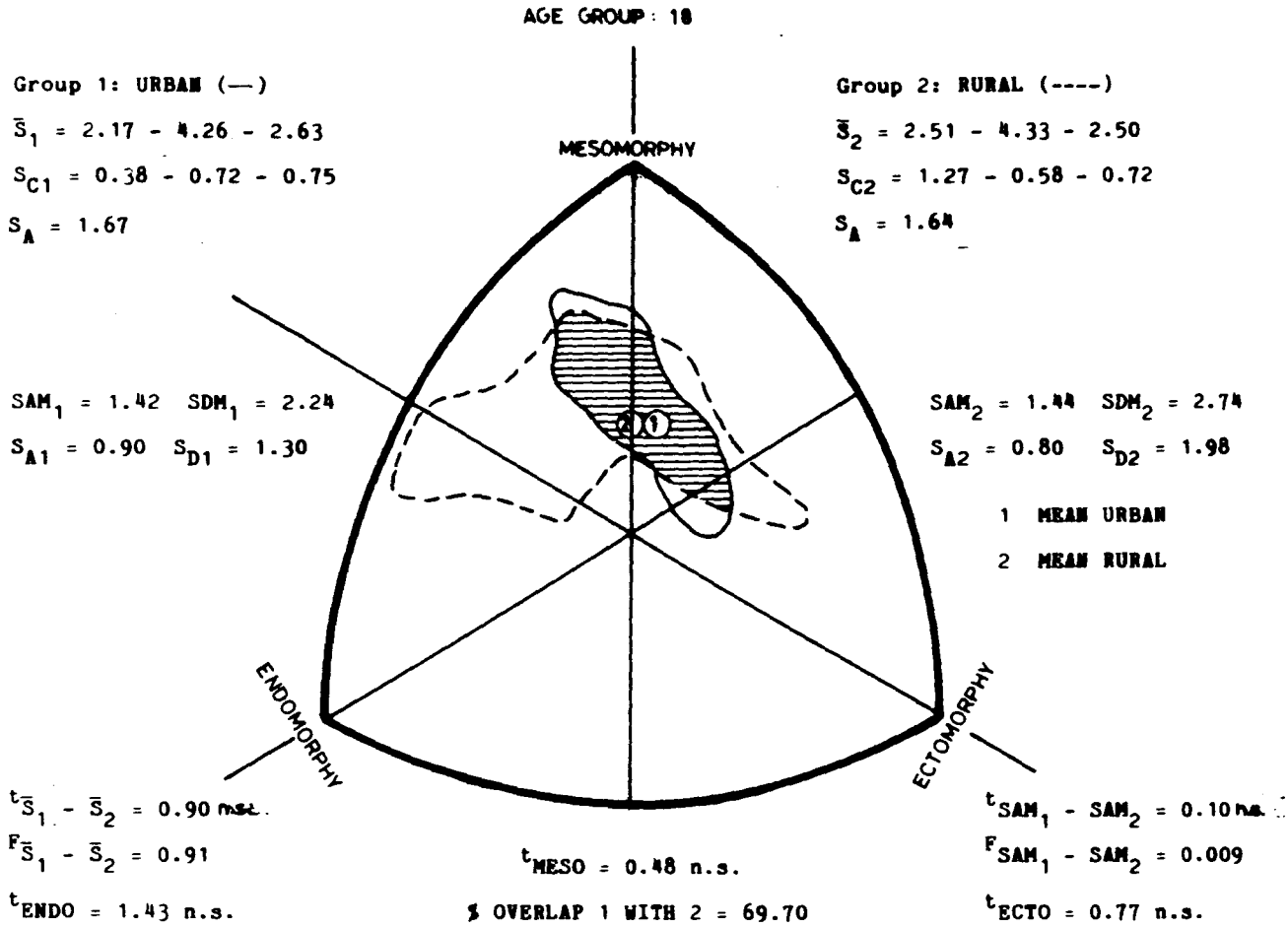


FIG. 12 DESCRIPTIVE AND COMPARATIVE SOMATOTYPE STATISTICS IN URBAN AND RURAL SAMPLES.

Somatocharts: The somatotype of each subject of the urban sample is plotted on somatochart according to age-group. Thereafter, the area of somatotype distribution for each age group is drawn, along with the depiction of mean somatotype of an age group. These age-wise somatocharts and other descriptive statistics are presented in Fig. 5 to 12.

It is clear from these somatocharts that at all ages the somatotypes of urban boys are distributed in the ectomorphy-mesomorphy sector above the ectomorphy axis. At age 11 years a majority of the somatotypes cluster around the upper side of endomorphy axis, in the ectomorphy-mesomorphy sector. However, as age increases, somatotypes show a general tendency to shift towards the upper side of mesomorphy axis. At all ages the mean somatotype lies between the upper mesomorphy and upper endomorphy axes. Some extreme somatotypes are found to occur only in age groups 12, 14, 16 and 17 years.

Range of Component Ratings: Considering the total urban sample of 253 boys together, ratings of the three components range between 0.7 and 3.7 for endomorphy, 1.9 and 6.8 for mesomorphy, and 0.2 and 6.0 for ectomorphy. However, a majority of the subjects show values falling within the range of 1.0-2.0 for endomorphy, 3.0-5.0 for mesomorphy, and 2.0-4.0 for ectomorphy.

Table 3. Age-wise frequency and percentage of urban boys in various somatotype categories.

Sl. No.	Somatotype Categories	AGE GROUP							
		11 Year	12 Year	13 Year	14 Year	15 Year	16 Year	17 Year	18 Year
		f (%)	f (%)	f (%)	f (%)	f (%)	f (%)	f (%)	f (%)
1.	Balanced endomorph	-	-	-	-	-	-	-	-
2.	Mesomorphic endomorph	-	-	-	-	-	-	-	-
3.	Mesomorph-endomorph	-	-	-	-	-	-	-	-
4.	Endomorphic mesomorph	-	-	-	-	2(6.061)	3(10.000)	1(3.333)	3(9.091)
5.	Balanced mesomorph	2(6.250)	9(29.032)	3(9.091)	6(19.355)	13(39.394)	9(30.000)	17(56.667)	18(54.546)
6.	Ectomorphic mesomorph	3(9.375)	8(25.807)	9(27.273)	5(16.129)	6(18.182)	3(10.000)	4(13.333)	1(3.030)
7.	Mesomorph-ectomorph	25(78.125)	11(35.484)	13(39.394)	14(45.161)	11(33.333)	11(36.667)	4(13.333)	10(30.303)
8.	Mesomorphic ectomorph	2(6.250)	3(9.677)	7(21.212)	5(16.129)	1(3.030)	3(10.000)	2(6.667)	1(3.030)
9.	Balanced ectomorph	-	-	1(3.030)	1(3.226)	-	1(3.333)	2(6.667)	-
10.	Endomorphic ectomorph	-	-	-	-	-	-	-	-
11.	Endomorph-ectomorph	-	-	-	-	-	-	-	-
12.	Ectomorph endomorph	-	-	-	-	-	-	-	-
13.	Central	-	-	-	-	-	-	-	-

