ISSN: 2476-5279; International Journal of Musculoskeletal Pain Prevention. 2023;8(1): 846-855.

Anthropometric Data of Iranian Population: Current Position and Direction of Future Studies

ARTICLEINFO

Article Type
Original Article

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How to cite this article

Ghasemi E., Ahmadi O. Anthropometric Data of Iranian Population: Current Position and Direction of Future Studies. IJMPP. 2023; 8(1): 846-855.

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Article History
Received: Nov 5, 2022
Accepted: Dec 26,2022
ePublished: Jan 21, 2023

ABSTRACT

Aims: Some Musculoskeletal Disorders (MSDs), fatigue and human errors are rooted in improper design of tools and equipment. The design that is based on anthropometric data compatible with the target population is an appropriate design. The present study, with a review of the studies conducted on anthropometric data of Iranian population tried to determine the current position and direction of future studies.

Method and Materials: In order to find relevant studies, a search was conducted in databases including Google scholar, Scopus, PubMed, Sid, Medlib, Magiran and Iranmedex, using keywords related to anthropometric dimensions of the Iranian population. The criteria for inclusion in the study was due to its aim compliance with the measurement of body dimensions of the Iranian adult for the design of workstations and equipment.

Findings: 1276 articles during searching databases were found. After examination of the articles, 29 articles were eligible to be included in the detailed study. The selected documents were related to the time period of 2014 to 2021. Based on the studies, the most studied anthropometric dimensions were standing height and sitting height, and the least studied dimensions were rump-knee length, rump width, and shoulder-elbow height.

Conclusion: The results of the study showed that the use of existing data in the design for the general population of Iranian adults faces limitations. It is suggested that, in addition to correcting and updating existing anthropometric tables, prepare a comprehensive anthropometric data base for Iranian adults.

Keywords: Anthropometry, Anthropometric Database, Musculoskeletal Disorders.

Introduction

Anthropometry is a science that examines body dimensions in human societies [1, 2]. The main application of this data is in the design of tools or devices used in the work or life environment [3, 4]. The anthropometric characteristics of any population depend on many variables including social, biological and demographic variables [5]. Therefore, the tools used in the work environment should be designed in such a way that they fit the physical dimensions of most of the working people [6]. If there is no access to anthropometric data to make equipment and tools, Musculoskeletal Disorders (MSDs) related to the tools used in the work or living environment will occur in people [7].

Unfortunately, many workers in the industrial setting, service and agricultural sectors still have to adjust themselves to the inappropriate, imposed and unchangeable conditions of the work station or tools. Lack of physical fitness is considered as the main biomechanical risk factor for creating MSDs caused by work [8]. Despite the significant progress in the field of technology and the automation of jobs, human power is still considered the main factor in moving the wheels of industry [9]. According to the definition of the International Ergonomics Association (IEA) ergonomics is the science of work design with the aim of ensuring human well-being and

improving productivity. Therefore, paying attention to human physical capacities and limitations (humans have mental and behavioral characteristics in addition to physical aspects) should be considered in the designing of the work places [8]

The primary requirement of human-centered design is access to the anthropometric database. By collecting information on the physical characteristics of the people of a society and providing a database and statistical surveys, it is possible to provide them the body sizes that are needed by designers and engineers, thus enabling them to design workstations, tools, design equipment, machines, etc. according to the target population [8]. Designing based on anthropometric data leads to the elimination of inappropriate postures and its subsequent complications for the body [10].

The structural characteristics of the human body are influenced by factors such as age, race, sex and type of nutrition. In fact, these factors cause the data of each population to be specific to that population and cannot be used for other societies [11,6]. Anthropometric differences have also been observed between different age groups of adults, and among the adult samples which has been shown a decrease in height to some extent with increasing age. According to the studies, black Africans have a higher lower body than Europeans. Examples of people from the Far East, such as the Japanese population, have shorter lower limbs than Europeans, and the lower limbs of Chinese and Koreans are also shorter and reach the minimum size in the population of Thailand and Vietnam. The population of Turkey, the Middle East and India have similar proportions of body dimensions to Europeans, but they are usually shorter [12,13].

Obviously, the existence of these differences in the body sizes of people of different countries prevents the possibility of common use of anthropometric tables. Accordingly, an existed study claims that the anthropometric differences between the European and North American populations are so great that the product or part of the equipment designed for the European population will not be usable for the North American population [12].

