

## PRELIMINARY ANTHROPOMETRIC DATA OF MEDICAL STUDENTS FOR EQUIPMENT APPLICATIONS

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Forty-six measurements were measured on 127 medical students (60 males and 67 females) in Indonesia by using the traditional anthropometric methods. The means, standard deviations and, 5<sup>th</sup>, 50<sup>th</sup>, and 95<sup>th</sup> percentile values were calculated and presented.

**Key words:** anthropometry; Indonesian; medical students

To design equipment and work stations, as well as specific applications, sizes of clothings, helmets and other kinds of individual equipment, information about the human factors is needed (Mamansari et al., 1994). Manuaba and Sutjana (1988) reported the variability of body dimensions from subjects engaged in many occupations in Indonesia. Mamansari et al. (1994) presented anthropometric data for agricultural laborers in selected parts of Thailand. However, little anthropometric data is available in Asian developing countries. Therefore, we conducted a preliminary anthropometric research on male and female medical students.

### SUBJECTS AND METHODS

Subejects were 124 medical students (58 males and 66 females) in the second semester in academic year 1999/2000. They were healthy and without any serious diseases or physical handicaps. Their age varied from 18 to 23. The students were from families of higher socioeconomic status, and the growth had stopped in most of them.

An anthropometer, a sliding caliper and a spreading caliper were used to measure the body dimensions (Figure 1). Body weight was measured by using a weight scale. The definitions of measurements were adapted from Panero and Zelnik (1979). During the measurements, the subjects wore casual cloths with bear feet. The postures for measurements were as follows.: In the standing position, the subject stood erect, while the heels, the buttocks, the shoulders and the head touched the same vertical plane. In the sitting position, the subjects sat erect, with the shoulders and the head touching the same vertical plane, with the thighs held horizontal, the lower legs vertical and the feet supported on the floor. All measurements were carried out in the morning from 09.00 to 12.00 a.m.. The data were analyzed by using SPSS.

### RESULTS AND DISCUSSION

The means and standard deviations of the anthropometric measurements are shown in Tables 1 and 2. The measurements are not completely from the traditional anthropometric ones defined by Martin and Saller (1957), but they are actually useful for the purpose of this study. From these data

