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ANTHROPOMETRIC STUDY OF MEDICAL STUDENTS

by

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SUMMARY. Stature, sitting height, biacromial diameter, total arm length and foot length were measured in 133 medical students. Analysis of data showed no ethnic differences in the mean values for measurements in males and females, in contrast to some past studies. Sex differences in the mean values were significant.

Stature, sitting height, total arm length and foot length showed positive correlation with each other in both sexes. While the correlation of biacromial diameter with other measurements was low in males, there was no correlation in females.

The results indicate that a significant increase in stature since 1937 and 1948 has taken place due to a disproportionate increase in length of the lower limbs compared to the trunk. The upper limbs too appear to show an increase in length proportionate to stature. There is a significant increase in the transverse diameter of the upper end of the trunk. Certain segments of the body bear a constant relation ship to stature in both sexes.

INTRODUCTION

Adult physique is determined by genetic as well as environmental factors. Differences in stature have been demonstrated between nations, between ethnic groups and between socio-economic classes, as well as rural and urban dwellers within the same population (1).

Several studies of anthropometric characteristics of Sri Lankan adults have been reported since 1939. Data on 1590 Ceylonese males collected by Marett in 1937—39 were published by Stoudt in 1961 (2). Cullumbine and his associates conducted an extensive survey in 1947—48 on approximately 10,000 Ceylonese males and females and the results were published in 1949 (3). Chanmugam's study of 100 Ceylonese males was reported in 1948 (4). In all three studies the Tamils were found to be taller than their Sinhala counterparts, the differences being statistically significant in most age groups. This result has been supported by a study on University students in 1976—79(5). On the other hand, a study of 10857 school children aged 7—19 years carried out in 1975 has shown that the mean heights for Sinhalese were greater in certain age groups, the differences being statistically significant in certain cases (6).

In Stoudt's and Cullumbine's studies, mean sitting height and biacromial diameter were significantly higher for Tamil males than for Sinhalese males ($p > 0.001$). In Cullumbine's study, the mean biacromial diameter of females was higher in the Tamils though not significantly ($p > 0.1$). Similarly, in Chanmugam's study, the mean biacromial

diameter as well as the mean foot length was higher for Tamil males ($p > 0.05$). The mean of the ratio, sitting height to total height has not shown a constant pattern when differences between ethnic groups are compared(2,4), while the mean ratio, biacromial diameter to stature is higher in the Tamils (2,5). These differences suggest different body sizes and body proportions between Sinhalese and Tamils.

This is a report of a study of 133 undergraduate students admitted to the Faculty of Medicine, Peradeniya in 1979. The anthropometric measurements taken and their relationship to one another are presented and compared with results of earlier studies.

SUBJECTS AND METHODS

All students who entered the Faculty of Medicine, University of Peradeniya in 1979 were studied. There were 63 males (mean age 21.3 years, SD 1.6, range 19.0—24.9) and 70 females (mean age 21.5 years, SD 1.2, range 18.9—23.3). Their distribution by sex and ethnic group is shown in Table 1.

TABLE 1. Distribution of sample by sex and ethnic group

Sex	Sinhala	Tamil	Moor	Total
Male	42	18	3	63
Female	51	17	2	70
Both sexes	93	35	5	133

Stature, sitting height (SH), biacromial diameter (BAD), total arm length (TAL), and foot length (FL) were measured, using techniques which satisfied as closely as possible the standard techniques of Weiner and Lourie(8). Stature and SH were measured to the nearest 0.5 cm using Detecto scales. For measuring SH, a stool of known height was placed over the horizontal platform of the scale. TAL (on the left side) and BAD were measured to the nearest 0.1 cm using a steel tape. As calipers were not available for measuring BAD, an error due to varying amounts of subcutaneous fat over the shoulders would have been introduced. No correction has been applied to allow for this error. FL was measured to the nearest 0.1 cm in the left side, using a meter scale with a wooden bar fixed at one end of the scale and a movable arm at the other end.

RESULTS

The results have been analysed by sex for the whole group and for Sinhalese and Tamils separately (Table 2). Muslims were not considered as a separate group because the numbers were too small.

The differences between mean values for Sinhalese and Tamils are not significant except in the case of BAD in females ($p<0.05$). All differences between mean values for the two sexes are significant ($p<0.05$).

