

## Craniofacial anthropometry of Sri Lankans

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### Summary

The data available on craniofacial anthropometry of Sri Lankans are very scanty. These measurements are an important consideration to the clinician and the anthropologist. A total of 8409 children, 3954 males and 4450 females in the age range of 6-18 years, belonging to the three major ethnic groups in Sri Lanka, the Sinhalese, Sri Lankan Tamils and Sri Lankan Moors were examined with the aim of establishing the normal values for a series of seven craniofacial measurements obtained using Holtain anthropometric instruments. Norms were established for 1-year age categories from 6-18 years, for males and females in the three ethnic groups. The Sinhalese males and females showed higher values for head circumference, head breadth and bicondylar breadth than the Sri Lankan Tamils and Moors, differences which were statistically significant ( $P < 0.05$  to  $P < 0.001$ ). The facial height of the Sri Lankan Moors were significantly greater than that of the Sinhalese and Sri Lankan Tamils.

**Key words** – Craniofacial Anthropometry, Ethnicity

### Introduction

Anthropometric data on Sri Lankans have been extensively documented (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11). However, with regard to the craniofacial anthropometry the studies available are very scanty.

The only study comprising a reasonable sample size is that done by Marett in 1937. Based on the data collected by Marett, Stoudt (5), established the norms for 12 craniofacial dimensions of the Ceylonese adult males and formulated 12 craniofacial indices.

To date, no data are available on craniofacial measurements of the Sri Lankan child during the pre-adolescent and adolescent periods. As these measurements are an important consideration for the clinician and the anthropologist, the present study was undertaken with the aim of establishing the craniofacial norms for Sri Lankan children. The influence of age, gender and ethnicity on these measurements have also been studied.

### Study Population and Methods

This study was conducted in three provinces of Sri Lanka, the North Central, Uva and Western. Two districts from each province were selected, and five schools (three Sinhalese, one Tamil and one Moor) chosen randomly from each district.

A total of 8409 children (27 schools) participated in the survey. Socio-demographic data such as the date of birth, occupation of the parents, ethnicity of the parents and grandparents were gathered from the school records. These data were re-checked at the direct interview that the investigators had with the children. Seven craniofacial parameters were measured using Holtain anthropometric instruments. The measurements studied were the head circumference, cranial length, cranial breadth, facial height, bicondylar breadth, bigonial breadth and bizygomatic breadth. When measuring these parameters landmark definitions described by Montagu (12) were adopted.

All children having prominent craniofacial anomalies were excluded from the study. The children belonging to ethnic groups other than the Sinhalese, Sri Lankan Tamils and Sri Lankan Moors were also excluded.

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The age of a child was calculated from the date of birth to the date of examination and the children were grouped at yearly intervals. Multiple criteria, such as the occupation and educational level of the parents, family size etc., were utilised to identify the socio-economic status of a child. The majority of children included in the study belonged either to the low or the middle socio-economic group.

### Results

Table 1 indicates the number of children studied, grouped according to their age, gender and

Tamils are shown in Table 9. The levels of significance are also indicated.

The Sinhalese males and females have the greatest head circumference values while the Tamil males and females have the lowest. The differences between the Sinhalese and Tamils in both males and females are statistically significant. The differences between the Sinhalese and Moors, and the Moors and Tamils are significant only in certain age groups.

The Sinhalese males and females have higher head length values than the Tamils and Moors. The differences between the Sinhalese and

**Table 1**  
The distribution of the sample according to the age, gender and ethnicity

Age (Years)	Males			Females		
	Sinhalese	Tamils	Moors	Sinhalese	Tamils	Moors
5	43	—	—	31	—	—
6	171	71	64	197	81	84
7	194	64	78	235	91	78
8	196	68	77	226	64	81
9	181	59	66	201	88	74
10	162	74	71	189	71	84
11	122	79	74	196	89	82
12	151	81	76	215	66	86
13	148	68	73	195	78	61
14	181	76	81	206	72	76
15	121	72	84	195	61	70
16	116	69	71	127	63	69
17	162	76	67	137	59	63
18	114	80	73	197	63	49
Total	2062	937	955	2547	946	957

ethnicity. The means and standard deviations for each of the craniofacial variables of males and females in different age groups of the three ethnic groups are presented in Tables 2, 3, 4, 5, 6, 7 and 8. A number of consistent differences are observed for these variables among the Sinhalese, Tamils and Moors. An analysis of variance was carried out. Statistically significant differences observed between the Sinhalese and Tamils, Sinhalese and Moors, and Moors and

Tamils are not significant however. The differences between the Sinhalese and Moors are statistically significant in certain age groups.

Of the three major ethnic groups the Sinhalese have the broadest heads. The differences between the Sinhalese and Tamils in both males and females are highly significant in all age groups. The differences observed for the Sinhalese and Moors are statistically significant only in certain age groups.

