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Anthropometric measurements for young males in Saudi Arabia

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The purpose of this study was to fill the gap of not having enough anthropometric data for young males in Saudi Arabia. Developing an anthropometric database on Saudi adults will help the local designers, manufactures and producers to create more efficient industrial applications, and products for Saudi population. The study was performed in the Riyadh city, the capital and the largest city in Saudi Arabia, among a sample of Saudi males aged between 19 to 26 years old.

Key words: Anthropometric data, Saudi Adults.

INTRODUCTION

In spite of the importance of using the anthropometric database to make work environments safer and more user-friendly, specifically in what is related to the work and life applications, there is not yet a primary reference of the anthropometric database for the Saudi population.

The largest effort for collecting Saudi anthropometric data was done in 2009 (Taha et al., 2009) when 646 Saudis participated in measuring 38 body dimensions. The studies of Ramadan (2011) and Al-Saleh et al. (2013) also contributed in Saudi anthropometric database by providing a design of schools' furniture for Saudis students.

In fact, although the anthropometric measurements for Saudis are limited in the literature, there were few attempts to provide anthropometric measurements in last decade.

The primary objective of this study is to provide the local manufacturers and producers with updated and sufficient anthropometric data for Saudi adults.

MATERIAL AND METHODS

Subjects

A total of 93 Saudi young males from Riyadh city with ages ranging from 19 to 26 years old participated in the study.

Anthropometric dimensions

In this study, 18 different anthropometric dimensions were measured. They provide appropriate information for designing several industrial and applications in workplaces. The anthropometric dimensions were:

(1) Stature
(2) Elbow height (Standing)
(3) Upper limb length

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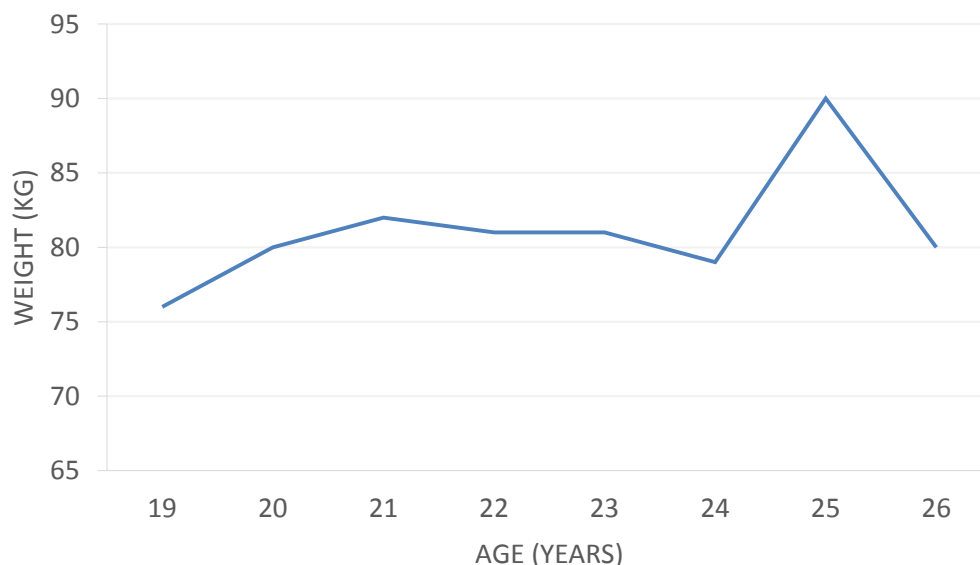
Figure 1. The weight growth chart for Saudis in the study.

(4) Overhead grip reach (standing)
(5) Chest depth
(6) Sitting height
(7) Shoulder height (sitting)
(8) Shoulder elbow length
(9) Elbow rest height (sitting)
(10) Overhead grip reach (sitting)
(11) Knee height
(12) Popliteal height
(13) Buttock-knee length
(14) Buttock-Popliteal length
(15) Thigh clearance
(16) Breadth across elbows
(17) Hip breadth (sitting), and
(18) Weight.

Equipment

Six sets of the equipment were used to collect all data required for this study. These instruments consisted of the following:

(1) Large Lafayettee anthropometer (Model 01290, range of 0-60±cm in 0.1 cm increments)
(2) Fixed Lafayettee anthropometer (0 to 2100±mm with straight probes, and curved measuring branches)
(3) Chest depth Caliper (Model 01140)
(4) Adjustable stool
(5) Stadiometer (seca 217, measuring up to 225 cm with extended bar), and
(6) Balance scale (0.1 to180±0.1 kg).

Measuring procedure

The collecting of these measurements was carried out by trained team for the period from August 2013 until March 2014. The team participated equally in the activities, one for measuring the dimensions and other for assisting the positioning of the participant as well as recording the measurements in the survey's form. Before starting the measurements, each participant was informed about the purpose of the study and his duties.

The participants were given a brief introduction to understanding the structure of the survey as well as the measuring techniques in the experiment. The participants' dimensions were measured in standing and sitting positions, and were taken inside the King Saud University Human Factors' Lab. All participants wore light clothing without shoes and were in good health condition. The measurements were taken in sessions, usually from morning till the afternoon.

Each participant in this study was engaged individually, and the measurements were taken for him on the right side (Hertzberg, 1968; Lohman et al., 1988). After the checking process, the data was analyzed by using the IBM Statistical Package for the Social Sciences (SPSS®), and Microsoft® Windows Version 7. The descriptive statistics (mean, standard deviation and the 5th, 95th percentiles) were reported to describe the characteristics of the participants.

