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Anthropometric measurements of teenagers

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ABSTRACT

Anthropometry is the measurement of certain parameters of the human body. Anthropometry has also been used to study the growth and development of school aged children and adolescents. Anthropometric data can be used as a basis for general standards and specific requirement in the design of new systems and in the evaluation of existing ones. In this study, 31 anthropometric variables were measured. The results obtained were subjected to the statistical analysis and presented in table forms as the mean, SD, minimum, maximum and percentile according to gender. The findings may provide some useful data for architects and designers for developing furniture for teenagers at school and home.

KEY WORDS : Anthropometry, Teenagers, body measurement, Percentile

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Anthropometry is the science dealing with the static and dynamic measurements of human body and needs to be studied for developing proper, comfortable and convenient setups so as to enable the worker to compute the activities without postural stress. Since long time anthropometry has been used to study the growth and development of school age and adolescents.

Anthropometry is the study of people in terms of their physical dimensions and their capabilities. It includes the measurement of human body characteristics, such as height, weight, breadth and distance between anatomical points.

Oxford dictionary gives the meaning of term anthropometry as, "the measurements of human body with view to determine its average dimensions at different ages and in different classes".

The need for anthropometric data arises because people are different in age, sex, geographical regions, even different occupations and all these influence human body dimension. Anthropometric data can be used as a basis for general standards and specific requirements, in the design of new systems and in the evaluation of existing ones. The reason for applying anthropometric data to the selection of design of tools, equipments, workstation etc. is to make sure that the design can be used easily, comfortably and productively by all workers who will be required to use it.

The review provides a guideline to formulate the problem precisely and hence account of studies is given below.

Mououdi(1997) took 28 anthropometric measurement of 179 students of both sexes at the university of Teheran to determine the static anthropometric characteristics of the students.

Parcells *et al*. (1999) took anthropometric measurements of students' body dimensions to study mismatch between students' body dimensions and furniture that they use.

Ten anthropometric measurements were taken by Jeong and Park (1993) from 1248 subjects (age range 6-17 years) to study the sex differences in interrelationship between body dimensions, to provide suitable sizes of chair and desk for boys and girls.

In order to determine, the anthropometric characteristics of university girl students, Gonen and Kalnkara (1993) took 20 anthropometric measurements of 204 students and the results were used as data base for designing and planning for the ready-made wear industry and places like school, laboratory, theatre, conference halls etc.

The present study was carried out to study the anthropometric measurements of teenagers.

RESEARCH METHODS

This study was conducted in Parbhani city. The data to be used for study of the anthropometric characteristics of the students was obtained from student of three schools and one college. Total 300 teenagers (150each of girls and boys) within age range 13-18 years were selected

randomly. A total of 31 measurements of these teenagers were taken with the help of anthropometer and measuring tape. Selected anthropometric measurements with respect to age, weight, standing measurements, sitting measurements, breadth measurements, length measurements and reach measurements were collected. The determination of the individual posture, definition of the anthropometric parameters and the taking of measurements were done in accordance with the standard procedure defined by Chakrabarti (1997).

The data were tabulated and the appropriate statistical technique constituted of calculation of percentages and ranges. The percentile values were calculated by using the formula given by Chakrabarti (1997).

RESEARCH FINDINGS AND DISCUSSION

In the present study anthropometric measurements of 300 teenagers were collected. The anthropometric measurements of this study are presented in a way that is easy to use by designers. The summary of anthropometric measurement in mean, standard deviation (S.D.), minimum, maximum and in 5th and 95th percentile by gender are presented in Table 1. All the anthropometric parameters are reported in cm except weight in kg.

In Fig. 1 number of girls and boys participants are presented according to age, weight and height range. Total three hundred teenagers out of which 150 boys and 150 girls were selected randomly from school and colleges.