**Table 2**  
**Head circumference (in mm) of males and females in the three ethnic groups**

Age		Males						Females					
Group	Sinhalese	Tamils	Moors	Sinhalese	Tamils	Moors	Sinhalese	Tamils	Moors	Sinhalese	Tamils	Moors	
Years	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
5	485.5	6.7	-	-	-	-	487.0	17.9	-	-	-	-	
6	498.8	15.3	491.1	13.8	492.2	12.9	489.7	13.9	485.6	18.2	482.4	12.2	
7	501.2	14.3	490.7	16.6	492.6	11.7	488.5	13.1	480.7	12.1	487.8	13.4	
8	502.5	16.4	498.5	19.1	496.4	18.9	495.5	14.7	493.0	13.9	489.0	16.8	
9	507.8	16.2	499.1	19.0	496.6	12.7	498.3	14.8	486.9	16.0	494.7	15.8	
10	509.0	17.2	501.7	17.9	503.5	14.2	501.7	18.4	493.3	17.6	498.5	11.8	
11	513.7	16.1	505.4	15.4	506.6	13.2	509.3	18.4	502.0	20.9	502.5	14.3	
12	516.0	15.9	505.2	13.7	514.2	11.3	512.1	16.1	501	16.2	511.7	14.5	
13	522.2	16.8	511.9	15.1	515.9	13.5	521.0	14.0	507.8	19.1	515.9	16.9	
14	526.6	15.5	523.3	17.7	518.9	14.9	523.5	17.6	515.9	17.7	519.2	13.4	
15	532.1	19.2	519.9	18.7	521.4	17.7	523.7	13.9	519.4	17.9	522.9	13.4	
16	529.7	17.7	520.8	16.8	529.1	17.4	525.0	12.7	520.8	17.1	525.3	15.2	
17	538.7	15.3	526.5	19.4	530.3	10.3	527	12.6	524.7	16.2	526.2	14.2	
18	538.9	14.7	532.0	24.1	541.2	16.7	526.5	15.8	526.0	9.1	527.9	13.6	

**Table 3**  
**Head length (in mm) of males and females in the three ethnic groups**

Age		Males						Females					
Group	Sinhalese	Tamils	Moors	Sinhalese	Tamils	Moors	Sinhalese	Tamils	Moors	Sinhalese	Tamils	Moors	
Years	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
5	165.0	2.2	-	-	-	-	164.0	8.1	-	-	-	-	
6	169.2	7.3	168.9	6.0	166.8	6.9	165.6	7.7	165.0	6.5	164.0	5.8	
7	170.0	6.7	166.4	8.1	165.6	6.7	164.3	6.1	163.9	6.7	163.8	6.3	
8	169.0	8.5	170.8	9.7	167.1	6.5	166.8	6.6	165.7	5.1	164.0	9.2	
9	170.9	7.7	169.0	9.8	168.6	5.8	167.3	6.9	164.1	7.6	165.5	5.5	
10	171.2	7.8	170.8	7.9	169.9	6.7	168.5	7.3	165.8	6.7	165.8	5.8	
11	172.5	7.7	171.6	8.4	170.7	6.5	170.2	7.4	169.4	8.1	168.6	6.1	
12	173.4	6.7	169.7	9.6	172.0	6.6	170.9	6.7	168.7	5.6	169.3	6.1	
13	175.2	7.5	175.2	8.8	173.5	6.1	172.9	6.2	171.6	7.7	170.9	7.3	
14	177.0	6.9	177.1	7.3	172.2	6.0	173.3	5.9	172.8	6.3	172.4	5.2	
15	177.3	7.4	176.2	8.7	173.5	8.3	171.2	5.9	171.4	5.7	173.6	6.2	
16	177.0	6.1	175.2	9.6	176.0	7.7	173.9	5.7	172.5	5.9	171.6	6.5	
17	178.3	6.3	178.4	8.2	177.6	5.7	171.6	5.1	171.8	6.7	174.5	4.3	
18	180.1	8.3	179.3	9.6	181.5	6.0	173.4	6.2	177.0	4.9	173.1	5.1	

**Table 4**  
Head breadth (in mm) of males and females in the three ethnic groups

Age		Males						Females					
Group	Sinhalese	Tamils	Moors	Sinhalese	Tamils	Moors	Sinhalese	Tamils	Moors	Sinhalese	Tamils	Moors	
Years	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
5	136.3	4.9	-	-	-	-	139.0	3.9	-	-	-	-	
6	140.6	5.2	134.1	4.8	139.7	7.2	138.1	4.7	134.1	5.2	135.6	4.9	
7	141.6	9.9	137.7	7.1	140.3	4.1	138.5	6.1	134.5	5.9	137.3	5.6	
8	141.3	5.6	136.8	5.3	139.3	5.2	140.7	5.3	136.8	4.9	139.1	4.8	
9	142.4	5.4	139.4	6.2	140.6	7.2	141.5	5.9	136.8	8.1	140.5	5.6	
10	143.9	5.4	139.6	5.3	143.1	4.5	142.9	5.9	139.4	5.8	141.5	5.5	
11	144.3	6.2	140.9	5.2	142.5	5.0	144.5	6.6	140.4	6.8	143.3	6.9	
12	145.5	7.2	140.3	5.3	145.5	6.6	144.4	5.3	139.5	6.2	145.0	7.3	
13	146.7	5.2	140.6	5.5	144.0	4.8	147.1	5.1	141.4	5.9	144.7	6.5	
14	147.7	5.4	145.5	6.7	143.6	5.9	147.1	5.0	143.6	4.8	144.8	5.5	
15	150.5	6.0	143.4	5.9	146.3	5.9	149.1	4.8	147.3	4.9	147.2	5.5	
16	149.4	4.7	143.0	8.6	146.4	8.1	146.1	5.1	145.1	5.8	146.9	6.1	
17	152.2	6.6	145.5	7.3	148.7	4.1	148.5	5.9	145.6	6.1	147.4	5.9	
18	150.1	5.6	149.9	5.9	149.0	6.1	147.9	5.1	143.9	4.3	147.4	6.1	