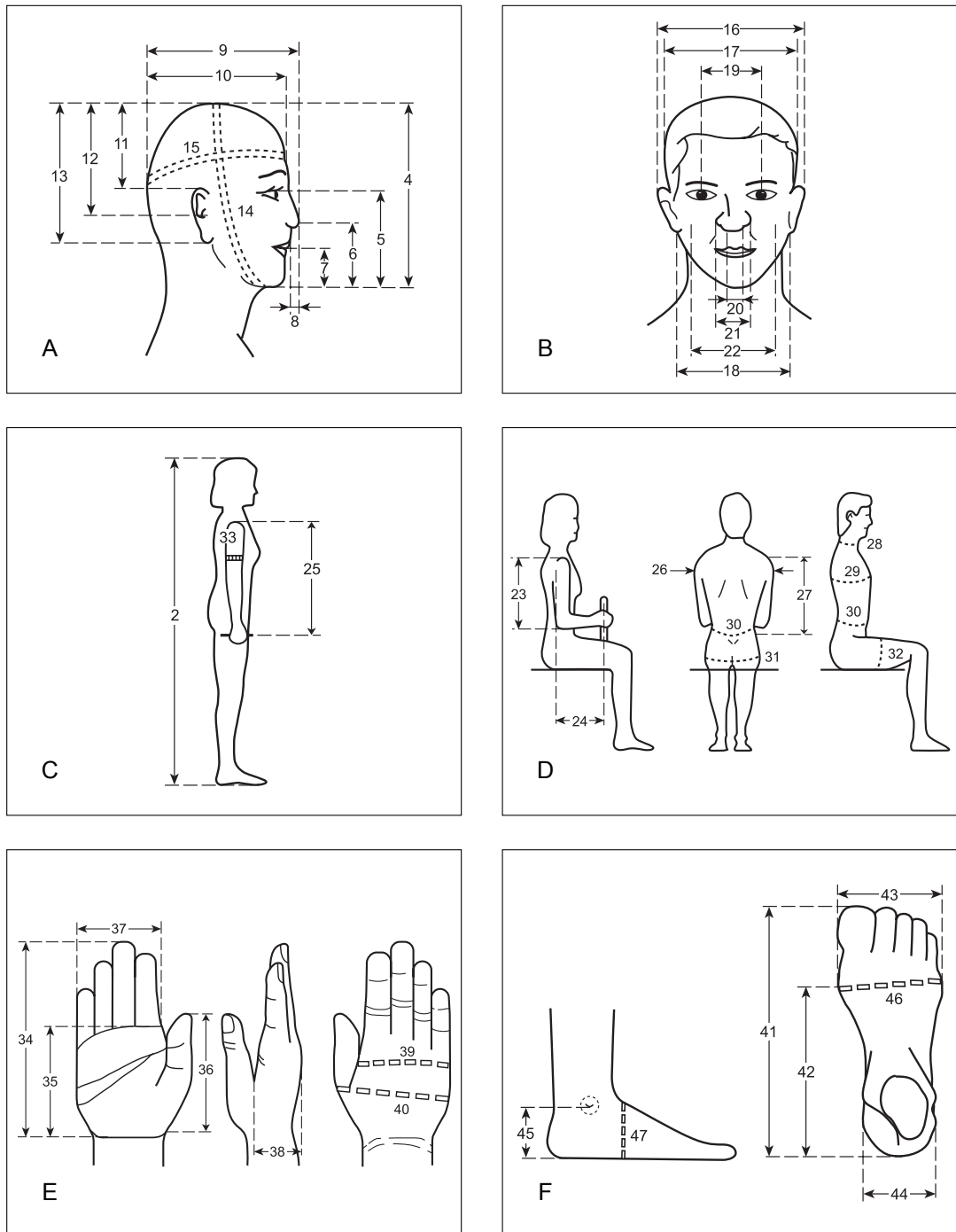


Fig. 1. Anthropometric measurements. A and B: Measurements taken from a head outline. C and D: Measurements taken from standing and sitting position. E: Measurements taken from a hand outline. F: Measurements taken from a foot outline. (Modified from Panero and Zelnik, 1979)

the female body dimensions are always smaller than those of the male subjects. Because the number of female students is increasing from year to year, the female body dimensions should be taken into consideration in designing students' equipment.

The data obtained may not represent the Indonesian population because the medical students were from higher socioeconomic status groups. Comparison of the data with other measurements conducted with clear definitions of items may be required. The data may be useful for designing students' facilities (lecture rooms or laboratories) or other individual equipment such as helmets, clothes, hand tools, shoes, etc.

Table 1. Anthropometric data of male medical student of the Udayana University (in cm) (n = 58)