Somatotype Categories: The somatotype data on urban sample has been grouped into different categories following the component dominance method of Carter (1980). The age-wise frequency and percentage of urban subjects falling under various categories is listed in Table 3. On the whole it can be seen from the table that out of 13 generalized categories of somatotypes, the urban boys of different age groups of the present study are distributed only among 6 categories, viz., Endomorphic-mesomorph, Balanced mesomorph, Ectomorphic mesomorph, Mesomorph-ectomorph, Mesomorphic-ectomorph and Balanced ectomorph. The 11 year old urban boys are found to be distributed into 4 categories, i.e., Balanced mesomorph (6.25%), Ectomorphic-mesomorph (9.38%), Mesomorph-ectomorph (78.13%) and Mesomorphic-ectomorph (6.25%). In 12 year old boys also the somatotype distribution are found in four categories with a majority (35.48%) being Mesomorph-ectomorph. The somato-types of 13 and 14 years old boys are distributed in the same five categories with a majority (39.39%) in 13 year and (45.15%) in 14 year age group, falling under Mesomorph-ectomorph. In 15 year old, the somatotypes are distributed into 5 categories with a majority (39.39%) being Balanced mesomorph. The somatotypes in age group 16 year and 17 year are found to be distributed into 6 categories, while, in 16 year old maximum number of boys (36.67%) are Mesomorph-ectomorph, whereas in 17 year old boys a majority (56.67%)

are Balanced mesomorph. And in the age group 18 years the somatotypes are distributed into 5-categories with a majority (54.55%) being Balanced mesomorph, while only (30.30%) of the boys falls under the Mesomorph-ectomorph category.

SOMATOTYPE DISTRIBUTION OF RURAL SAMPLE

Mean Somatotypes: Age-wise distribution of the mean somatotypes and other descriptive statistics for the rural sample of 256 Pnar boys is presented in Table 4. At 11 years of age rural boys are ecto-mesomorphic, with mesomorphy dominating over ectomorphy component by almost 1.0 unit. Among the 12 year old boys mesomorphy value decreases a little while the value for ectomorphy increases, but these boys still remain ecto-mesomorphic. From 12 to 18 years the value for mesomorphy increases steadily, however, the value for ectomorphy first decreases between 12 and 13 years, then increases between 13 and 14 years, thereafter from 14 to 18 years decreases steadily. On the other hand, the value for endomorphy component increases steadily from 11 to 18 years, and at age 18 both ectomorphy and endomorphy component show equal values. On the whole, it can be said that the rural Pnar boys, like their urban counterparts, are also ecto-mesomorphic from age 11 to 18 years. Among the three components of somato-

Table 4. Age-wise statistics for somatotypes of rural Pnar boys.

Age	N	Statistics	Endomorphy	Mesomorphy	Ectomorphy	Two Dimensions Plot Coordinates X	Two Dimensions Plot Coordinates Y	SDM	Three Dimensions SAM
11	32	Mean	1.65	3.93	2.99	1.34	3.20	1.95	1.19
		Variance	0.26	0.29	0.47	0.98	2.27	1.46	0.31
		SD	0.51	0.54	0.68	0.99	1.51	1.21	0.56
12	32	Mean	1.69	3.81	3.24	1.54	2.72	2.38	1.62
		Variance	0.19	0.43	0.83	1.08	3.81	1.46	0.77
		SD	0.43	0.66	0.91	1.04	1.95	1.21	0.88
13	32	Mean	1.62	3.84	2.94	1.33	3.13	2.63	1.53
		Variance	0.17	0.57	0.87	1.15	4.64	1.49	0.53
		SD	0.40	0.75	0.94	1.07	2.16	1.22	0.73
14	34	Mean	1.70	4.02	3.21	1.50	3.12	2.26	1.41
		Variance	0.13	0.45	0.76	1.09	3.71	1.04	0.49
		SD	0.36	0.67	0.87	1.05	1.93	1.02	0.70
15	32	Mean	1.89	3.89	3.10	1.24	2.76	2.54	1.62
		Variance	0.29	0.47	1.21	1.99	3.87	2.96	1.10
		SD	0.54	0.69	1.10	1.41	1.97	1.72	1.05
16	31	Mean	1.88	4.10	3.06	1.18	3.27	2.25	1.24
		Variance	0.23	0.35	0.59	1.16	2.79	1.23	0.40
		SD	0.48	0.60	0.77	1.08	1.67	1.11	0.63
17	31	Mean	2.01	4.34	2.62	0.61	4.14	2.61	1.49
		Variance	0.20	0.52	0.81	1.41	3.92	1.59	0.62
		SD	0.45	0.72	0.90	1.19	1.98	1.26	0.79
18	32	Mean	2.51	4.33	2.50	-0.01	3.65	2.74	1.44
		Variance	1.61	0.33	0.52	2.95	2.47	3.92	0.64
		SD	1.27	0.58	0.72	1.72	1.57	1.98	0.80

type the lowest values are observed for endomorphy and the highest for mesomorphy, whereas ectomorphy lies in the middle. In other words, an observed for the urban boys, the rural boys of the present sample also show a high musculo-skeletal development with relatively less fat in their physique.

An overall increase of 0.86 unit in endomorphy, 0.40 unit in mesomorphy and 0.45 unit decrease in ectomorphy is observed in the mean component ratings between 11 and 18 years of age. The values for somatotype dispersion means as well as somatotype attitudinal means (Table 4) indicate that the somatotypes at various ages considered here do not differ in the dispersion about their means.

Age-wise component variation in the somatotypes of rural boys is depicted in Fig. 4. It can be seen from the figure that though the rural boys of the present study are generally ecto-mesomorphic as they grow in age a change in the values of the three components of their physique is observed.

