Cylinder: Jurnal Ilmiah Teknik Mesin
Volume 9, Nomor 1, April 2023
ISSN 2252-925X (Online)

A PRELIMINARY RESULT OF STANDING POSTURE ANTHROPOMETRY OF INDONESIA MALE WORKERS IN JAKARTA

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ABSTRAK

Paper ini menyajikan hasil pengukuran pendahuluan data antropometri pekerja industri Indonesia yang berdomisili di DKI Jakarta. Untuk hasil pendahuluan, disajikan sebanyak 16 dimensi antropometri dalam postur berdiri sebanyak 30 orang pekerja pria. Untuk masing-masing dimensi antropometri, disajikan ringkasan rata-rata, standar deviasi dan persentil 5 dan 95 yang dapat bermanfaat sebagai dasar dalam perancangan produk, mesin dan peralatan. Data yang diperoleh juga dibandingkan dengan data dari populasi negara lain yang tersedia dalam literatur, dalam hal ini pekerja dari Norwegia, Nigeria dan India. Berdasarkan perbandingan, pekerja industri Indonesia cenderung lebih pendek dibandingkan dengan pekerja dari negara Norwegia dan Nigeria. Sementara itu, karakteristik fisik pekerja Indonesia ditemukan hampir sama dengan pekerja dari India. Dalam aplikasinya, hasil penelitian dapat berguna sebagai dasar menentukan ukuran yang tepat dalam penentuan dimensi alat dan mesin bagi pekerja. Lebih jauh, ukuran yang diperoleh dapat menjadi patokan bagi negara lain yang menyasar produk, mesin dan peralatan untuk pasar Indonesia.

Kata kunci :
Dimensi antropometri; Perancangan; Pekerja industri Indonesia.

ABSTRACT

This paper presents a preliminary result of anthropometric data of 30 males Indonesian industry workers. For this preliminary results, 16 dimensions in the standing posture were presented. For each dimension, the summary of mean, SD and percentile (5 and 95) were calculated which are useful as the basis for the design of products, machines and equipments. The data in this study were compared with those from previous studies i.e Norwegia, Nigeria and India. From data comparisons, Indonesian workers are shorter than those of other nationalities from Norwegia and Nigeria. Meanwhile, anthropometric characteristics of Indonesian workers were found to be similar with India workers. As for application, anthropometric data could be used as the basis to determine the proper dimensions of equipments and machines to be used by workers. Furthermore, the results could become a benchmark for other countries targeting products and machinery for Indonesia market.

Keywords **:**
Anthropometric dimensions; Design; Indonesian industry workers.

1. INTRODUCTION

All products including clothes, consumer products as well as systems of products such as office workplaces, vehicles and assembly lines need to be adjusted to user anthropometrics to maximise usability and minimise the negative effects on the user [1]. In this regard, the basic information required is the anthropometric body dimensions of the users of tools and equipment [2]. Prior studies have shown that anthropometry data are essential as the basis for the design of machine and equipment to be used safely and comfortable by workers. For example, Hsiao et al. [3] developed anthropometric criteria for the design of tractor cabs and protection frames in order to enhance operator productivity, comfort and safey. In particular, Mehta et al. [4] considered anthropometry of operators in the sitting posture for tractor seat design. In India, Kumar et al. [5] developed grain threshers based on ergonomics criteria.

In Indonesia, a few anthropometric studies have been conducted either for database or for the use of evaluation, design products of equipments such as primary school students [6], junior high school students [7], university students [8, 9] and infants [10]. Adding to prior studies, anthropometry for industry workers also need to be done. In the future, the need for anthropometry data of industry workers will become increasingly important. Hence, this study presents a preliminary result of anthropometry for male industry worker.

2. RESEARCH METHODS

In this preliminary study, 30 male workers were measured. The measurements were conducted in the Laboratory of Work System Design and Ergonomics, Industrial Engineering Program Study, Faculty of Engineering, Atma Jaya Catholic University of Indonesia. Only persons of normal health could participate in the survey. For the selection of anthropometric dimensions, this study presents 16 anthropometric dimensions in the standing posture (Figure 1). Anthropometric dimensions were defined by Pheasant and Haslegrave [11], including the measurements of each body dimension procedures – as illustrated in Figure 1. To measure the anthropometric dimensions in the standing posture, a variety of conventional instruments was used including anthropometer (Human Body Measuring Kit), sliding caliper, meter scale and weighing scale. For data analysis, the data were summarized and presented in mean, standard deviation and percentile 5 and 95. The percentile means the proportion of workers population with body dimension at or less than the given value. The data were used when considering dimensions to accommodate population. In addition, normality test was also conducted for each dimension.