**Table 5**  
Facial heights (in mm) of males and females in the three ethnic groups

Age		Males						Females					
Group	Sinhalese	Tamils	Moors	Sinhalese	Tamils	Moors	Sinhalese	Tamils	Moors	Sinhalese	Tamils	Moors	
Years	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
5	85.8	8.2	-	-	-	-	83.8	2.6	-	-	-	-	
6	89.4	4.6	87.3	3.8	88.7	3.9	86.6	3.9	85.9	3.9	86.7	3.6	
7	90.8	4.4	87.9	4.7	89.5	4.1	86.2	8.1	86.7	3.7	87.8	3.9	
8	91.8	3.6	90.3	5.1	90.2	4.0	89.0	4.7	88.0	3.9	90.2	4.2	
9	93.8	4.7	91.3	4.4	92.6	4.0	90.0	4.6	89.2	4.3	91.4	4.0	
10	95.3	5.2	92.9	4.6	94.3	5.1	92.1	5.1	90.9	4.7	92.3	4.1	
11	96.9	5.3	94.8	4.8	96.2	4.8	95.9	5.7	93.8	4.7	95.0	4.4	
12	99.0	4.9	95.1	5.6	99.9	9.7	96.7	4.8	94.1	4.7	98.0	3.9	
13	101.7	6.6	98.0	5.5	102.1	4.6	99.6	5.4	96.2	4.4	100.3	5.3	
14	104.2	5.7	104.2	6.9	102.0	5.6	100.4	4.9	99.8	5.8	100.9	4.7	
15	108.4	9.4	104.0	5.9	104.5	5.7	102.1	4.7	101.4	4.9	102.6	4.5	
16	106.3	6.7	107.2	7.0	107.2	6.5	103.7	5.9	102.2	5.6	102.7	6.0	
17	108.9	4.4	105.7	8.4	110.6	5.0	102.4	5.7	102.6	6.2	104.9	5.1	
18	109.7	5.7	110.1	5.5	111.5	5.3	102.8	4.5	104.2	4.7	106.2	5.4	

**Table 6**  
**Bicondylar breadths (in mm) in males and females in the three ethnic groups**

Age		Males						Females					
Group	Sinhalese		Tamils		Moors		Sinhalese		Tamils		Moors		
Years	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
5	102.3	3.6	-	-	-	-	104.0	3.3	-	-	-	-	
6	106.9	4.4	102.4	5.1	104.2	5.6	104.5	4.2	102.0	4.5	103.4	4.5	
7	107.8	4.5	104.8	6.9	105.6	3.5	106.1	9.8	103.0	5.8	105.8	4.5	
8	108.4	4.8	106.7	4.6	106.3	5.1	110.0	4.9	106.0	4.6	107.7	4.8	
9	110.6	4.6	108.1	4.5	108.4	4.8	110.7	4.8	107.9	5.0	109.9	4.9	
10	111.9	5.1	109.2	5.0	111.0	4.5	111.8	5.7	109.9	5.6	111.1	3.9	
11	114.0	6.1	110.6	5.0	113.0	4.6	114.4	5.8	110.9	5.6	112.0	5.1	
12	114.9	5.2	110.1	6.6	114.2	8.0	114.4	4.8	111.0	6.2	114.6	4.9	
13	116.7	5.1	113.2	4.4	115.4	5.2	116.9	5.0	112.8	9.2	115.0	5.4	
14	117.6	4.6	116.4	5.3	115.7	4.8	116.5	4.8	113.4	6.8	116.4	5.1	
15	120.7	6.1	116.4	5.4	117.1	5.5	117.5	5.6	118.6	4.9	119.4	5.3	
16	122.0	8.3	117.3	6.2	119.4	6.5	119.1	4.5	116.3	6.1	119.7	4.4	
17	124.7	4.5	119.5	6.7	120.9	5.0	118.4	4.2	116.8	5.0	119.8	5.5	
18	124.8	4.6	121.3	5.9	124.9	5.2	119.9	4.9	119.4	4.7	120.1	4.3	