Somatocharts: The age-wise somatocharts and other descriptive statistics for the rural sample is presented in Fig. 5 to 12. It is obvious from these somatocharts that, excepting for age 18 years, at all ages the somatotypes of

rural boys are distributed in the ectomorphy-mesomorphy sector above the ectomorphy axis. At age 18 years the somatotypes of only 4 boys fall in the endomorphy-mesomorphy sector below the ectomorphy axis. A majority of the somatotypes of 11 and 12 year old boys tend to cluster around the upper side of endomorphy axis in the ectomorphy-mesomorphy sector. With increasing age from 13 years onwards, however, somatotypes show a general tendency to shift towards the upper side of mesomorphy axis. A few extreme somatotypes are observed in age groups 11, 12 and 18 years. The mean somatotypes for age groups 11 to 17 years are located between the upper mesomorphy and upper endomorphy axes. However, the mean somatotype of 18 year old rural boys lies on the upper mesomorphy axis.

Range of Component Ratings: Based on the total rural sample of 256 boys, ratings of the three components range between 0.9 and 6.3 for endomorphy, 2.5 and 5.7 for mesomorphy, and 0.4 and 6.3 for ectomorphy. However, most of the rural subjects show values falling within the range of 1.0-2.0 for endomorphy, 3.0-5.0 for mesomorphy, and 2.0-4.0 for ectomorphy.

Somatotype Categories: The age-wise frequency and percentage of rural subjects falling under various categories according to component dominance is presented in

Table 5. Age-wise frequency and percentage of rural boys in various somatotype categories.

Sl. No.	Somatotype Categories	AGE GROUP							
		11 Year	12 Year	13 Year	14 Year	15 Year	16 Year	17 Year	18 Year
		f (%)	f (%)	f (%)	f (%)	f (%)	f (%)	f (%)	f (%)
1.	Balanced endomorph	-	-	-	-	-	-	-	
2.	Mesomorphic endomorph	-	-	-	-	-	-	-	1(3.125)
3.	Mesomorph-endomorph	-	-	-	-	-	-	-	5(15.625)
4.	Endomorphic mesomorph	-	-	1(3.125)	-	2(6.250)	1(3.226)	4(12.903)	2(6.250)
5.	Balanced mesomorph	10(31.250)	8(25.000)	10(31.250)	9(26.471)	11(34.375)	13(41.936)	14(45.161)	15(46.875)
6.	Ectomorphic mesomorph	4(12.500)	5(15.625)	3(9.375)	5(14.706)	5(15.625)	2(6.452)	3(9.677)	3(9.375)
7.	Mesomorph-ectomorph	17(53.125)	15(46.875)	14(43.750)	18(52.941)	10(31.250)	14(45.161)	10(32.258)	5(15.625)
8.	Mesomorphic-ectomorph	1(3.125)	4(12.500)	3(9.375)	2(5.882)	2(6.250)	1(3.226)	-	1(3.125)
9.	Balanced ectomorph	-	-	1(3.125)	-	2(6.250)	-	-	-
10.	Endomorphic ectomorph	-	-	-	-	-	-	-	-
11.	Endomorph-ectomorph	-	-	-	-	-	-	-	-
12.	Ectomorphic endomorph	-	-	-	-	-	-	-	-
13.	Central	-	-	-	-	-	-	-	-

Table 5. The somatotypes of different age group of rural boys are distributed into 8 categories, viz., Mesomorphic-endomorph, Mesomorph-endomorph, Endomorphic-mesomorph, Balanced mesomorph, Ectomorphic-mesomorph, Mesomorph-ectomorph, Mesomorphic-ectomorph and Balanced ectomorph are observed. The 11 year old rural boys are found to be distributed into 4 categories, Balanced mesomorph (31.25%), Ectomorphic-mesomorph (12.50%), Mesomorph-ectomorph (53.13%) and Mesomorphic-ectomorph (3.13%). The somatotypes of the 12 year old boys also distributed into the same 4 categories with a majority (46.88%) falls under Mesomorph-ectomorph. In age group 13 year the somatotypes are distributed into 6 categories with a majority (43.75%) falls under mesomorph-ectomorph. Whereas, in the age group 14 year, the somatotypes are distributed into 4 categories with a majority (52.94%) falling under Mesomorph-ectomorph. In the age group 15 year, the somatotypes are distributed into 6 categories with a majority (34.38%) being Balanced mesomorph. In 16 year old boys, the somatotypes are distributed into 5 categories with a majority (41.94%) falling under Balanced mesomorph. The 17 year old boys are found to be distributed into 4 categories with a majority (45.16%) being Balanced mesomorph. And in the age group 18 year, the somatotypes are distributed into 7 categories with a majority (46.88%) as Balanced mesomorph, whereas only (15.63%) falls under Mesomorph-ectomorph.

Table 6. Age-wise comparisons (t-values) of three components of mean somatotype in urban and rural Pnar boys.

Age groups compared	URBAN BOYS			RURAL BOYS		
	Endomorphy	Mesomorphy	Ectomorphy	Endomorphy	Mesomorphy	Ectomorphy
11-12 Yrs	- 0.233	- 1.446	2.787**	- 0.334	0.784	- 1.225
12-13 Yrs	- 0.792	0.656	- 2.144*	0.664	- 0.167	1.277
13-14 Yrs	- 1.906	0.372	0.170	- 0.839	- 1.010	- 1.191
14-15 Yrs	- 4.468**	- 3.366**	3.203**	- 1.645	0.567	0.562
15-16 Yrs	0.641	0.895	- 0.508	0.077	- 0.930	0.213
16-17 Yrs	- 1.158	0.091	0.548	- 1.082	- 1.215	2.286*
17-18 Yrs	- 1.326	- 1.024	0.853	- 2.062*	0.048	0.716
11-18 Yrs	- 9.693**	- 3.146**	5.892**	- 3.906**	- 2.810*	2.755**