3. RESULTS AND DISCUSSION

Table 1 presents the mean, standard deviation (SD), 5th and 95th percentile values of body dimensions of subjects. Table 1 also presents the results of normality test for each dimension. Meanwhile, the data were also compared with those of other nationalities such as Norwegian workers [12], Nigerian workers [13] and India workers [14]. The comparison data are shown in Table 2.

Studying Table 1, all data are normally distributed at α=0.01 except for shoulder and knuckle height. Considering this, when doing data comparison between two population, non-parametric test could be used for shoulder and knuckle height as the data were not normally distributed [15, 16]. Meanwhile studying Table 2, in general Norwegian workers [12] and Nigeria workers [13] were taller than Indonesian workers for all dimensions. In addition, anthropometry of Indonesian workers was similar with workers from India [14].

As for application, anthropometric data could be used as the basis to determine the proper dimensions of equipments and machines to be used by workers. In the workplace, the data could also be used to evaluate postures and distance to reach controls [17]. Furthermore, agricultural tools, equipments and machines could increase workload and occupational disorders if not fit for the target users. The use of anthropometric data can help in the proper design of equipment for better efficiency and improved human comfort. According to Bolstad et al. [12], data from the general working population has become increasingly more relevant as more effort is put into the development of standards and guidelines for construction of workplaces, and production of machines and equipment to be used and serviced by humans. As for this study, the measurements are still ongoing to obtain more data, including female workers.

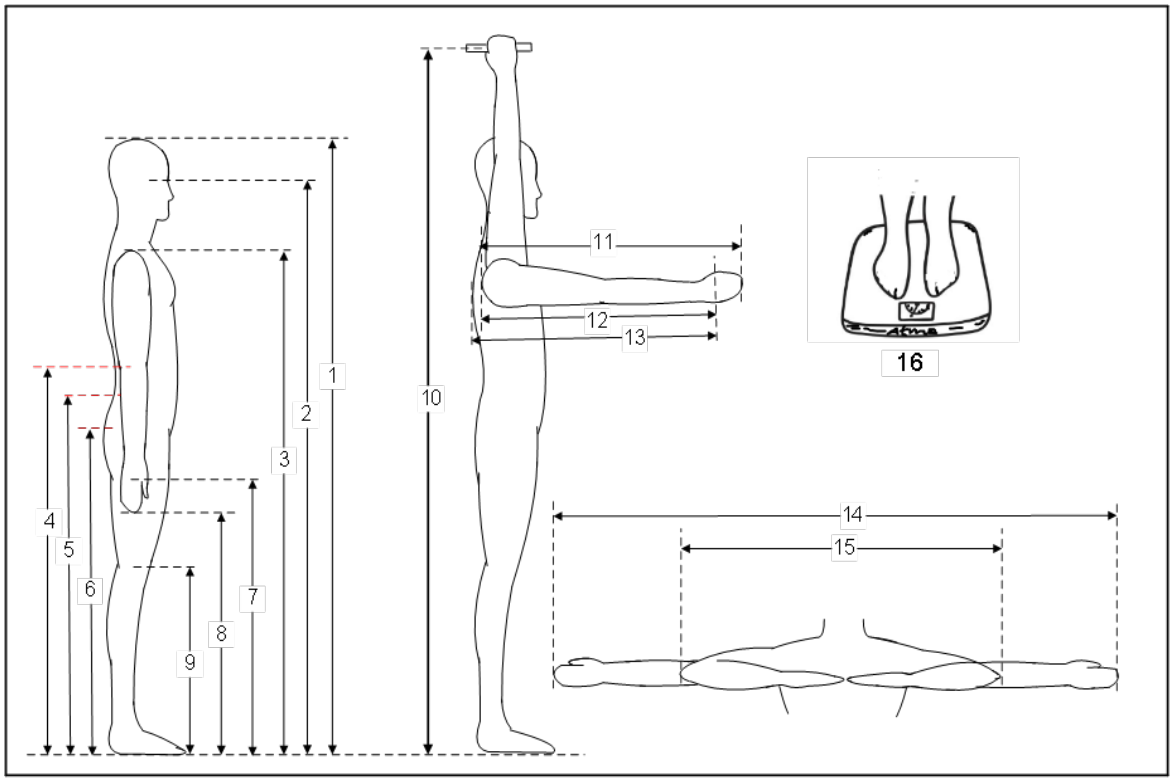

Figure 1. Standing anthropometric dimensions, including body weight

Table 1. Anthropometric data of Indonesian workers (in cm, except weight in kg)