RESULTS

The descriptive statistic, mean, standard deviations (SD), 5 and 95th percentile values of Saudi adults were considered. Figure 1 and Figure 2 show the changes in the height and weight of the participants cross the age. Table 1 shows the results of the anthropometric measurements of the Saudi male adults. Table 2 presents the body proportions to the mean stature.

The means, standard deviations of age, stature, sitting height and weight were 21.6±(1.3) years; 173.2±(6.5) cm, 88.8±(6.2) cm, and 80.58±(22.7) kg, respectively. The
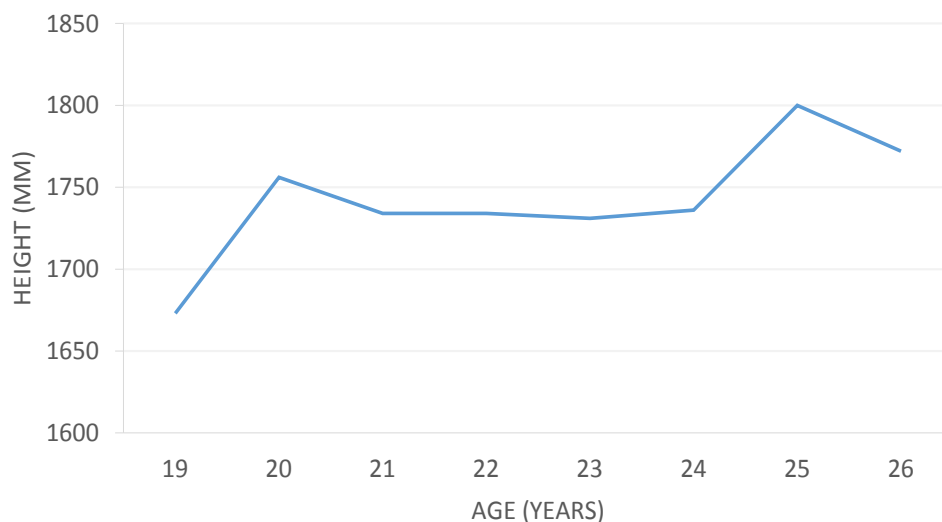
Figure 2. The height growth chart for Saudis in the study

Table 1. Descriptive statistic results of Saudi Arabian adults aged 19-26 years (n=93).

Measurements	Saudi adults (N=93)			
	Mean	**SD**	**5th**	**95th**
Weight (kg)	80.5	22.7	43	118
Stature (mm)	1732	64.6	1625	1839
Elbow height (standing) (mm)	1085	49.9	1003	1167
Forward arm reach (mm)	787	56.7	693	881
Overhand grip reach standing (mm)	2084	77.6	1956	2212
Chest depth (mm)	220	36.3	160	280
Sitting height (mm)	888	61.8	786	990
Shoulder height (mm)	607	43.9	535	679
Shoulder elbow length (mm)	381	33.4	326	436
Elbow rest height (Sitting) (mm)	262	59.2	164	360
Overhand grip reach (Sitting) (mm)	1235	63.7	1130	1340
Knee height (mm)	551	64.9	444	658
Popliteal height (mm)	439	33.4	384	494
Buttock-knee length (mm)	577	59.9	478	676
Buttock-popliteal length (mm)	477	32.6	423	531
Thigh clearance (mm)	148	27.7	102	194
Breadth across elbows (mm)	470	67.2	359	581
Hip breadth (sitting) (mm)	379	53.1	291	467
BMI	26.8	7.25	17.6	40.9
RSH	0.51	0.03	0.48	0.54

mean of the body mass index (BMI) was 26.8 which indicate that the Saudi adults are overweight as per the definition of the (World Health Organization (WHO). The 5 and 95th percentile values were 17.6 and 40.9, respectively.

The results indicate that 5% of the subjects are underweight, and 5% of are categorized as obese. The mean of the relative sitting height (RSH) was 0.51 and 0.48 and 0.54 for the 5th and 95th percentile, respectively. These values indicate that Saudi adults have long-legs

Table 2. The body proportions to the mean stature.

Measurements	Body proportions
Elbow height (standing) (mm)	0.63
Forward arm reach (mm)	0.45
Overhand grip reach standing (mm)	1.20
Chest depth (mm)	0.13
Sitting height (mm)	0.51
Shoulder height (mm)	0.35
Shoulder elbow length (mm)	0.22
Elbow rest height (sitting) (mm)	0.15
Overhand grip reach (Sitting) (mm)	0.71
Knee height (mm)	0.32
Popliteal height (mm)	0.25
Buttock-knee length (mm)	0.33
Buttock-popliteal length (mm)	0.28
Thigh clearance (mm)	0.09
Breadth across elbows (mm)	0.27
Hip breadth (sitting) (mm)	0.22

(Pheasant, 1996) (Tables 1 and 2).

Conclusion

The main contribution of this study is providing a new dataset of anthropometric measurements for Saudi young males. The measurements were reported in table with mean, standard deviations, 5th, and 95th percentiles, along with the body mass index (BMI) and relative sitting height (RSH). The anthropometric results from this study could be used to provide safer and user-friendly workstations, tools, and school furniture for Saudi Arabian population. It could be also applied to enhance any existing human-machine system used in Saudi Arabia, by providing the correct body size dimensions and accurate measurements.

Recommendation

The study essentially was performed to provide new anthropometric measurements for Saudi young males, but more attempts could be carried out leading to extend the results of this research. This includes exploring additional body dimensions, and studying the anthropometric dimensions while body position is moving. In fact, this will help providing more functionality dimensions and database for the designers and manufactures. Additionally, it would be recommended to update the anthropometric measurements frequently to keep anthropometric information as up to date and representative of the current Saudi population as possible.

CONFLICT OF INTERESTS

The author has not declared any conflict of interests.

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