* $p < 0.05$
** $p < 0.05$

Age Changes in Somatotypes

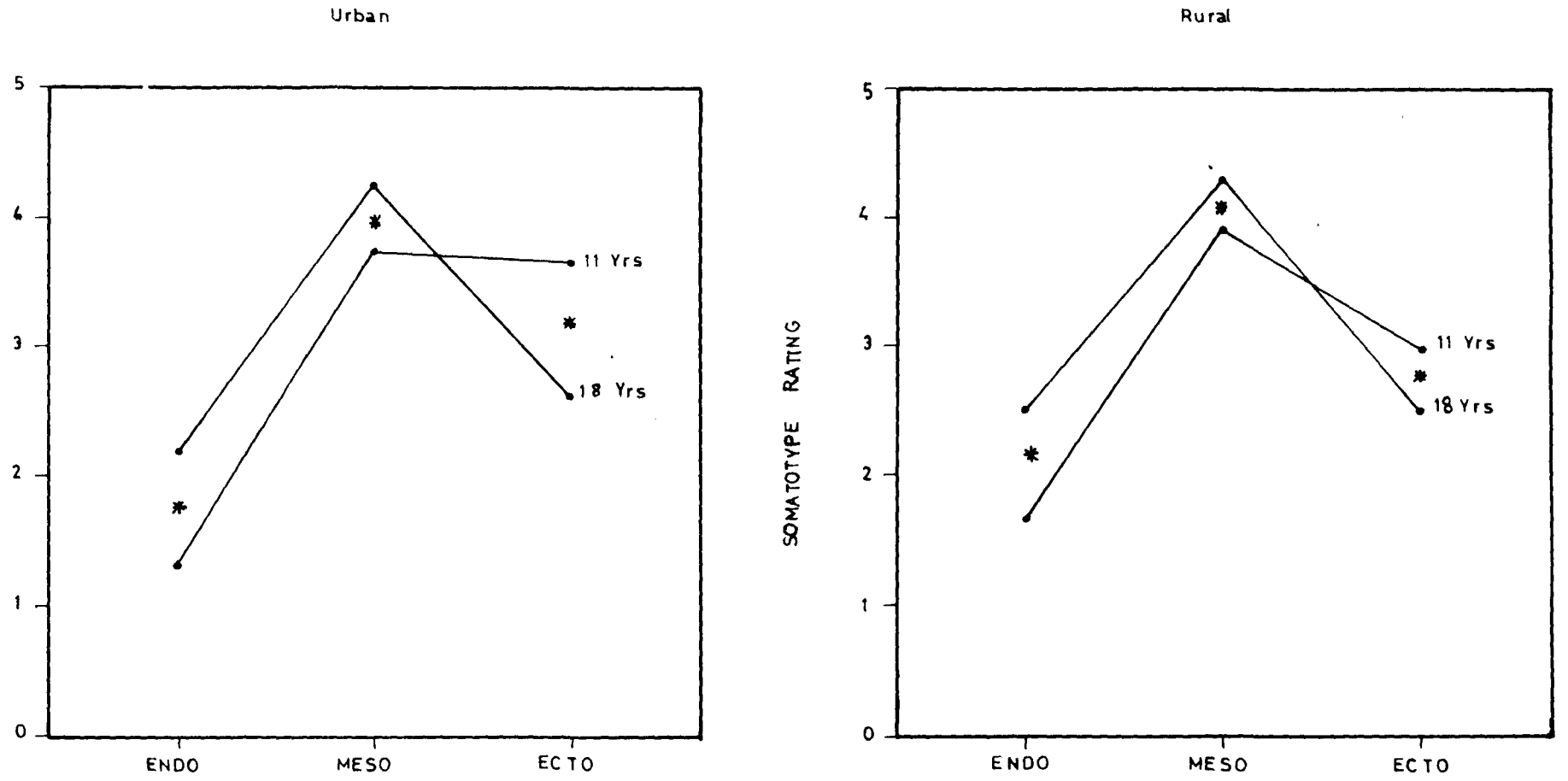
It is known that some children change somatotype while others have relatively stable somatotypes. Many cross-sectional and longitudinal studies (reviewed in Chapter II) have provided information on the question of stability of somatotypes. The present study also makes an attempt to answer this question. The age changes in somatotypes are being analyzed here by using t-test and chi-square test as applied to mean somatotype ratings and somatotype categories, respectively.

Mean Somatotypes: Age-wise comparisons of three components of mean somatotypes in urban and rural Pnar boys are presented in Table 6. The table gives t-values between preceding and succeeding age groups for endomorphy, mesomorphy and ectomorphy. It is clear from the values that from age 14 to 15 years a statistically significant change in all the three components of physique occur among urban boys. These boys also reveal a significant change in ectomorphy between age 11 and 12, and 12 and 13 years. On the other hand, the rural boys show statistically significant change in ectomorphy between age 11 and 12, and 12 and 13 years. On the other hand, the rural boys show statistically significant changes only between age 16 and 17 years for ectomorphy, and 17 and 18 years for endomorphy. The

Table 7. Age-wise comparisons (X^2-values) of the distribution of somatotype categories in urban and rural Pnar boys.

Age groups compared	Urban Boys			Rural Boys		
	X^2	d.f.	Significance	X^2	d.f.	Significance
11-12 Yrs	4.402	3	n.s.	0.283	3	n.s.
12-13 Yrs	0.908	4	n.s.	0.190	5	n.s.
13-14 Yrs	0.470	4	n.s.	0.363	5	n.s.
14-15 Yrs	1.252	5	n.s.	1.153	5	n.s.
15-16 Yrs	0.492	5	n.s.	0.555	5	n.s.
16-17 Yrs	2.002	5	n.s.	0.451	4	n.s.
17-18 Yrs	0.872	5	n.s.	0.905	6	n.s.
11-18 Yrs	7.613	4	n.s.	3.126	6	n.s.

FIG.13 COMPOGRAM SHOWING AGE CHANGES IN MEAN COMPONENT RATINGS OF URBAN AND RURAL PNAR BOYS (* P <0·05)



last row of Table 6 shows t-values between 11 and 18 years for different components of mean somatotypes, and the same comparison is depicted in Fig. 13. From 11 to 18 years of age statistically significant changes are observed for all components of physique in urban as well as rural boys.

Somatotype Categories: Age-wise comparisons of the distribution of somatotype categories in urban and rural Pnar boys are given in Table 7. Though some age changes in the frequency distribution of somatotypes into various categories are observed (Tables 3 and 5). However, no statistically significant changes in somatotype categories are observed among any age group comparisons of urban as well as rural boys. As seen from X^2 values listed in the last row of Table 7, no statistically significant changes in the distribution of somatotypes into different categories occur from the youngest to the oldest age groups of urban as well as rural Pnar boys of the present study.

Urban-Rural Somatotype Comparisons

After describing the somatotypes and the age changes in urban and rural samples separately, an appropriate comparison between the two samples based on parametric as well as non-parametric statistics has been attempted. These comparisons are for mean somatotypes, component ratings, somatotype categories, per cent overlap.

Table 8. Age-wise urban-rural comparisons (t-values) of somatotypes of Pnar boys.