**Table 7**  
**Bigonial breadths (in mm) of males and females in the three ethnic groups**

Age		Males						Females					
Group	Sinhalese		Tamils		Moors		Sinhalese		Tamils		Moors		
Years	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
5	85.3	2.3	-	-	-	-	87.0	3.8	-	-	-	-	
6	88.7	4.1	85.8	3.9	86.9	4.0	85.8	3.5	84.7	4.5	85.0	3.7	
7	89.3	3.8	86.4	4.1	86.4	3.9	87.4	3.9	86.1	2.9	87.1	3.4	
8	90.0	4.3	87.8	3.4	89.0	4.9	89.7	4.3	86.9	4.2	88.4	4.2	
9	92.1	4.3	89.4	3.7	89.8	4.7	90.4	4.2	87.5	4.2	88.3	5.9	
10	93.3	5.2	91.6	4.7	91.7	4.8	91.5	4.5	89.8	4.1	90.6	4.2	
11	94.2	5.1	92.7	4.0	93.8	3.8	93.8	5.4	92.2	4.8	93.2	5.3	
12	95.9	4.9	93.7	4.4	96.7	5.6	94.0	4.9	91.8	4.3	93.9	4.7	
13	97.5	4.7	95.2	4.2	96.9	3.6	96.6	4.7	92.8	4.6	96.3	5.4	
14	98.2	5.1	98.1	5.8	97.1	3.4	96.1	4.8	94.2	4.5	95.8	4.4	
15	99.4	5.5	97.8	4.7	99.8	4.2	96.8	4.4	96.8	4.4	98.8	4.3	
16	100.3	5.3	99.0	4.8	101.7	5.9	98.2	4.9	96.4	4.4	98.5	5.9	
17	100.9	3.3	98.7	6.2	102.5	4.3	95.9	4.7	96.7	4.1	98.9	4.9	
18	101.3	5.5	100.9	8.7	102.9	4.0	98.2	4.7	98.8	4.9	98.7	4.4	

**Table 8**  
**Bizygomatic breadth (in mm) of males and females in the three ethnic groups**

Age Group	Males						Females					
	Sinhalese		Tamils		Moors		Sinhalese		Tamils		Moors	
Years	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
5	93.8	3.9	-	-	-	-	95.3	2.7	-	-	-	-
6	97.2	5.3	91.6	5.8	96.7	5.9	94.1	4.5	93.0	2.7	95.8	5.0
7	99.2	7.6	95.6	4.7	97.5	5.7	96.3	4.8	95.2	3.5	97.9	4.5
8	100.4	4.6	96.6	4.4	98.7	5.9	97.9	5.7	95.9	5.1	99.3	5.5
9	102.6	4.5	97.6	3.9	100.8	4.9	98.2	5.4	97.2	5.9	98.8	4.9
10	103.7	5.1	100.0	4.3	102.0	4.8	100.0	5.5	99.5	4.3	100.2	4.1
11	104.5	5.8	102.1	3.6	104.4	6.1	103.0	5.7	101.8	5.3	103.4	6.2
12	105.5	5.3	103.3	4.3	105.3	4.8	103.2	4.8	102.3	4.4	105.0	4.7
13	108.3	5.7	104.5	4.6	108.0	5.1	106.3	5.4	104.2	5.3	106.9	5.3
14	108.4	5.4	107.9	5.7	108.8	4.0	107.6	4.7	105.5	5.0	108.6	5.2
15	112.2	5.6	107.4	4.9	110.7	5.3	109.1	4.8	108.3	4.6	110.1	5.6
16	113.7	4.6	110.3	7.2	113.6	5.8	111.6	7.2	108.5	6.7	110.4	5.3
17	115.9	8.3	112.0	7.0	114.3	5.3	109.3	4.7	108.7	5.9	111.2	5.3
18	114.6	4.7	115.1	4.9	117.5	5.8	111.1	4.5	111.2	4.2	111.8	5.6

The Moor males and females have greater facial heights than their Sinhalese and Tamil counterparts. The difference is significant in some age groups. The Tamils have the lowest facial heights.

The broadest bicondylar dimensions are observed among the Sinhalese, the Moors being intermediate and the Tamils having the narrowest dimensions. The differences between the Sinhalese and Tamils are highly significant.

The Sinhalese males and females have the largest bigonial breadths. The differences between the Sinhalese and Tamils are significant in most age groups. The bigonial breadths of the Moor males exceeded those of Sinhalese males in the 15-18 year age group only.

Moor females as a group have much higher bizygomatic breadths than either Sinhalese or Tamil females. This ethnic difference is statistically significant for most age groups between the Moors and Sinhalese. The Moor

males are much closer to the Sinhalese in this dimension than they are to the Tamils who have the smallest values.

In all three ethnic groups, all linear dimensions except the bicondylar breadth, are larger in males than in females. The bicondylar breadths of the females are closer to those of males or they are slightly greater.

The growth curves constructed for the seven craniofacial measurements of males and females in the three ethnic groups are illustrated in Figures 1, 2 and 3. The adolescent growth spurts seem to occur at different ages for the three ethnic groups.