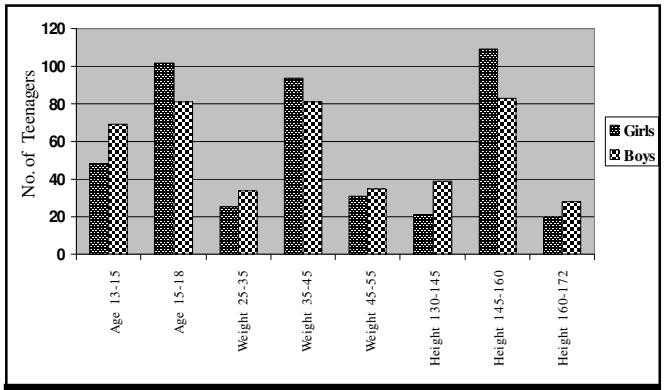

Fig. 1: Categorization of the teenagers according to age, weight and height range of teenagers

The data shown in Table 1, the mean values of all the selected anthropometric measurements of girls and boys which are at par. The mean value of almost anthropometric dimensions in boys were higher (by 1 to 5c.m.) than in girls except in knuckle height (girls 64.08 and boys 63.43), sitting shoulder height (girls 49.93 and boys 48.30), thigh height (girls 9.29 and boys 8.91), hip breadth (girls 33.63 and boys 30.13), elbow to elbow close (girls 29.14 and boys 28.82), elbow to elbow relaxed (girls 43.48 and boys 37.02), buttock popliteal length (girls 44.49 and boys 43.73) and minimum horizontal forward (girls 71.10 and boys 68.73) this anthropometric dimensions of girls are higher than boys. This may be due to the more no. of girls participants (102) are from age range of 15 – 18 years.

The 5th and 95th percentile were computed and it can be concluded from the table that the 5th and 95th percentile values for standing and sitting anthropometric measurement were noted to be almost at par for most of the measurements while for few measurement, the variation ranged between 2-5cm, except for the 5th percentile value for minimum vertical reach of girls being 169.9 cm and for boys it was found to be 181.2 cm.

Table 2 explains correlation between age and selected standing anthropometric dimensions of girls and boys. It is clear form the table that age of girls had positive correlation with weight (r = 0.22**) standing body height (r = 0.20*), eye height (r = 0.20*), shoulder height (r = 0.23**), elbow height (r = 0.20*), knuckle height (r = 0.20*), span akimbo (r = 0.15*) and minimum vertical reach (r = 0.20*). This indicated that as the age of girls increased there was increase in weight, standing body height, eye height, shoulder height, elbow height, knuckle height, span akimbo and minimum vertical reach.

Prediction equation indicated meagre increase of 0.03 to 0.09 cm in above said anthropometric dimension with an increase of one year in the age of girls. As the age increased by one year the body weight increased by 0.06 kg as inferred from the linear regression.

The age of boys was having positive correlation with weight (r= 0.40**), body height (r = 0.23**), eye height (r = 0.20*), shoulder height (r=0.20*), elbow height (r = 0.20*), knee height (r = 0.20*), span (r = 0.15*) and span akimbo (r = 0.20*). This indicated that as the age of boys' increased there was increase in weight, body height, eye height, shoulder height, elbow height, knee height, span and span akimbo.

Prediction equation indicated meagre increase of 0.02 to 0.07 cm in selected standing anthropometric dimension with an increase of one year in the age of boys. As the age increased by one-year, body weight increased by 0.11 kg as inferred by linear regression.

Table 3 explains the correlation between age and selected sitting anthropometric dimensions of girls and boys. It is clear form the table that age of girls was having positive correlation with sitting height (r = 0.20) sitting eye height (r = 0.20*) sitting shoulder height (r = 0.21*), buttock knee length (r = 0.17*), buttock popliteal length

