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Development of anthropometric data for Bangladeshi male population

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ABSTRACT

An anthropometric study of a group of people is important when designing ergonomic products and workstations for that group. This study surveys the anthropometric dimensions of the Bangladeshi male population between the ages of 15 and 64 years to compare these dimensions with male anthropometrics for different countries available in the literature.

The mean stature and sitting height of Bangladeshi males are 167.7 cm and 82.9 cm, respectively. Stature and body mass are significantly correlated with most of the other dimensions for the Bangladeshi male population. The mean BMI is 23.62, which indicates that the Bangladeshi male population is normal. Significant differences are found between the body dimensions of the Bangladeshi male population and male samples of other nationalities in a comparative analysis. In comparison with European males, the mean stature of Bangladeshi males is 1.3 cm shorter (Portuguese) to 11.8 cm shorter (Netherlands). The average stature of Bangladeshi males is 5.7 cm, which is 3.8 cm taller than southern Indian males and Sri Lankan males and is 6.3 cm shorter than the Singaporean male population.

As the first comprehensive anthropometric study of the Bangladeshi male population, these results are expected to have considerable value in designing ergonomic products and workstations for the Bangladeshi male population.

Relevance to industry: The findings of this study indicate differences in anthropometric data between Bangladeshi male and other countries. The utilization of an updated anthropometric database that incorporates geographical origin is useful. Product designers would be able to outfit to a wider range of target users.

1. Introduction

Over the course of a day, people interact with various products in both formal and informal workplaces. An appropriate match between people, products and workplaces in these interactions requires that users' anthropometrics must be ergonomically adjusted to products and workplaces (Mokdad, 2002; Wichansky, 2000; Pentikis et al., 2002). Anthropometry is an important area of human science that concerns measures of human height and weight and the dimensions of various body parts. Anthropometry also examines how these measurements vary in certain circumstances, such as by age group, race, gender and nationality. Anthropometrical data and formulae are used in anthropological and medical research and in forensic investigations. Thus, anthropometry is an important area of human science that indicates people's health status (Marks et al., 1989). It is difficult to design products and workplaces because the dimensions of the human body vary by age, sex, race and nationality. Thus, it is advisable to consider some essential anthropometric dimensions (Chuan et al., 2010).

Although a perfect match between a product or workplace and a user is not always possible (Pentikis et al., 2002), integrating anthropometric data into ergonomic designing ensures a safe and user-friendly relationship between a product or workplace and a user (Pheasant, 1998) that contributes to high work performance and productivity (Klamklay et al., 2008). However, incorrect adjustments or the omission of anthropometric data in product or workplace designs may result in work-related psychological discomfort (Mokdad, 2002), physical fatigue and suffering or injuries such as musculoskeletal disorders of the neck (Chuan et al., 2010), shoulders, back (Westgaard and Aaras, 1984), arm and hand, or wrist (Snook, 1978). As a result, the use of anthropometric data is essential for a safe, comfortable and productive working environment.

To collect anthropometric data, researchers have used numerous tools, such as sophisticated and expensive three-dimensional technology with error-detection procedures (Park

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et al., 2009), integrated high-tech equipment (Hua et al., 2007; Dewangan et al., 2005), or less expensive standard equipment (Chuan et al., 2010; Mokdad and Al-Ansari, 2009; Klamklay et al., 2008; Mohammad, 2005; Kothiyal and Tettey, 2000; Dewangan et al., 2008, 2010). For accurate and reliable data collection, less expensive traditional equipment is similar to expensive high-tech equipment (Ghoddousi et al., 2007). Furthermore, traditional equipment is easy to use because dimensions are measured in traditional ways (Musaiger et al., 2000).