#### Discussion

Anthropometry remains an efficient, non invasive method to describe craniofacial morphology although several sophisticated methods have become available during recent years. The main advantage lies in its technical simplicity. Hence it is better suited for

Table 9

Statistical significance of different craniofacial measurements between ethnic groups (LSD)

Age Group Years	Sinhalese/ Tamils	Males Sinhalese/ Moors	Moors/ Tamils	Sinhalese/ Tamils	Females Sinhalese/ Moors	Moors/ Tamils
6	HC <sup>3</sup> , HB <sup>3</sup> , FH <sup>2</sup> , BC <sup>3</sup> , BZ <sup>3</sup> , BG <sup>3</sup>	HC <sup>2</sup> , HL <sup>1</sup> , BC <sup>2</sup> , BG <sup>1</sup>	HL <sup>1</sup> , HB <sup>3</sup> , FH <sup>1</sup> , BC <sup>1</sup> , BZ <sup>3</sup>	HC <sup>1</sup> , HB <sup>2</sup> , BC <sup>3</sup> , BG <sup>2</sup> , BZ <sup>1</sup>	HC <sup>2</sup> , HL <sup>1</sup> , HB <sup>2</sup> , BC <sup>2</sup> , BG <sup>1</sup> , BZ <sup>2</sup>	HB <sup>1</sup> , BC <sup>1</sup> , BZ <sup>3</sup>
7	HC <sup>3</sup> , HL <sup>2</sup> , HB <sup>2</sup> , FH <sup>3</sup> , BC <sup>3</sup> , BG <sup>3</sup> , BZ <sup>3</sup>	HC <sup>3</sup> , HL <sup>2</sup> , FH <sup>1</sup> , BC <sup>3</sup> , BG <sup>3</sup> , BZ <sup>1</sup>	HB <sup>2</sup> , FH <sup>1</sup> , BZ <sup>1</sup>	HC <sup>1</sup> , HB <sup>3</sup> , BC <sup>2</sup> , BG <sup>2</sup> , BZ <sup>1</sup>	FH <sup>2</sup> , BZ <sup>2</sup>	HB <sup>2</sup> , FH <sup>1</sup> , BC <sup>2</sup> , BG <sup>1</sup> , BZ <sup>3</sup>
8	HC <sup>1</sup> , HB <sup>3</sup> , FH <sup>1</sup> , BC <sup>1</sup> , BG <sup>3</sup> , BZ <sup>3</sup>	HC <sup>2</sup> , HL <sup>1</sup> , FH <sup>2</sup> , BC <sup>2</sup> , BG <sup>3</sup> , BZ <sup>2</sup>	HL <sup>2</sup> , BG <sup>1</sup> , BZ <sup>2</sup>	HB <sup>3</sup> , BC <sup>3</sup> , BG <sup>3</sup> , BZ <sup>2</sup>	HC <sup>2</sup> , HL <sup>1</sup> , HB <sup>1</sup> , FH <sup>1</sup> , BC <sup>2</sup> , BG <sup>2</sup> , BZ <sup>1</sup>	HB <sup>2</sup> , FH <sup>2</sup> , BC <sup>1</sup> , BG <sup>2</sup> , BZ <sup>3</sup>
9	HC <sup>2</sup> , HB <sup>3</sup> , FH <sup>2</sup> , BC <sup>2</sup> , BG <sup>3</sup> , BZ <sup>2</sup>	HC <sup>3</sup> , HL <sup>2</sup> , HB <sup>1</sup> , FH <sup>1</sup> , BC <sup>2</sup> , BG <sup>2</sup> , BZ <sup>2</sup>	FH <sup>1</sup> , BZ <sup>3</sup>	HC <sup>3</sup> , HL <sup>2</sup> , HB <sup>3</sup> , BC <sup>3</sup> , BG <sup>3</sup>	HC <sup>1</sup> , HL <sup>1</sup> , FH <sup>2</sup> , BG <sup>2</sup>	HC <sup>2</sup> , HB <sup>3</sup> , FH <sup>2</sup> , BC <sup>2</sup> , BZ <sup>1</sup>
10	HC <sup>2</sup> , HB <sup>3</sup> , FH <sup>2</sup> , BC <sup>2</sup> , BZ <sup>1</sup> , BG <sup>3</sup>	HC <sup>2</sup> , FH <sup>1</sup> , BG <sup>1</sup> , BZ <sup>1</sup>	HB <sup>3</sup> , FH <sup>1</sup> , BC <sup>1</sup> , BZ <sup>2</sup>	HC <sup>2</sup> , HL <sup>1</sup> , HB <sup>3</sup> , BC <sup>2</sup> , BG <sup>2</sup>	HC <sup>1</sup> , HL <sup>2</sup>	HB <sup>1</sup> , FH <sup>1</sup>
11	HC <sup>2</sup> , HB <sup>3</sup> , FH <sup>2</sup> , BC <sup>3</sup> , BG <sup>1</sup> , BZ <sup>2</sup>	HC <sup>3</sup> , HB <sup>1</sup> , HL <sup>1</sup>	HB <sup>1</sup> , FH <sup>1</sup> , BC <sup>2</sup> , BG <sup>1</sup> , BZ <sup>2</sup>	HC <sup>2</sup> , HB <sup>3</sup> , FH <sup>2</sup> , BC <sup>3</sup> , BG <sup>2</sup> , BZ <sup>1</sup>	HC <sup>1</sup> , HL <sup>1</sup> , BC <sup>2</sup>	HB <sup>1</sup> , BZ <sup>1</sup>