Today, an anthropometric data bank has been established in advanced countries in which anthropometric information is regularly updated. There is no single database in Iran. Therefore, it is necessary for each country to have its own anthropometric database to enable designers to design workstations, tools, equipment, machines, etc. according to the target population. Various Iranian researchers have conducted studies with the aim of collecting the data needed for the design of workstations. A study that was conducted on anthropometric studies in Iran by Saremi et al in 2013, which included the studies done from 1977 to 2013. The present study tried to determine the current position and direction of future studies with a review of the available documents. Therefore, this study was aimed to review all the studies conducted in the field of anthropometry among Iranian population from 2013 to 2021.

Method and Materials

In order to find relevant studies, a search was conducted in databases including Google scholar, Scopus, PubMed, Sid, Medlib, Magiran and Iranmedex, using keywords related to anthropometric dimensions of the Iranian population such as “anthropometry”, “body dimensions”, "anthropometry dimensions", "adult anthropometry", "anthropometry of workers", "anthropometry of employees", "anthropometry of the army" and

"anthropometry of military personnel" and "Iranian" and "Persian". The criteria for inclusion in the study was the conformity of its purpose with measuring the physical dimensions of the Iranian adult population. To select the related documents, the titles of the studies were first checked in terms of thematic relevance. After reviewing the titles, the articles were selected in terms of the relevance of the abstract to the intended purpose. The selected sources were fully studied and finalized, the required materials and necessary points were extracted from the sources and comparisons were made, and also the strengths and limitations of the studies were examined. The steps of the study is presented in the flowchart of Figure 1.

Findings

In all. 1276 articles in searched databases were found. Of which 46 articles (6.2 percent) were related to the aim of the study. Then17 articles were removed from the review because measured certain dimensions of body. Finally, 29 articles were eligible to be included in the study. The removed articles were mainly related to topics such as the measurement of several specific dimensions such as height, weight, hands, feet and examining their relationship with health indicators including types of cancers, diseases, etc., or body morphology studies in the areas of the jaw, face, etc., and also some documents were unrelated in the field of ergonomics, which were excluded