Anthropometric data have long been available for segments of the population or for entire populations in both developed and developing countries. Studies include the hand anthropometry of the Jordanian population (Mandahawi et al., 2008), the static anthropometry of Tehran University students (Mououdi, 1997), the anthropometry of the elderly in Australia (Kothiyal and Tettey, 2000), the anthropometry of the Chinese elderly living in the Beijing area (Hua et al., 2007), an anthropometric study of Algerian farmers (Mokdad, 2002), the anthropometry of Taiwanese women (Huang and You, 1994) and Taiwanese workers (Wang et al., 1999), the anthropometry of Portuguese workers (Barroso et al., 2005), the anthropometry of Turkish women (Gonen et al., 1991), the anthropometry of the Turkish population (İşeri and Arslan, 2009), the anthropometry of the Thai population (Klamklay et al., 2008), the anthropometry of Bahraini school children (Mokdad and Al-Ansari, 2009), the anthropometry of northeastern Indian female farm workers (Dewangan et al., 2008), farm youth (Dewangan et al., 2005) and male agricultural workers (Dewangan et al., 2010), the anthropometry of Sri Lankan university students (Thariq et al., 2010), the anthropometrics of Sweden for product and workplace design (Hanson et al., 2009), the anthropometry of Filipino manufacturing workers (Prado-Lu, 2007), the anthropometry of the Malaysian population (Mohamad et al., 2010) and the anthropometry of the Singaporean and Indonesian populations (Chuan et al., 2010). Since Imrhan et al.'s (2009) measurement of the hand anthropometry of the Bangladeshi adult population living in America, there has been no publication of anthropometric data for the overall Bangladeshi population. Bangladesh is the eighth most populated country in the world, with approximately 160 million people. The age range of 15–64 years is considered working age in Bangladesh. Approximately 61% of the population belongs to this age range, of which less than half (approximately 47%) are male.

The main objectives of this study are as follows:

i) to measure the anthropometry dimensions of the overall Bangladeshi male population;
ii) to compare the results with the anthropometric data of different countries available in publications;

2. Method

This study included a search of relevant literature, familiarity with the tools and data collection techniques, data collection and analysis of the data by means of descriptive statistics.

2.1. Subjects

A total of 470 male subjects from the Bangladeshi population were evaluated in this study. Subjects in the 15- to 64-year-old age range, which is considered working age in Bangladesh, were targeted. Males from five different public places in two large cities were randomly measured to allow subjects to be chosen from around the country. The subjects were asked to participate voluntarily in this research study. The demographics of the subjects are shown in Table 1.

Table 1
Demographic record of subjects (Sample size, $n = 470$).

	% (Statistics)
Age ranks	
15 ~ 20	2.12% (10)
21 ~ 30	54.46% (256)
31 ~ 40	31.48% (148)
41 ~ 50	8.72% (41)
51 ~ 64	3.19% (15)
Occupation	
Industrial workers	41.70% (196)
Bankers	2.12% (10)
Employees	24.89% (117)
Doctors	1.27% (6)
Students	20.0% (94)
Others	10.0% (47)
Born in	
Dhaka	20.85% (98)
Chittagong	44.46% (210)
Rajshahi	3.61% (17)
Khulna	7.02% (33)
Barishal	9.36% (44)
Sylhet	10.42% (49)
Rangpur	4.04% (19)
Note: $n = 470$	

2.2. Dimensions

This study was influenced by two previous anthropometric studies by Chuan et al. (2010) and Pheasant and Haslegrave (2006). Based on these studies, the authors decided to use 37 dimensions for each subject in this research. Fourteen measurements were taken in a standing position (including body mass) and 23 measurements were taken in a seated position (Chuan et al., 2010). Three anthropometric indices were calculated for each subject to examine the health condition of the male population: body mass index (BMI), relative sitting height (RSH) and body surface area (BSA). The subjects were measured in the late afternoon and evening. They were asked to wear as little clothing as possible with respect to local culture. Subjects were barefoot and wearing casual dress during the measurements. The weight (0.5 kg) of clothes was subtracted from the subjects' weights. Measurements of anthropometric data are sensitive for some people, and some subjects refused to wear less clothing or to allow themselves to be measured due to religious cause. Although body measurement can be taken from either side (Klamklay et al., 2008), only the right side was used to measure the subjects in this study. The subjects were in static (fixed) positions while the measurements were recorded.

2.3. Equipment

The traditional anthropometric equipment/toolbox is considered as reliable and accurate as semi-high-tech or high-tech equipment for measuring the dimensions (Chuan et al., 2010). Most importantly, traditional equipment is portable, easy to use and inexpensive. Thus, a traditional manual anthropometric toolbox that included an anthropometer, two calipers and one measuring tape were adopted as the equipment in this study. An anthropometer is a 2-meter graduated rod that has one fixed edge and another sliding edge at a right angle. One spreading caliper had two curved branches that were joined in a hinge, and a scale fixed near the hinge was used to measure distance. The second small sliding caliper was used to measure short distances, such as hand length, hand width, leg length and leg width. Some small lengths were measured by tape. An analog weighing scale and a small adjustable steel stool with flat sitting support were also used to measure the dimensions.