No.	Measurement	Mean	SD	Min	Max	Percentile		
						5	50	95
1	Age (year)	19.4	0.95	18.0	23.0	18.0	19.0	22.0
2	Stature	168.2	6.22	152.2	183.7	157.9	168.5	181.8
3	Weight (kg)	61.1	12.48	46.5	115.0	47.4	57.5	88.9
4	Total head height (Vertex to gnathion)	22.8	1.51	19.6	27.3	20.3	23.0	24.8
5	Pupillary face height	11.6	0.63	10.5	13.0	10.6	11.7	12.8
6	Pronasale to gnathion	7.6	0.76	5.7	9.6	6.2	7.6	9.0
7	Lower face height (Stomion to gnathion)	4.6	0.64	3.7	7.2	3.8	4.5	6.3
8	Nose depth	1.7	0.22	1.5	2.4	1.5	1.7	2.2
9	Pronasale to occiput	20.5	1.03	18.2	24.3	18.6	20.4	22.1
10	Head length	18.7	1.75	16.1	30.2	17.2	18.5	20.3
11	Vertex to supraurale	10.7	1.05	8.7	13.5	9.1	10.7	12.7
12	Auricular height (Vertex to auditory canal)	13.4	0.92	10.8	15.5	11.9	13.6	14.7
13	Vertex to subaurale	16.4	1.09	13.8	18.0	14.3	16.5	18.0
14	Vertical head circumference	63.6	3.62	53.0	81.5	59.4	63.5	68.2
15	Horizontal head circumference	55.8	1.69	52.5	60.0	53.4	55.5	59.0
16	Ear to ear breadth	19.3	1.40	17.4	26.5	17.4	19.2	21.4
17	Head breadth	16.0	0.73	14.9	18.2	15.0	16.0	17.4
18	Bigonal breadth (Jaw to jaw distance)	13.5	1.05	11.9	17.0	12.1	13.4	15.5
19	Inter pupillary distance	6.9	0.53	5.6	8.2	6.0	7.0	7.9
20	Nostril to nostril distance	2.4	0.55	1.5	3.8	1.5	2.5	3.4
21	Nose breadth	4.4	0.71	3.4	8.2	3.5	4.3	5.3
22	Bizygomatic breadth	13.2	1.11	9.5	15.7	11.4	13.3	15.0
23	Upper arm length (Acromion to elbow)	27.2	3.06	22.5	39.9	23.4	26.7	32.2
24	Lower arm length (Elbow to gripped pencil)	27.7	1.63	24.6	33.4	24.8	27.6	30.9
25	Arm length (Acromion to gripped pencil)	54.7	2.96	48.0	63.2	49.6	54.5	59.7
26	Bideltoid breadth	42.4	2.70	34.0	50.0	38.1	42.3	47.1
27	Shoulder to hip length (Acromion to iliocrestale)	39.2	3.93	21.2	47.0	32.8	39.7	44.9
28	Neck circumference, sitting	34.2	2.21	31.0	42.7	31.1	34.0	38.5
29	Chest circumference, sitting	83.1	8.71	64.0	117.0	72.7	81.2	99.0
30	Abdominal circumference, sitting	73.2	10.28	61.5	115.0	63.2	69.0	99.5
31	Buttock circumference, sitting	90.5	6.99	80.5	120.0	82.0	89.2	105.0
32	Thigh circumference, sitting	51.0	5.78	43.5	74.5	43.9	50.0	61.3
33	Arm circumference	25.7	3.05	21.0	37.8	21.5	25.0	32.2
34	Hand length	18.7	1.05	14.3	20.3	16.7	18.8	20.0
35	Palm length	10.9	0.61	9.2	12.1	9.5	11.0	11.8
36	Palmer finger length (Thumb length)	10.5	0.65	9.2	12.5	9.4	10.5	11.5
37	Hand breadth	8.8	0.53	7.4	10.2	7.8	8.9	9.7
38	Hand thickness	3.5	0.53	2.4	4.6	2.6	3.6	4.5
39	Hand circumference	19.8	1.03	17.0	22.0	17.9	20.0	21.5
40	Maximum hand circumference	23.4	1.50	20.3	27.0	20.9	23.5	26.2
41	Foot length	25.2	1.39	21.2	27.8	22.4	25.0	27.5
42	Instep length	18.3	1.44	11.0	20.5	16.4	18.5	20.0
43	Foot breadth	10.3	0.66	9.0	11.8	9.2	10.4	11.6
44	Heel breadth	6.7	0.78	4.9	9.5	5.4	6.7	7.7
45	Outer ankle-joint height	6.0	1.01	4.5	8.5	4.6	5.7	8.0
46	Foot circumference (mt.f –mt.t)	24.0	1.36	21.4	28.0	21.9	24.0	27.1
47	Foot circumference	26.1	1.89	22.5	32.0	23.1	25.7	29.0

Table 2. Anthropometric data of female medical students of the Udayana University (in cm) (n = 66)