12	HC <sup>3</sup> , HL <sup>2</sup> , HB <sup>3</sup> , FH <sup>3</sup> , BC <sup>3</sup> , BG <sup>2</sup> , BZ <sup>2</sup>		HC <sup>2</sup> , HL <sup>1</sup> , HB <sup>3</sup> , FH <sup>1</sup> , BC <sup>2</sup> , BG <sup>1</sup> , BZ <sup>2</sup>	HC <sup>2</sup> , HL <sup>1</sup> , HB <sup>3</sup> , FH <sup>2</sup> , BC <sup>3</sup> , BG <sup>2</sup>	HL <sup>1</sup> , FH <sup>2</sup> , BZ <sup>2</sup>	HC <sup>2</sup> , HB <sup>3</sup> , FH <sup>2</sup> , BC <sup>3</sup> , BG <sup>2</sup> , BZ <sup>2</sup>
13	HC <sup>3</sup> , HB <sup>3</sup> , FH <sup>3</sup> , BC <sup>3</sup> , BG <sup>2</sup> , BZ <sup>3</sup>	HC <sup>2</sup> , HL <sup>1</sup> , HB <sup>3</sup>	HC <sup>1</sup> , HL <sup>3</sup> , HB <sup>2</sup> , FH <sup>3</sup> , BC <sup>3</sup> , BG <sup>1</sup> , BZ <sup>3</sup>	HC <sup>3</sup> , HB <sup>3</sup> , FH <sup>2</sup> , BC <sup>3</sup> , BG <sup>3</sup> , BZ <sup>1</sup>	HC <sup>1</sup> , HL <sup>1</sup> , HB <sup>1</sup> , BC <sup>2</sup>	HC <sup>3</sup> , HB <sup>3</sup> , FH <sup>3</sup> , BC <sup>1</sup> , BG <sup>3</sup> , BZ <sup>2</sup>
14	HC <sup>2</sup> , HB <sup>2</sup> , BC <sup>1</sup>	HC <sup>3</sup> , HL <sup>3</sup> , HB <sup>3</sup> , FH <sup>2</sup> , BC <sup>2</sup> , BG <sup>1</sup>	HC <sup>3</sup> , HL <sup>1</sup> , HB <sup>1</sup> , FH <sup>1</sup>	HC <sup>2</sup> , HB <sup>3</sup> , BG <sup>2</sup> , BZ <sup>1</sup>	HC <sup>1</sup> , HB <sup>2</sup>	BC <sup>2</sup> , BG <sup>3</sup> , BZ <sup>2</sup>
15	HC <sup>3</sup> , HB <sup>3</sup> , FH <sup>3</sup> , BC <sup>3</sup> , BG <sup>1</sup> , BZ <sup>3</sup>	HC <sup>3</sup> , HL <sup>2</sup> , HB <sup>3</sup> , FH <sup>2</sup> , BC <sup>3</sup> , BZ <sup>1</sup>	HB <sup>2</sup> , BG <sup>2</sup> , BZ <sup>3</sup>	HC <sup>1</sup> , HB <sup>1</sup>	HL <sup>2</sup> , HB <sup>1</sup> , BC <sup>2</sup> , BG <sup>2</sup>	HL <sup>1</sup> , BG <sup>2</sup> , BZ <sup>1</sup>
16	HC <sup>2</sup> , HB <sup>3</sup> , BC <sup>3</sup> , BG <sup>1</sup> , BZ <sup>2</sup>	HC <sup>2</sup> , BC <sup>1</sup> , BG <sup>1</sup> , HB <sup>2</sup>	HC <sup>2</sup> , HB <sup>2</sup> , BC <sup>1</sup> , BG <sup>2</sup> , BZ <sup>2</sup>	HC <sup>1</sup> , FH <sup>1</sup> , BC <sup>2</sup> , BG <sup>1</sup> , BZ <sup>1</sup>	HL <sup>1</sup>	HB <sup>1</sup> , BC <sup>2</sup> , BG <sup>2</sup> , BZ <sup>1</sup>
17	HC <sup>3</sup> , HB <sup>3</sup> , FH <sup>2</sup> , BC <sup>3</sup> , BG <sup>1</sup> , BZ <sup>2</sup>	HC <sup>3</sup> , HB <sup>2</sup> , FH <sup>2</sup> , BC <sup>3</sup> , BG <sup>1</sup> , BZ <sup>1</sup>	HB <sup>2</sup> , FH <sup>2</sup> , BG <sup>3</sup> , BZ <sup>2</sup>	HB <sup>2</sup> , BC <sup>2</sup>	HL <sup>2</sup> , FH <sup>2</sup> , BC <sup>1</sup> , BG <sup>3</sup>	HL <sup>1</sup> , HB <sup>1</sup> , FH <sup>1</sup> , BC <sup>2</sup> , BG <sup>2</sup> , BZ <sup>2</sup>
18	HC <sup>1</sup> , BC <sup>1</sup>	FH <sup>1</sup> , BC <sup>1</sup> , BG <sup>1</sup> , BZ <sup>2</sup>	HC <sup>2</sup> , HL <sup>1</sup> , BG <sup>1</sup> , BZ <sup>2</sup>	HB <sup>2</sup> , FH <sup>1</sup> , HL <sup>2</sup>	FH <sup>2</sup>	HB <sup>2</sup> , FH <sup>1</sup> , HL <sup>2</sup>