Table 1: Summary of anthropometric measurement of teenagers

	Body measurements	Mean		SD		Minimum		Maximum		5th percentile value		95th percentile value	
		Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
1.	Weight	40.56	37.88	6.06	5.16	25	28	54	56	29.87	30.38	50.10	48.33
2.	Body height	152.40	153.27	7.70	8.49	130	140	168	172	137.37	141	166.7	138.31
3.	Eye height	142.38	143.38	7.1	8.63	123	130	154	162	125.5	130.75	153.2	159.56
4.	Shoulder height	127.01	127.00	6.45	8.21	110	111	140	145	115.18	112.5	135.44	167.6
5.	Elbow height	97.51	97.20	5.44	6.42	80	85	111	110	87.06	84.5	105.19	109.5
6.	Knuckle height	64.08	63.43	3.39	3.75	55	47	71	73	56.7	56.85	69.8	70.68
7.	knee height	47.18	47.85	2.74	3.37	41	37	52	55	42.10	42.5	51.25	58.5
8.	Popliteal height	40.90	40.53	2.71	3.23	34	32	49	52	35.69	34.5	45.85	46.5
9.	Sitting height	77.52	77.38	5.21	4.60	66	69	88	88	68.17	68.5	86.33	86.5
10.	Sitting eye height	67.08	67.07	4.72	5.10	57	59	78	79	57.47	58.5	74.95	76.5
11.	Sitting shoulder height	49.93	48.30	3.79	3.29	41	42	58	58	43.01	43.62	56.9	55.05
12.	Sitting elbow height	19.77	19.15	2.95	5.25	16	14	30	28	14.09	14.70	25.06	25.75
13.	Thigh height	9.29	8.91	1.42	1.22	6	7	13	12	6.5	6.75	12.04	11.18
14.	Sitting knee height	47.71	48.34	1.96	3.41	42	37	52	56	43.91	38.5	51.69	54.5
15.	Sitting popliteal height	39.77	39.36	3.24	2.95	31	32	49	47	32.8	33.72	45.7	44.44
16.	Shoulder breadth	32.84	34.79	2.93	3.33	28	29	42	44	28.6	30.11	38.3	40.5
17.	Hip breadth	33.63	30.13	3.44	3.31	25	27	42	38	26.2	25.92	39.8	34.75
18.	Elbow to elbow (closed)	29.14	28.82	3.58	2.49	20	22	45	42	23.11	24.5	34.75	34.5
19.	Elbow to elbow (relaxed)	43.48	37.02	6.31	4.68	33	28	63	48	34.8	29.68	59.8	46.82
20.	Knee to knee (closed)	14.37	15	1.53	2.01	12	12	18	18	10.4	14.5	17.77	17.5
21.	Knee to knee (relaxed)	31.78	36.69	4.74	4.76	23	26	49	45	25.7	27.32	41.5	44.05
22.	Forearm length	41.90	42.87	1.98	3.29	37	37	47	53	38.57	39.5	45.45	48.5
23.	Buttock knee length	51.82	51.17	3.60	3.72	42	43	58	58	44.14	44.92	58.4	58.48
24.	Buttock popliteal length	44.49	43.73	3.26	3.56	36	38	50	50	38.5	38.71	49.7	49.56
25.	Minimum vertical reach	191.65	194.26	8.98	7.80	160	180	206	210	169.8	181.22	204.2	205.81
26.	Maximum vertical reach	204.78	205.46	7.47	8.12	180	191	217	222	187.3	193	214.8	219.4
27.	Minimum horizontal forward	71.10	68.73	6.46	6.27	58	58	89	82	61.08	60.33	84.25	81.10
28.	Maximum horizontal forward	107.90	108.78	10.75	3.54	92	94	134	135	91.9	92.82	127.06	129.04
29.	Span	154.59	155.43	7.96	8.33	132	141	170	174	138	144.51	166.3	171.5
30.	Span akimbo	84.15	85.15	4.09	5.80	72	74	93	105	76.4	76.18	90.8	96.57
31.	Minimum lateral reach	64.71	64.61	4.53	4.83	60	52	78	75.5	56.08	55.66	73	73.58
32.	Maximum lateral reach	102.42	104.46	6.65	6.54	95	92	125	118	89.4	94.76	113.3	117.66

Table 2: Co-efficient of correlation and prediction equations between age and selected standing anthropometric dimensions