Age Group	Sample	Mean Somatotype	$t_{\bar{S}_1-\bar{S}_2}$		$t_{SAM_1-SAM_2}$		t_{Endo}		t_{Meso}		t_{Ecto}	
11	Urban Rural	1.29-3.76-3.65 1.65-3.93-2.99	2.48	$p < 0.05$	1.13	n.s.	3.27	$p < 0.01$	1.25	n.s.	3.99	$p < 0.01$
12	Urban Rural	1.31-3.98-3.01 1.69-3.81-3.24	1.37	n.s.	0.57	n.s.	3.88	$p < 0.01$	1.01	n.s.	0.89	n.s.
13	Urban Rural	1.37-3.87-3.55 1.62-3.84-2.94	1.69	n.s.	1.00	n.s.	2.93	$p < 0.01$	0.17	n.s.	2.68	$p<0.05$
14	Urban Rural	1.52-3.82-3.51 1.70-4.02-3.21	0.95	n.s.	1.32	n.s.	2.01	n.s.	1.50	n.s.	1.28	n.s.
15	Urban rural	1.94-4.31-2.80 1.89-3.89-3.10	1.18	n.s.	0.57	n.s.	0.42	n.s.	1.77	n.s.	1.66	n.s.
16	Urban Rural	1.86-4.12-2.92 1.88-4.10-3.06	0.67	n.s.	2.00	$p<0.05$	0.15	n.s.	0.10	n.s.	0.58	n.s.
17	Urban Rural	2.02-4.10-2.79 2.01-4.34-2.62	1.38	n.s.	0.41	n.s.	0.08	n.s.	1.11	n.s.	0.91	n.s.
18	Urban Rural	2.17-4.26-2.63 2.51-4.33-2.50	0.90	n.s.	0.10	n.s.	1.43	n.s.	0.48	n.s.	0.77	n.s.

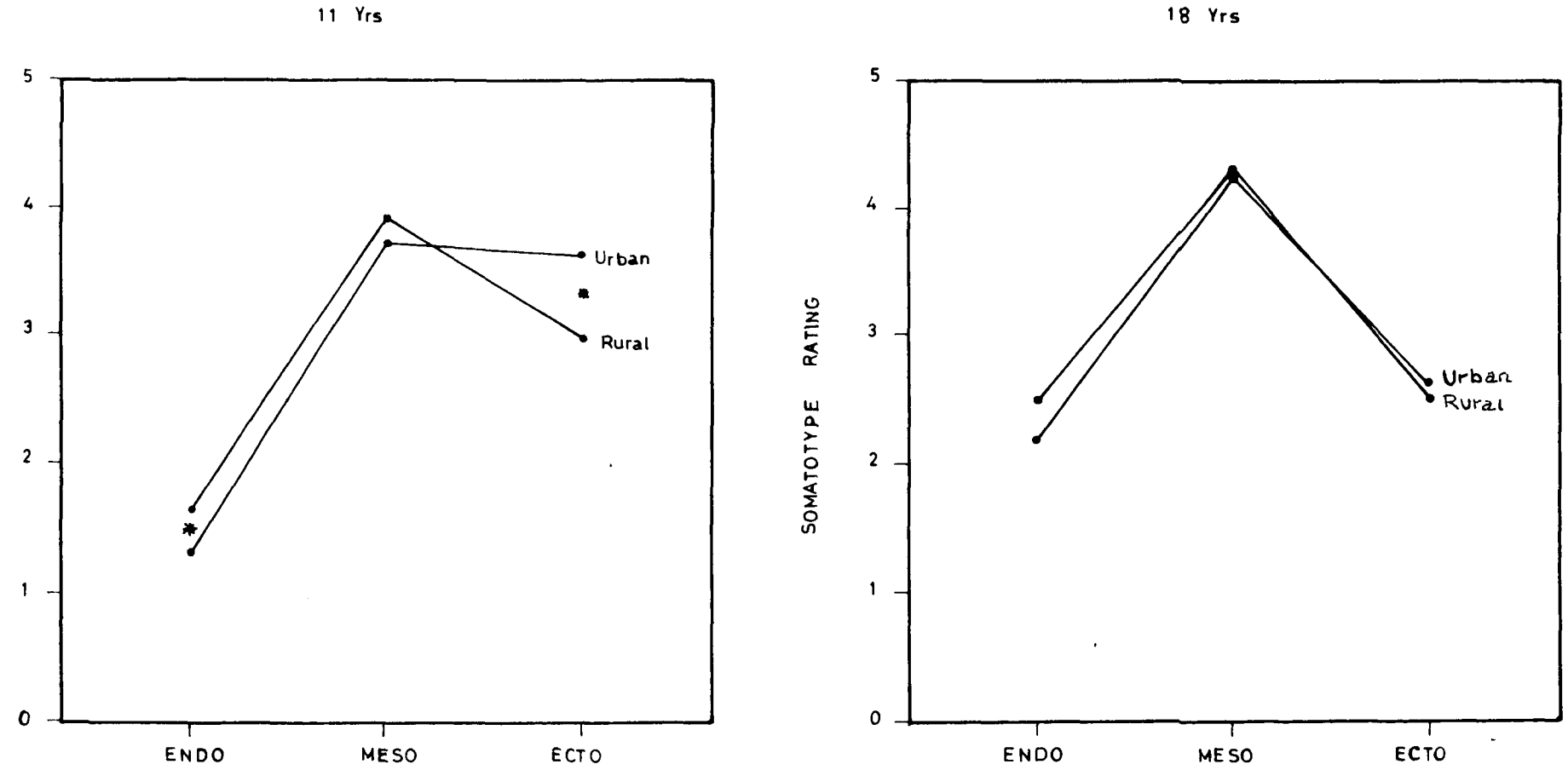
The comparative statistics used include t-ratio, F-ratio, and Chi-square. According to Carter et al. (1983), "The F- and t-ratios appear to be valid when the scatter of somatotypes about their mean is approximately uniform in all directions (i.e., circular). They are less likely to be valid when one or more samples of somatoplots is ~~are~~ asymmetrical (i.e., elliptical)." In the preceding analysis it is observed that ignoring a few extreme somatotypes for both urban and rural samples of the present study the scatter of somatotypes about their means is more or less uniform in all directions. Therefore, an attempt is being made here to find out somatotype similarities/differences between the urban and rural Pnar boys.

Mean Somatotypes: Table 8 shows age-wise urban-rural comparisons (t-values) based on mean somatotypes ($\bar{S}$), somatotype attitudinal means (SAM), and the three somatotype components (Endo, Meso, Ecto). Mean somatotypes reveal statistically significant differences between urban and rural samples at age 11 years only ($t = 2.48$, $p < 0.05$). At all other ages considered in the present study urban and rural Pnar boys are observed to have similar somatotypes. For somatotype attitudinal means the urban-rural difference is statistically significant at age 16 years only ($t = 2.00$, $p < 0.05$). Among the three somatotype components,

Table 9. Total frequency and percentage of Urban and Rural boys in various somatotype categories.