TABLE 2. Mean ± sd of measurements by sex and ethnic group

Measurement	Male			Female		
	Sinhala (42)	Tamil (18)	All (83)	Sinhala (57	Tamil (17)	All (70)
Stature	164.73 ±5.4	167.86 ±8.6	165.78 ±5.8	153.58 ±3.8	154.44 ±5.2	153.69 ±4.2
SH	81.95 ±3.8	82.07 ±5.1	81.93 ±4.1	75.45 ±3.5	75.03 ±2.0	75.26 ±3.2
BAD	39.93 ±2.2	39.94 ±3.0	40.00 ±2.4	36.97 ±2.2	38.50 ±2.4	37.41 ±2.3
TAL	75.39 ±3.4	75.53 ±4.0	75.47 ±3.5	70.45 ±2.6	79.26 ±3.0	70.32 ±2.7
FL	24.31 ±1.2	24.44 ±1.3	24.38 ±1.2	22.55 ±0.8	23.18 ±1.6	22.71 ±1.1

TABLE 3. Indices of body measurements (mean±sd)

Index	Male			Female		
	Sinhala (42)	Tamil (19)	All (63)	Sinhala (51)	Tamil (17)	All (70)
SH/Stature	.497± .081	.492± .026	.498± .041	.490± .018	.485± .013	.489± .021
BAD/Stature	.242± .011	.240± .013	.241± .012	.240± .015	.248± .012	.242± .022
TAL/Stature	.457± .013	.451± .014	.455+ .011	.458± .013	.456± .013	.456± .011
FL/Stature	.147± .005	.145± .006	.147± .005	.146± .005	.149± .001	.147± .007

SH, BAD, TAL and FL were calculated as indices of stature and analysed by sex in each ethnic group and as a whole group (Table 3). There were no significant differences between ethnic groups or between sexes, the only exception being the BAD in Tamil females which is significantly different from all males and Sinhala females ($p<0.05$). This difference may be due to the faulty technique in BAD measurement.

A correlation grid between measurements is shown in Table 4. Stature, SH, TAL and FL show good positive correlations with each other except in the case of FL in females where the correlation with other measurements is low. BAD shows a low correlation with all other measurements in males while it shows no correlation with any other measurement in females.

TABLE. 4. Correlation between body measurements

	Stature		SH		FL		TAL	
	Male	Female						
SH	0.69	0.55						
			Male	Female				
FL	0.71	0.25	0.37	0.29				
					Male	Female		
TAL	0.80	0.77	0.36	0.41	0.67	0.26		
							Male	Female
BAD	0.29	0.17	0.28	-0.006	0.22	0.20	0.24	0.12

Table 5 compares the results of the present study with those of earlier studies, and gives the probability difference between the mean values. In the 1937—39 column are the values obtained by Marett(2), the 1947—48 data are from a study of University students by Bibile *et al*(7), summarised by Cullumbine(3), and the 1949 data are from Chanmugam's study of 100 medical students (4). All measurements and indices in Table 5 have increased during the past 30—40 years except SH and FL.

TABLE 5. Past data and significance of difference from present data

Parameter	Year of study							
	1937—38		1947—48				1949	
	Male		Male		Female		Male	
	Sinhala (604)	Tamil (592)	Sinhala (280)	Tamil (151)	Sinhala (100)	Tamil (41)	Sinhala (50	Tamil (47)
Stature (cm)	160.4a ±6.0	164.5c ±6.2	160.4a ±6.0	162.3a ±6.1	151.3a ±2.8	152.1c ±3.5	165.3f ±?	167.4f ±?
SH (cm)	81.5e ±3.5	83.4e ±3.5	—	—	—	—	83.2f ± ?	85.5f ± ?
BAD (cm)	37.0a ±2.1	38.6c ±2.0	32.4a ±2.5	33.8a ±2.2	30.3a ±2.1	30.8a ±2.3	36.0a ±3.3	36.2a ±2.5
FL (cm)	—	—	—	—	—	—	24.0d ±1.9	24.3d ±0.0
SH index	.509a ± .01	.508b ± .01	—	—	—	—	—	—
BAD index	.231a ± .01	.234c ± .01	.203a ± .02	.210a ± .02	.202a ± .01	.202a ± .03	—	—

a $p<0.001$ b $p<0.01$ c $p<0.05$
d $p>0.01$ e $p>0.05$ f p not calculated

DISSCUSSION

The findings for body size and body proportions are not in agreement with earlier studies on Sri Lankan adults with regard to ethnic differences. These differences may be disappearing due to environmental factors. The significant increase in stature in mlaes without a significant increase in SH indicates that the increase has taken place due to a disproportionate increase in length of the lower limbs compared to the trunk. This has led to a significant change in the SH index in Sinhalese and Tamil males from 0.509 and 0.508 respectively (Table 5) to 0.497 and 0.492 (Table 3).

Even though no data are available for comparison with TAL, it shows good correlation with stature (Table 4) and it appears that the upper limb has grown in length in proportion to the increase in stature, as in the case of the lower limb.

Growth retardation is said to be most marked in the limbs in children subjected to malnutrition. A low limb : trunk ratio has been observed in poorly nourished population groups(9). As the results of this study suggest satisfactory growth in the limbs over the years, it is unlikely that these students have been subjected to malnutrition during their growing period.

The significant increase in BAD index in both sexes (Table 5) indicates a proportionate increase in the transverse size of the trunk in its upper extremity compared to increase in stature. The four indices studied are not significantly different between sexes (Table 3) except in the case of the BAD index in Tamil females where $p < 0.05$. This may be due to the error in measurement already mentioned.

The study indicates that certain segments for the body bear a constant relationship to stature in both sexes in spite of significant differences in stature and these body segments between sexes.

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