Parameters	Correlation and regression equation	
	Girls	Boys
Weight	0.22** (Y=14.50+0.06X)	0.40** (Y=11.67+0.11X)
Standing body height	0.20* (Y=10.67+0.04X)	0.23** (Y=94.83+0.04X)
Eye height	0.20* (Y=10.69+0.04X)	0.20* (Y=10.69+0.04X)
Shoulder height	0.23** (Y=9.31+0.06X)	0.20* (Y=9.31+0.06X)
Elbow height	0.20* (Y=11.17+0.06X)	0.20* (Y=11.17+0.06X)
Knuckle height	0.20* (Y=11.38+0.09X)	0.05NS
Knee height	0.12NS	0.20* (Y=12.28+0.07X)
Popliteal height	0.12NS	0.13NS
Span	0.14NS	0.15* (Y=11.50+0.02X)
Span akimbo	0.15* (Y=11.56+0.06X)	0.20* (Y=11.56+0.06X)
Minimum vertical reach	0.20* (Y=10.04+0.03X)	0.10NS
Maximum vertical reach	0.11NS	014NS

NS= Non-significant

Table 3: Co-efficient of correlation and prediction equations between age and selected sitting anthropometric dimensions

Parameters	Correlation and regression equation	
	Girls	Boys
Sitting height	0.20* (Y=11.80+0.06 X)	0.10 NS
Sitting eye height	0.20* (Y=12.01+0.07 X)	0.20* (Y=12.03+0.05 X)
Sitting shoulder height	0.21* (Y=12.26+0.09 X)	0.10 NS
Sitting elbow height	0.12 NS	0.10 NS
Thigh height	0.10 NS	-0.14 NS
Sitting knee height	0.11 NS	0.10 NS
Sitting popliteal height	-0.002NS	0.20* (Y=11.83+0.10 X)
Buttock knee length	0.17* (Y=12.85+0.08 X)	0.10
Buttock popliteal length	0.15* (Y=13.45+0.08 X)	0.02 NS
Minimum horizontal forward	0.20* (Y=13.35+0.05 X)	0.02 NS
Maximum horizontal forward	0.16* (Y=14.36+0.02 X)	-0.02 NS
Minimum lateral reach	0.05 NS	0.22** (Y=11.24+0.07 X)
Maximum lateral reach	0.22** (Y=11.15+0.05 X)	-0.10NS
Shoulder breadth	0.10NS	0.20* (Y=12.81+0.08 X)
Hip breadth	0.05NS	-0.02 NS
Elbow to elbow close	0.10NS	-0.10 NS
Elbow to elbow relax	0.14NS	-0.10 NS
Knee to knee close	0.03 NS	-0.05 NS
Knee to knee relax	0.10 NS	0.06 NS
Forearm length	0.10NS	0.18* (Y=12.28+0.08X)

NS=Non-significant

(0.18*), minimum horizontal forward reach, (r = 0.20*), maximum horizontal forward reach (r = 0.16*) and maximum lateral reach (r=0.22**). This indicated that as the age of girls increased there was increase in above selected sitting anthropometric dimensions.

Predication equation indicated meagre increase of 0.02 cm to 0.09 cm in above said anthropometric dimension with an increase of 1 year in the age of girls.

The age of boys was having positive correlation with sitting eye height (r = 0.20*), sitting popliteal height (r = 0.20*), minimum lateral reach (r = 0.22**) and shoulder breadth (r = 0.20*). This indicated that as the age of boys increased there was increase in sitting eye height, sitting popliteal height, minimum lateral reach and shoulder breadth.

Prediction equation indicated meagre increase of 0.05 to 0.10 in above said sitting dimensions with an increase of 1 year in the age of boys.

This finding is similar to the results of studies on anthropometry among children (Parcell *et al.,* 1999)

stating that as the age increased there was gradual increase in body dimension.

Conclusion:

The mean value of almost anthropometric dimensions in boys were higher (by 1 to 5 cm) than in girls. The 5th and 95th percentile values for standing and sitting anthropometric measurements were noted to be almost at par for most of the measurements while for few measurements the variation ranged between 2-5 cm. As the age increased, the anthropometric dimension and weight of teenagers increased.

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