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Anthropometric study of Portuguese workers

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Abstract

In spite of the importance of anthropometric data, namely in what concerns the design of machinery safety devices and protective equipment, there is not as yet an extended and validated database of anthropometric measures for adult Portuguese population. The study described here consists of the development of a procedure for data acquisition and of an anthropometric database for Portuguese adult workers. Eight hundred and ninety-one individuals were measured—399 female and 492 male, with ages ranging from 17 to 65 years old. A set of 24 static anthropometric measures plus body weight was obtained for each individual. Results of the pilot study undertaken and the practical application of the procedure suggest that this is a valid one for anthropometric data acquisition. Additionally, the statistical analysis carried out to the data show that some statistical parameters, such as the variation and correlation coefficients, behave as expected, and as observed in other populations.

Relevance to industry

The data collected will serve as a basis for the design of industrial tools, equipment and clothing. In addition, the data constitutes an essential element for the ergonomic design of workplaces.

Keywords: Anthropometry; Portuguese workers; Database

1. Introduction

Anthropometry consists on the measurement of body characteristics such as reach, body segment length and circumferences, widths, and heights, among others. This information can be used to inform the design of tools, equipment, workstations and clothes. Appropriate use of anthropometry in design may improve well-being, health, comfort, and safety (Pheasant, 1998).

The anthropometric data of the adult Portuguese population is very limited. While a significant amount of data exists that has been compiled through the Portuguese military institutions over

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the years, this data comprised essentially anthropometric dimensions of men ranging from 18 to 24 years of age (Padez, 2002). What seems to be the only data reported for a general Portuguese adult population belongs to the Laboratory of Applied Anthropology (LAA). These include a set of 63 measures collected for a sample of 201 adults working in France in 1971. Given changes in body sizes due to secular trend and the differences shown for different countries (Pheasant, 1998; Mokdad, 2002), it is not clear if such a sample would accurately represent the distributional characteristics of body dimensions of the current adult Portuguese population. For anthropometric data to be useful it must accurately represent the dimensions of the target population, i.e., that for which the design is intended.

New methods of anthropometric data collection that allow data to be collected quickly and accurately, such as the use of computerized procedures, provide new opportunities for anthropometric study (Paquette, 1996; Roebuck, 1995). Studies of validity and reliability of anthropometric measurement methods have been performed (Feathers et al., 2004; Meunier and Yin, 2000). Results of these studies suggest that the use of computerized methods for anthropometric data collection provides valid and reliable data.

The main objective of this study was to determine the anthropometric dimensions for a large sample of Portuguese adults. A secondary objective was to develop and test a new data acquisition system designed to allow quick but accurate data collection.

2. Methodology

2.1. Subjects

Four hundred and ninety-two men and 391 women were measured. The sample comprised essentially individuals from industry, as well as some workers from the tertiary sector. Age varied between 17 and 65 years old. Underlying the choice of subjects from industry is the fact that this accounts for approximately 23% of active population in Portugal (INE, 2001), and also the fact that we intend to develop a database which can accurately represent the population for which most design problems and solutions are aimed at.

A total of ten small- and medium-size companies were contacted for data collection. The range included companies from the textile, electronics, and chemical sectors, among other, mainly located in the north of the country.

2.2. Range of dimensions measured

A total of 25 static anthropometric dimensions including weight were recorded for each individual. Ten dimensions were measured while the individual remained standing, while the remaining were taken while the individual remained seated. Definitions used were those published by Pheasant (1998).

2.3. Equipment used

The measurements were obtained with a portable digital camera with the minimum resolution of 2 Mpixel, a tripod, an adjustable bench, a scale, and ribbons for body marking. An acrylic panel with reference marks supported by an aluminium structure has also been designed for calibration of the measuring system. As previously mentioned, data processing and analysis is carried out subsequently, by means of a PC-based software which allows for the different body measurements taken to be automatically stored on a database.

2.4. Pilot study

A pilot study was carried out in order to determine the accuracy ensured by the data acquisition system developed, and to validate the measuring procedure. Two methods were applied, the traditional manual method (anthropometer and grid board) and the proposed method using digital photos.

This pilot study, in which three measurers participated, comprised the measurement of five anthropometric dimensions: stature, knee height, elbow height, abdominal breadth and hip breadth.

Each of the anthropometric dimensions was measured twice for three subjects, by each of the three measurers. When applying the proposed