Sl. No.	Somatotype Categories	Urban		Rural		$\frac{(f_1-f_2)^2}{ft}$
		f	%	f	%	
1.	Balanced endomorph	-	-	-	-	-
2.	Mesomorphic endomorph	-	-	1	0.39	.002
3.	Mesomorph-endomorph	-	-	5	1.95	.049
4.	Endomorphic mesomorph	9	3.55	10	3.91	.002
5.	Balanced mesomorph	77	30.44	90	35.16	.332
6.	Ectomorphic mesomorph	39	15.42	30	11.72	.159
7.	Mesomorph-ectomorph	99	39.13	103	40.23	.031
8.	Mesomorphic ectomorph	24	9.49	14	5.47	.196
9.	Balanced ectomorph	5	1.76	3	1.17	.007
10.	Endomorphic ectomorph	-	-	-	-	-
11.	Endomorph-ectomorph	-	-	-	-	-
12.	Ectomorphic endomorph	-	-	-	-	-
13.	Central	-	-	-	-	-
	Total	253		256		X^2=.778 n.s.

FIG.14 COMPOGRAM SHOWING URBAN RURAL COMPARISONS IN MEAN COMPONENT RATING AT AGE 11 AND 18 YEARS (* P <0·05)



Mesomorphy shows similar mean values for urban and rural samples at all ages considered. At age 11, 12 and 13 urban and rural boys reveal significantly different (Table 8) values for mean Endomorphy, while from 14 to 18 years both samples do not differ with regard to this component. On the other hand, the urban and rural boys are similar in their Ectomorphy component at almost all ages except at age 11 ($t = 3.99$, $p < 0.01$) and 13 years ($t = 2.68$, $p < 0.05$) where the two samples show statistically significant differences. An overall perusal of Table 8 reveals that urban-rural differences assume statistical significance only during the earlier years (i.e., 11, 12, 13) for two components, while the mean somatotypes of both urban and rural boys are almost similar from age 14 upto 18 years (also see Fig. 14).

Somatotype Categories: Total frequency and percentage of somatotype categories in the urban and rural samples are compared and the X^2 values presented in Table 9. It is obvious from these results that the overall distribution of somatotypes into various categories are more or less similar between the urban and rural samples.

Per cent Overlap: In order to visualize the extent of commonality between urban and rural samples of the present study, a graphical comparison of somatotype

distributions is made. For this 100% of somatoplots of the two samples are taken, and Figures 5 to 12 represent the somatocharts showing limits and overlap of somatotypes between urban and rural Pnar boys, at each age from 11 to 18 years. The percentage of overlap is listed under each figure. It can be seen that the minimum overlap (53.12%) occurs at age 11, and the maximum overlap (85.29%) is seen at age 14 years. Ignoring the extreme somatoplots, almost all distributions of the two samples are more or less circular in shape and are lying above the ectomorphy axis in the ecto-mesomorphy region. The area of overlap shows a tendency to shift from upper axis of endomorphy towards upper axis of mesomorphy with advancing age. On the basis of per cent overlap it may be said that in general the younger age groups (11, 12, 13 years) show less commonality while the older age groups (14, 15, 16, 17, 18 years) of Pnar boys show more commonality between urban and rural samples of the present study.

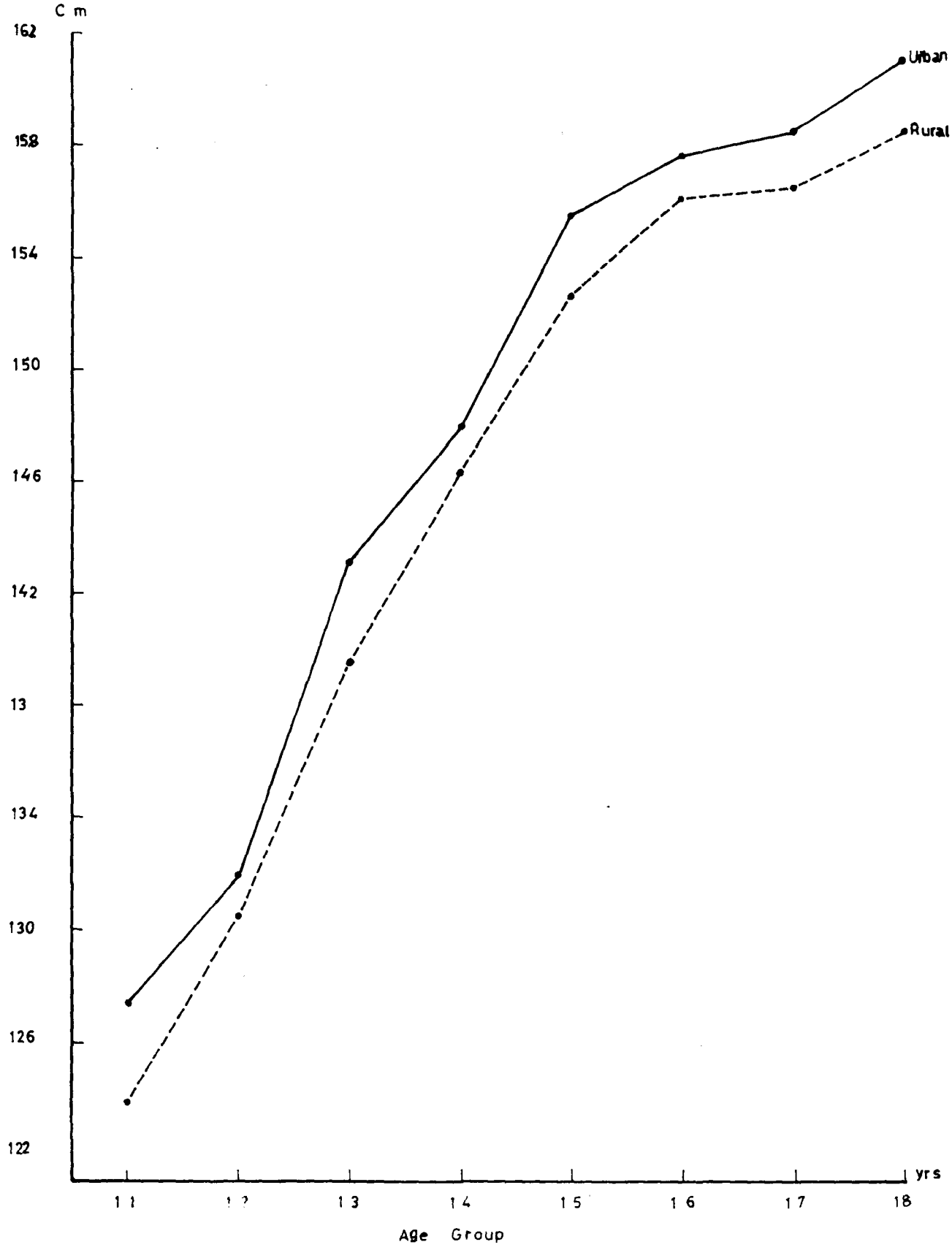
Age, Height, Weight and Height-Weight Ratio

The type and extent of analysis of somatotype data depends on the purpose of the study. According to Carter and Heath (1990) descriptive statistics and somatocharts (as already discussed) should be the minimum for any study, and 'to provide further information on each sample'

Table 10. Descriptive statistics for Age (years) in urban and rural Pnar boys.