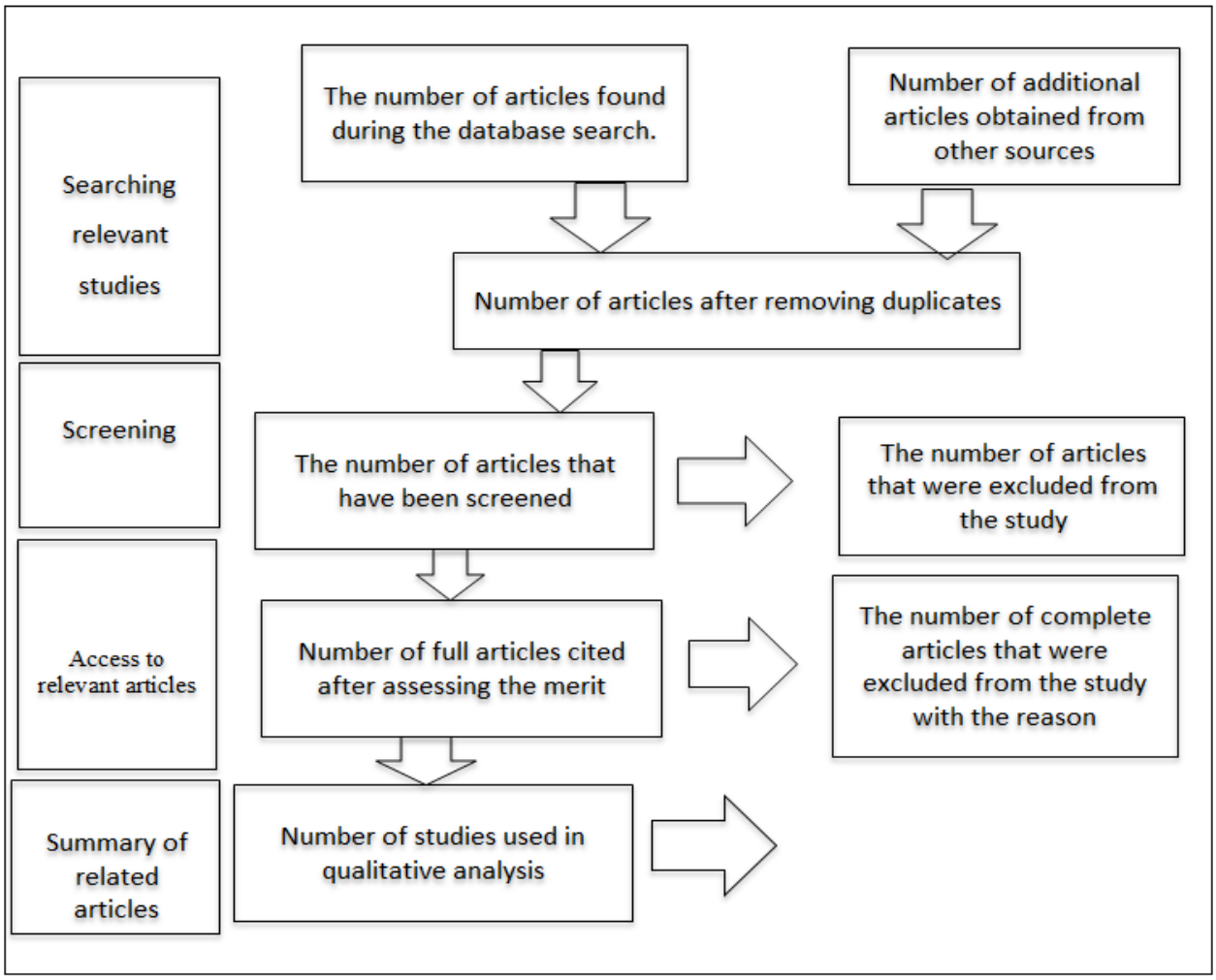

Figure 1) Study steps

Table 1) Summary of the studied articles

N	Title	Author(s)	Year	Province	Type of sampling	Number of sample			Age (Yrs)	No of studied dimension	Reference
						Female	Male	Total			
1	Design and manufacture of domestic sofa with ergonomic indices	Ghofrani and Noori	2016	Qaznvin, Zanjan	Random	110	150	260	25-35	12	(14)
2	Computer users from the monitoring room	Hosseini and Mououdi	2018	Mazandaran	Random	_	48	48	42	24	(15)
3	Designing an Iranian-Islamic toilet	Mououdi et al.	2020	_	categorical	_	_	61	19-60	7	(16)
4	Administrative jobs in a military center	Pourtaghi and Valipour	2015	_	Random	_	91	91	23-59	12	(17)
6	Investigating hand anthropometric dimensions- a case study on office personnel and car mechanics	Kelkanlo et al.	2019	_	Random	_	91	91	33-36	12	(18)
7	Ergonomic assessment and design of the tower crane cabin based on anthropometric dimensions of Iranian operators	Jannati et al.	2020	_	Random	_	30	30	42	37	**(19)**
8	Evaluation of the anthropometric dimensions of the femur bone	Sheikhmozafari, et al	2022	_	Random	-	-	100	29-59	9	**(20)**
10	Anthropometric dimensions of different ethnicities	Mirmohammadi et al.	2016	Yazd	Random	_	529	529	30	30	(21)
11	Workers of different Iranian populations	Sadeghi et al.	2014	East Azerbaijan _ Isfahan _ Khuzestan _ Tehran _ Fars _ Hormozgan _ Kurdistan _ Lorestan _ Sistan and Baluchistan	Random	720	3000	3720	20-60	37	(22)
12	Anthropometric dimensions of students with laptop desks	Jafarvand et al.	2018	Qazvin	Random	125	82	207	19-29	6	(23)
13	Adjustable ergonomic laptop table	Mououdi et al.	2017	Mazandaran	Random	47	61	108	20-30	10	(24)
14	Facial anthropometry	Salvarzi et al.	2020	Shiraz	Random	6	6	12	20-35	10	(25)
15	Office furniture design	Sohrabi and anbarian	2020	Hormozgan	Cluster	21	100	121	25-59	36	(26)

Table 1) Summary of the studied articles (ontinued)