No	Anthropometric dimensions	Male (n=56)				Normality test results	Normality at α =0.01
		Mean	SD	P5	P95		
1	Stature	165.1	6.6	153.5	172.9	0.047	Normally distributed
2	Eye height	155.4	6.7	145.3	163.7	0.010	Normally distributed
3	Shoulder height	138.2	5.9	127.5	144.9	0.005	Non-normally distributed
4	Elbow height	103.5	7.3	92.2	114.8	0.200	Normally distributed
5	Hip height	84.7	4.7	75.0	90.6	0.102	Normally distributed
6	Waist height	92.7	6.2	83.4	103.9	0.200	Normally distributed
7	Knuckle height	72.3	6.3	60.2	81.9	0.006	Non-normally distributed
8	Fingertip height	61.2	4.1	53.9	67.2	0.970	Normally distributed
9	Knee height	45.7	2.2	42.3	49.1	0.200	Normally distributed
10	Vertical grip reach	187.3	13.3	169.2	209.5	0.200	Normally distributed
11	Upper limb length	71.7	4.8	61.4	76.8	0.033	Normally distributed
12	Shoulder-grip length	65.2	4.9	57.7	71.5	0.200	Normally distributed
13	Forward grip reach	70.3	4.0	63.4	76.4	0.200	Normally distributed
14	Span	167.5	7.7	155.3	176.6	0.200	Normally distributed
15	Elbow span	86.0	5.3	77.2	92.4	0.098	Normally distributed
16	Weight	64.2	13.1	47.3	83.1	0.019	Normally distributed

Table 2. Comparison of anthropometry of male population among different countries

No	Anthropometric dimensions	Indonesian workers (This study)		Norwegian workers		Nigeria workers		India workers	
		Mean	SD	Mean	SD	Mean	SD	M	S
1	Stature	165.1	6.6	179.6	6.6	173.8	8.1	164.9	4.5
2	Eye height	155.4	6.7	n.a.	n.a.	162.2	9.6	153.5	5.0
3	Shoulder height	138.2	5.9	146.9	6.1	148.6	8.5	134.5	4.3
4	Elbow height	103.5	7.3	109.9	4.7	109.2	5.9	101.9	3.5
5	Hip height	84.7	4.7	n.a.	n.a.	95.3	6.2	n.a.	n.a.
6	Waist height	92.7	6.2	n.a.	n.a.	n.a.	n.a	93.1	3.2
7	Knuckle height	72.3	6.3	n.a.	n.a.	77.0	6.2	69.1	3.4
8	Fingertip height	61.2	4.1	n.a.	n.a.	63.7	4.4	n.a.	n.a.
9	Knee height	45.7	2.2	n.a.	n.a.	n.a.	n.a.	45.1	2.4
10	Vertical grip reach	187.3	13.3	n.a.	n.a.	216.2	9.7	n.a.	n.a.
11	Upper limb length	71.7	4.8	n.a.	n.a.	81.9	4.5	n.a.	n.a.
12	Shoulder-grip length	65.2	4.9	75.3	4.0	69.3	4.4	n.a.	n.a.
13	Forward grip reach	70.3	4.0	n.a.	n.a.	81.8	5.8	n.a.	n.a.
14	Span	167.5	7.7	n.a.	n.a.	187.9	7.3	167.1	5.3
15	Elbow span	86.0	5.3	n.a.	n.a.	94.4	5.6	83.3	3.3
16	Weight	64.2	13.1	63.4	9.3	72.3	9.4	n.a.	n.a.

CONCLUSION

In this study, 16 standing anthropometric dimensions of Indonesian male workers were collected and presented as preliminary results. The data were presented in mean, standard deviation and percentile (5th and 95th) as those are relevant for design purpose. The data were also compared with those of other nationalities. Based on comparison, Indonesian workers are shorter than those from Norway and Nigeria and are found to be similar with India workers. As for application, anthropometric data could be used as the basis to determine the proper dimensions of equipments and machines to be used by workers. Furthermore, as most machineries in Indonesia were imported, the results could become a benchmark for other countries targeting products and machinery for Indonesia market.

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