Age Group	Urban				Rural			
	N	$\bar{X}$	± SD	CV	N	$\bar{X}$	± SD	CV
11	32	11.04	0.25	2.217	32	11.02	0.22	1.949
12	31	12.10	0.21	1.742	32	12.06	0.22	1.856
13	33	13.08	0.29	2.189	32	13.07	0.20	1.544
14	31	14.01	0.26	1.839	34	14.07	0.25	1.774
15	33	15.05	0.31	2.072	32	15.04	0.23	1.551
16	30	16.06	0.26	1.619	31	16.00	0.27	1.706
17	30	16.98	0.22	1.297	31	17.07	0.23	1.332
18	33	17.98	0.28	1.567	32	17.95	0.25	1.386

FIG.15 HEIGHT



descriptive statistics 'should be calculated routinely for age, height, weight and the HWR'. In view of this, the information on the above four variables in the urban and rural samples is being presented here.

Age: The descriptive statistics for age are presented in Table 10, for both urban and rural samples. It can be seen from the table that the mean age for all age groups lies almost at the completed years, i.e., 11, 12, 13 years; or in other words, at the central point of the range of decimal age considered, for example, 11 is at the centre between 10.500 and 11.499. Further the intra-sample variability for age groups is very small for all the age groups of the two samples, the value of coefficient of variation lying between 1.297 and 2.217 for various age groups of urban boys, and, between 1.332 and 1.949 for the rural boys.

Height (Table 11, Fig. 15): It is clear from the table and the figure that the urban boys are relatively taller than their rural counterparts at all the ages considered in the present study. However, in both these samples there is a sharp increase in mean height between 11 and 15 years of age, while a relatively lesser increase in mean height is observed from 15 to 18 years of age. In both urban and rural boys the greatest addition to mean height

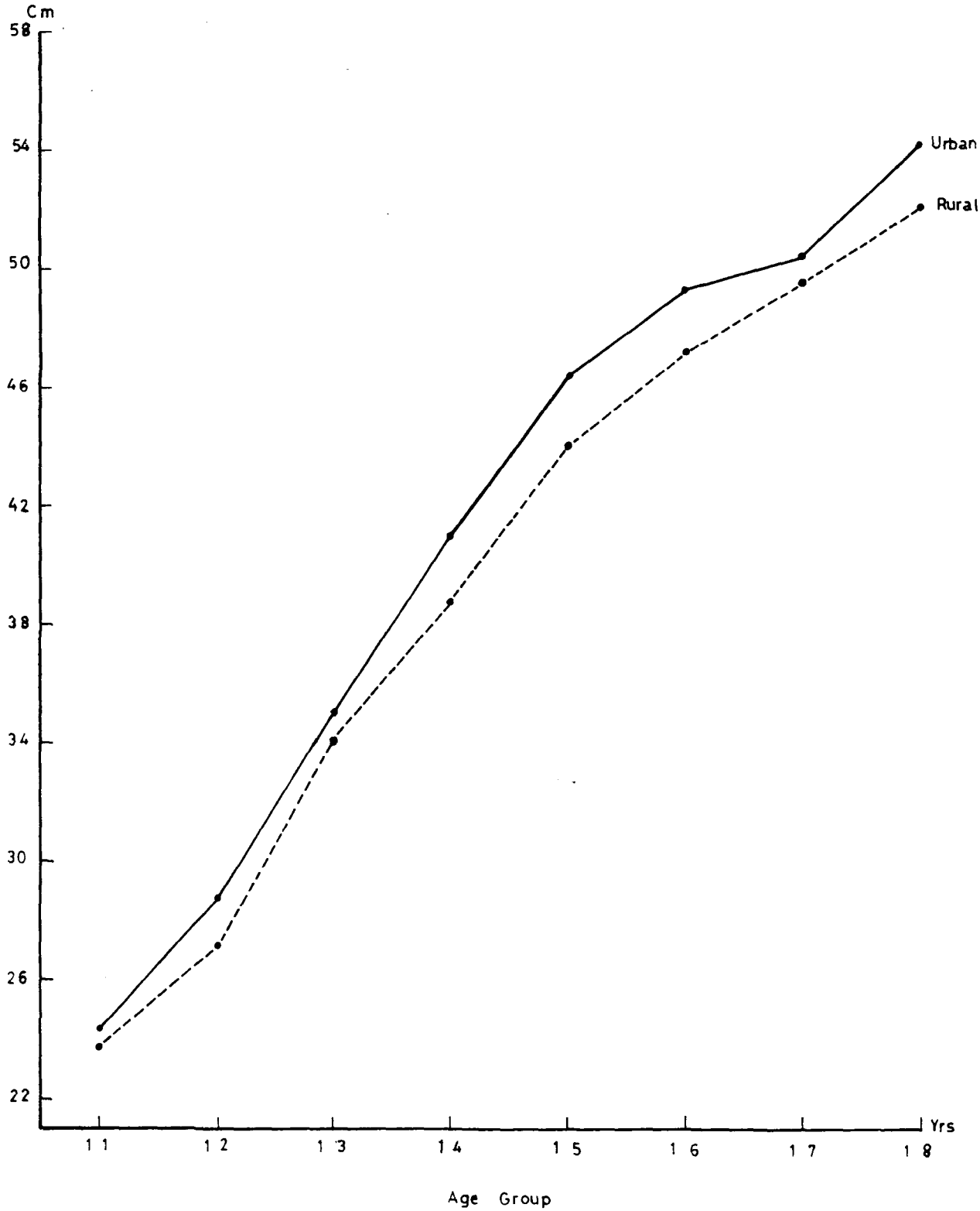
Table 11. Descriptive statistics for height (cm) in urban and rural Pnar boys.

Age Group	Urban			Rural		
	$\bar{X}$	± SD	CV	$\bar{X}$	± SD	CV
11 Yr	127.40	4.21	3.305	123.92	4.27	3.446
12 Yr	131.94	5.65	4.282	130.55	4.87	3.730
13 Yr	143.12	6.81	4.758	139.45	5.71	4.095
14 Yr	147.88	6.78	4.585	146.28	7.67	5.243
15 Yr	155.40	5.04	3.243	152.58	5.87	3.847
16 Yr	157.59	4.19	2.659	156.00	4.31	2.763
17 Yr	158.33	3.79	2.394	156.38	4.32	2.763
18 Yr	160.92	4.71	2.927	158.28	4.39	2.774

Table 12. Descriptive statistics for weight (kg) in urban and rural Pnar boys.