1=p&lt;0.05

2=p&lt;0.01

3=p&lt;0.001

HC - Head Circumference

HB - Head Breadth

HL - Head Length

FH - Facial Height

BC - Bicondylar Breadth

BG - Bigonial Breadth

BZ - Byzygomatic Breadth

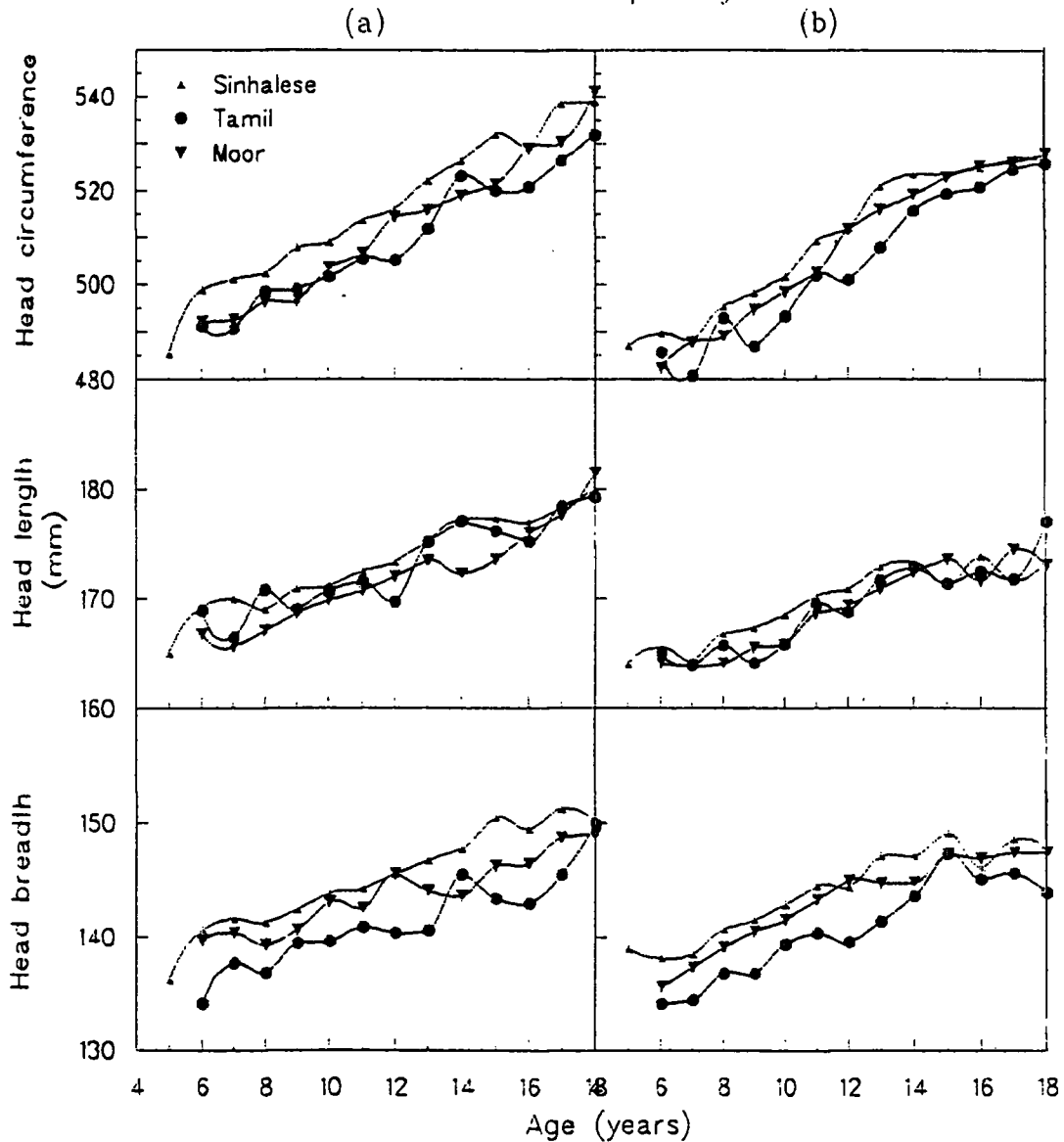


Figure 1

Distance curves for head circumference, head length and head breadth of a) males b) females in the three ethnic groups

population studies. Comparative studies are made possible as normal values for various population groups are available.

Numerous studies have been done to analyse the craniofacial morphologic differences among various population groups with a view to elucidating the influence of gender and ethnicity on them (13, 14, 15, 16, 17, 18, 19).