No.	Measurement	Mean	SD	Min	Max	Percentile		
						5	50	95
1	Age (year)	19.0	0.64	18.0	21.0	18.0	19.0	20.0
2	Stature	157.0	5.09	146.4	169.5	148.0	157.2	166.4
3	Weight (kg)	52.7	10.21	38.5	103.0	40.3	50.7	74.7
4	Total head height (Vertex to gnathion)	22.3	1.51	19.1	25.7	19.8	22.0	25.0
5	Pupillary face height	11.0	0.71	8.6	12.2	9.5	11.1	12.1
6	Pronasale to gnathion	7.3	0.95	4.8	9.6	5.3	7.4	8.9
7	Lower face height (Stomion to gnathion)	4.2	0.65	2.3	5.2	2.8	4.3	5.1
8	Nose depth	1.8	0.25	1.4	2.5	1.5	1.9	2.2
9	Pronasale to occiput	20.4	1.22	17.7	26.0	18.6	20.3	22.4
10	Head length	18.1	0.67	16.8	19.7	17.0	18.1	19.2
11	Vertex to supraurale	10.3	0.99	8.2	12.1	8.4	10.2	11.9
12	Auricular height (Vertex to auditory canal)	13.1	0.96	11.0	15.2	11.3	13.1	14.8
13	Vertex to subaurale	15.9	0.95	13.6	18.1	14.4	16.0	17.6
14	Vertical head circumference	63.6	2.77	55.2	69.0	58.3	63.4	68.1
15	Horizontal head circumference	54.9	1.87	51.2	64.5	52.0	54.7	57.9
16	Ear to ear breadth	18.4	0.90	16.3	21.0	17.0	18.5	19.9
17	Head breadth	15.9	0.63	14.5	17.6	15.0	15.8	17.1
18	Bigonal breadth (Jaw to jaw distance)	13.2	0.74	11.8	15.0	11.9	13.2	14.6
19	Inter pupillary distance	6.1	0.51	4.3	7.3	5.2	6.2	6.9
20	Nostril to nostril distance	1.9	0.39	1.4	3.9	1.5	1.9	2.8
21	Nose breadth	3.7	0.62	2.2	7.8	3.1	3.7	4.3
22	Bizygomatic breadth	13.6	0.80	11.7	15.7	11.9	13.5	14.9
23	Upper arm length (Acromion to elbow)	25.4	1.68	21.5	29.6	22.7	25.3	28.7
24	Lower arm length (Elbow to gripped pencil)	25.5	1.19	23.2	28.1	23.3	25.4	27.5
25	Arm length (Acromion to gripped pencil)	51.2	2.88	37.3	56.5	46.4	51.5	55.1
26	Bideltoid breadth	37.1	2.01	33.8	42.8	34.3	36.9	41.7
27	Shoulder to hip length (Acromion to ilioicristale)	31.3	2.75	20.5	42.7	28.1	31.4	35.1
28	Neck circumference, sitting	30.3	1.92	26.0	37.8	27.9	30.2	34.0
29	Chest circumference, sitting	81.4	7.54	71.1	119.0	73.0	80.0	98.9
30	Abdominal circumference, sitting	66.4	7.52	58.3	109.0	59.3	64.4	80.7
31	Buttock circumference, sitting	88.7	7.50	69.8	121.0	79.4	88.1	101.0
32	Thigh circumference, sitting	51.0	5.18	38.6	72.8	43.5	50.5	62.1
33	Arm circumference	24.6	2.87	20.8	37.9	21.7	24.0	31.1
34	Hand length	17.7	1.00	12.8	19.9	15.7	17.9	19.1
35	Palm length	10.3	0.65	8.6	11.8	9.2	10.4	11.4
36	Palmer finger length (Thumb length)	9.4	0.76	6.4	10.6	7.7	9.5	10.4
37	Hand breadth	8.0	0.56	6.4	9.1	6.8	8.1	8.7
38	Hand thickness	3.2	0.40	2.3	4.0	2.4	3.3	3.8
39	Hand circumference	18.2	1.06	16.0	20.3	16.2	18.3	20.0
40	Maximum hand circumference	21.2	1.00	18.9	23.5	19.5	21.3	22.8
41	Foot length	23.5	1.11	19.1	26.3	22.0	23.4	25.6
42	Instep length	17.3	0.98	15.2	19.7	15.5	17.0	18.9
43	Foot breadth	9.5	0.80	7.0	12.0	8.2	9.6	10.6
44	Heel breadth	5.9	0.80	2.6	7.7	4.4	6.0	6.9
45	Outer ankle-joint height	6.5	0.86	4.3	9.3	5.0	6.5	7.6
46	Foot circumference (mt.f –mt.t)	21.8	1.12	19.0	24.3	20.1	21.7	23.9
47	Foot circumference	23.6	1.44	21.0	27.0	21.5	23.5	26.6

## REFERENCES

- Mamansari, D U, Salokhe, V M, Intaranont, K (1994) Anthropometric Evaluation of Agricultural Laborers in Selected Parts of Thailand. *J.Human Ergol.*, **23**: 59-72.
- Manuaba, A, Sutjana, D P (1988) Anthropometric Data of Indonesian with Various Occupations. Second Conference of South East Asean Ergonomics Society, 27-29 July, Denpasar.
- Martin, R, Saller, K (1957) Lehrbuch der Anthropologie in Systematischer Darstellung. Band I, 3. Aufl. Gustav Fischer Verlag, Stuttgart.
- Panero, J, and Zelnik, M (1979) Human Dimension & Interior Space. A Source Book of Design Reference standards. The Architectural Press Ltd., London.