Age Group	Urban			Rural		
	$\bar{X}$	± SD	CV	$\bar{X}$	± SD	CV
11 Yr	24.38	2.39	9.803	23.78	1.96	8.242
12 Yr	28.87	4.08	14.132	27.13	3.18	11.721
13 Yr	35.03	5.37	15.901	34.13	4.16	12.189
14 Yr	41.07	5.52	13.441	38.86	5.76	14.938
15 Yr	46.36	4.41	9.513	44.16	5.51	12.477
16 Yr	49.33	4.68	9.487	47.16	3.34	7.082
17 Yr	50.40	4.32	8.571	49.55	5.16	10.414
18 Yr	54.21	4.24	7.821	52.03	4.53	8.687

FIG.16 WEIGHT



occurs from 12 to 13 years of age. From 11 to 18 years, the mean height of urban boys increases by 33.53 cm (or 26.31%), while in the rural boys this increase is slightly more, i.e., 34.36 cm (or 27.73%). It can be seen from the table that the intra-sample variability for height is not very large, the values for coefficient of variation ranging from 2.394 to 4.758 for age groups of urban boys, and 2.763 to 5.243 for age groups of rural boys.

Weight (Table 12, Fig. 16): The age group-wise changes in the mean weight of both urban and rural samples reveals almost a similar pattern as observed for height. The distance curves plotted for the urban as well as rural samples show a sharp increase in mean weight from 12 to 15 years, whereas, from 15 to 18 years this increase is relatively less. Once again the urban boys are ahead of their rural counterparts in possessing larger mean weight at all the age groups considered. As seen in the case of height, mean weight also show the greatest increase between 12 and 13 years of age in urban as well as rural sample. From 11 to 18 years the mean weight increases by almost 122% (29.83 kg) in urban boys and slightly less, i.e., 119% (28.25 kg) in rural boys. It can be seen from the table that age groups 12, 13, 14 of urban samples and 12, 13, 14, 15 of rural samples show relatively greater intra sample variability for weight.

Table 13. Descriptive statistics for Heigh-Weight Ratio (HWR) in urban and rural Pnar boys.

Age Group	Urban				Rural			
	N	$\bar{X}$	± SD	CV	N	$\bar{X}$	± SD	CV
11 Yr	32	44.03	0.85	1.933	32	43.12	0.93	2.152
12 Yr	31	43.13	1.50	3.474	32	43.45	1.25	2.864
13 Yr	33	43.88	1.18	2.690	32	43.05	1.28	2.971
14 Yr	31	43.83	1.33	3.028	34	43.41	1.19	2.735
15 Yr	33	42.84	1.02	2.389	32	43.28	1.50	3.469
16 Yr	30	43.04	1.48	3.440	31	43.21	1.04	2.414
17 Yr	30	42.88	1.44	3.350	31	43.00	1.25	2.899
18 Yr	33	42.63	1.02	2.384	32	42.45	0.98	2.311

Table 14. **Age-wise comparisons (t-values) for mean Height and Weight in urban and rural Pnar boys.**

Age groups compared	Height				Weight			
	Urban boys		Rural boys		Urban boys		Rural boys	
11-12 Yrs	-3.550	$p < 0.01$	-5.699	$p < 0.01$	-5.223	$p < 0.01$	-4.993	$p < 0.01$
12-13 Yrs	-7.052	$p < 0.01$	-6.632	$p < 0.01$	-5.105	$p < 0.01$	-7.222	$p < 0.01$
13-14 Yrs	-2.757	$p < 0.01$	-4.033	$p < 0.01$	-4.363	$p < 0.01$	-3.710	$p < 0.01$
14-15 Yrs	-4.931	$p < 0.01$	-3.703	$p < 0.01$	-4.175	$p < 0.01$	-3.769	$p < 0.01$
15-16 Yrs	-1.865	n.s.	-2.521	$p < 0.05$	-2.542	$p < 0.05$	-2.592	$p < 0.05$
16-17 Yrs	-0.717	n.s.	-0.327	n.s.	-0.920	n.s.	-2.140	$p < 0.05$
17-18 Yrs	-2.392	$p < 0.05$	-1.724	n.s.	-3.502	$p < 0.01$	-1.992	n.s.

Height-Weight Ratio: Age group-wise mean, standard deviation and coefficient of variation for HWR are presented in Table 13. The mean HWR of 11 year old urban boys is 44.03 and at 18 years of age the mean HWR value falls to 42.63. In the rural boys the mean HWR values are 43.12 and 42.45 at age 11 and 18 years respectively. As observed for height and weight, the intra-sample variability are low for height-weight ratio also. In the urban sample the value of coefficient of variation ranges between 1.933 and 3.474, while in the rural sample it varies between 2.152 and 3.469.

Age Changes in Height and Weight

Age-wise comparisons for mean height and weight in urban and rural boys are presented in Table 14. It is clear from the t-values and their statistical significance that mean height as well as weight in both urban and rural samples change significantly from age 11 to 12, 12 to 13, 13 to 14, and 14 to 15 years. While the urban boys do not show any statistically significant difference in their mean height from age 15 to 16, and 16 to 17 years, the mean height in rural sample differs significantly from age 15 to 16 years. Once again it is the urban sample which reveals statistically significant changes in mean height and weight from 17 to 18 years of age.

Table 15. **Age-wise Urban-Rural comparisons (t-values) for mean Height and Weight of Pnar boys.**

Age Group	Height		Weight	
11	3.231	$p < 0.01$	1.081	n.s.
12	1.028	n.s.	1.854	n.s.
13	2.295	$p < 0.05$	0.731	n.s.
14	0.879	n.s.	1.562	n.s.
15	2.043	$p < 0.05$	1.770	n.s.
16	1.133	n.s.	2.079	$p < 0.05$
17	1.609	n.s.	0.692	n.s.
18	2.302	$p < 0.05$	1.971	n.s.

Urban-Rual Comparison for Height and Weight

Table 15 presents age-wise comparisons for mean height and weight between urban and rural samples. The statistical differences do not reveal any consistent trend in the two samples. However, statistically significant differences in the mean height between urban and rural boys are observed at age 11, 13, 15 and 18 years. Mean weight of urban and rural samples appear to be almost similar at all ages considered, except at age 16 years where the t-value happens to be statistically significant.