These studies have revealed marked sexual dimorphism in the craniofacial complex, the female craniofacial dimensions being smaller than the corresponding dimensions in the male (13, 14, 15). The current findings are consistent with these observations.

Previous studies have shown ample evidence that ethnicity plays an important role in



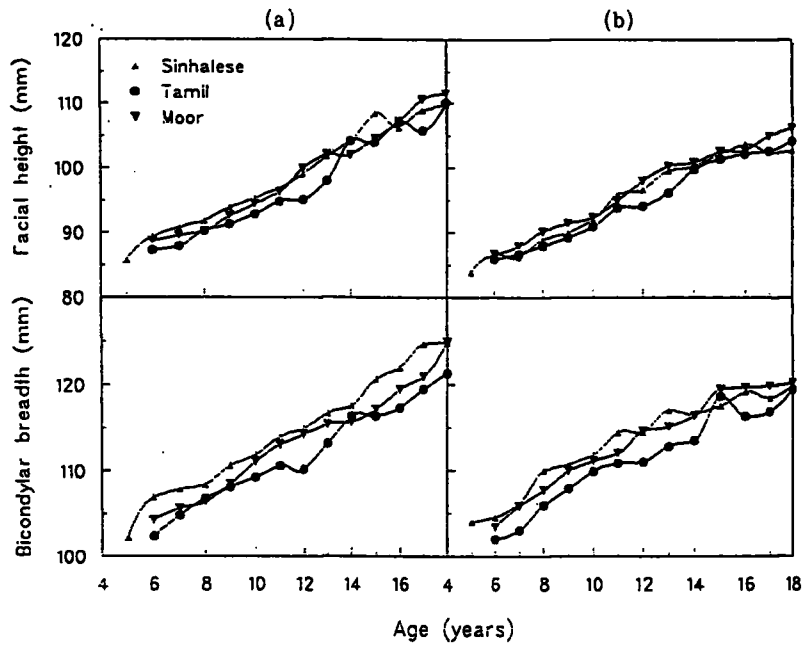


Figure 2

Distance curves for facial height and bicondylar breadth of a) males b) females in the three ethnic groups

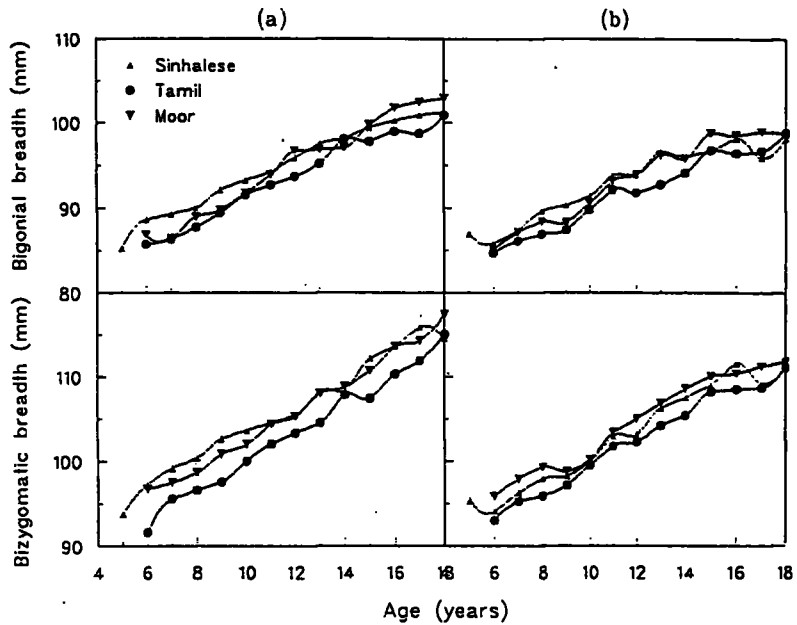


Figure 3

Distance curves for bigonial and bizygomatic breadth of a) males b) females in the three ethnic groups

determining the craniofacial characteristics (5, 16, 17, 18, 19). Stoudt (5) who published the results of the study on Ceylonese adult males carried out by Marett in 1937 reported that the head breadth of the Sinhalese males was significantly higher than that of the Tamils, but the head circumference, head length and the bigonial breadth were significantly greater in the Tamils.

The present series too demonstrated variations between ethnic groups. The Sinhalese males and females showed statistically significant higher values ( $P < 0.05$  to  $P < 0.001$ ) for the head circumference, head breadth and the bicondylar breadth. The facial height of the Sri Lankan Moors were significantly greater than that of the Sinhalese and Sri Lankan Tamils. A similar observation was made by Stoudt (5), the adult Sri Lankan Moors had the greatest facial height than any of the other ethnic groups. As the schools selected were all government aided, non fee-levying schools drawing children from households of similar socio-economic backgrounds, and living in like surroundings, the variations observed between the ethnic groups in the present study could be attributed to the ethnicity.

In a country like Sri Lanka, which shows an ethnic diversity, there is an obvious need for local standards. The values established for the craniofacial parameters in this series will help improve the diagnostic accuracy and surgical correction of craniofacial anomalies.

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