N	Title	Author(s)	Year	Province	Type of sampling	Number of sample			Age (Yrs)	No of studied dimension	Reference
						Female	Male	Total			
16	Tractor hand tool design	Feyzia et al.	2019	Kurdistan	Random	_	364	364	42	15	(27)
17	Seat dimensions of harvesters	Feyzi et al.	2020	Kurdistan	Random	_	156	156	22-69	8	(28)
18	Regression models predicting some static anthropometric dimensions	Soltanzadeh et al.	2019	_	Random	162	44	206	18-26	38	(29)
19	Anthropometric Characteristics of Female and Male Athletes Bear ADifferent Effect on Fitness	Carter-Thuillier et al.	2019	_	Random	77	112	189	21	6	(30)
20	Ergonomic table and chair based on the determination of students' anthropometric characteristics	Manouchehri et al.	2020	Tehran	Random	130	130	260	18-35	18	(31)
21	Anthropometric dimensions in determining temperament	Vahedi et al.	2016	_	Random				32	8	(32)
22	Comparison of anthropometric dimensions of healthy and unhealthy people	Davoudian et al.	2017	Tehran	Random	150	79	314	55	9	(33)
23	Determination of the static anthropometric characteristics of Iranian microscope users via regression model	Balande et al.	2016	Shiraz	Random	96	78	174	31	18	(34)
24	Assessment of posture and the impact of technical interventions on its improvement in petrochemical staff in 2018	Sepehr et al.	2018	_	Random	_	40	40	26	8	(35)
25	Relationship between musculoskeletal disorders and anthropometric indices among bus drivers in Zahedan city	Laal et al.	2017	Zahedan	Random	_	60	60	25-60	12	(36)
26	Pilot design of ergonomic bench for the elderly with anthropometric approach	Eyvazi and Mokhtarinia	2017	Tehran	Random	24	66	90	39	15	(37)
27	Ergonomic characteristics of park sports equipment with anthropometric characteristics of users	Ilbeigi et al.	2021	Tehran	Random	_	120	120	20	16	(38)
28	Identification of the ergonomics properties of outdoor fitness equipment machines with respect to the anthropometric characteristics of Iranian women	Sanchooli et al.	2021	_	Random	124	_	124	29	13	(39)
29	Ergonomic chair for microscopic surgeons	Riaei et al.	2021	_	Random	10	14	24	29	20	(40)

from the study.

Selected eligible documents were related to the field of anthropometric dimensions of Iranian adults (age range 20 to 55 years), which had anthropometric dimensions size related to the period of 2014 to 2021. In order to increase the accuracy of the comparison and ensure that a similar definition was used for each anthropometric dimension in all the studies, the text of all the articles was carefully examined. A summary of the studied documents is presented in Table 1.

Tables 2 and 3 present the average body dimensions of Iranian adults, which are reported in the studies. The comparison of the dimensions obtained from these measurements in different studies showed that in the group of women and men, respectively, the highest height was reported in the study of Ghofrani et al. in

Table 2) Anthropometric dimensions of men according to age in the reviewed documents

N	Height	Sitting height	Eye height (sitting)	Sitting shoulder height	Elbow height (sitting)	Thigh thickness	Buttock-Knee length	Buttock-Popliteal length	Knee height	Popliteal height	Width of seating area, sitting	Elbow-elbow breadth	Sitting shoulder-elbow length	Foot length	Reference
2	182	90	_	64	25	20	58	47	54	41	39	51	_	_	(15)
3	_	_	_	_		_	_	_	_	_	_	_	_	28	(16)
4	175	72	_	_	24	__	__	__	51	44	39		34		(17)
6	175														(18)
8	173														(19)
10	_	_	_	_	47	_	_	_	_	_	_	_	_	27	(21)
11	172	91	80	62	27	38	58	46	52	41	_	49	36		(22)
13	_	_	_	_	_	_	_	_	_	_	_	_	_	_	(24)
15	174	93	81	63	27	13	59	48	53	44	34		38	26	(25)
16	172	90	77	_	_	37	59	_	45	43	_	_	_	_	(27)
17	172	_		60	24		_	50	51	43	_	_	_	_	(28)
18	175	_	_	_	_	_	_	_	_	_	_	_	_	_	(29)
19	178	_	_	_	_	_	_	_	_	_	_	_	_	_	(30)
20	178	90	79	63	25	15	60	49	55	45	38	50	_	_	(31)
21	169	_	_	_		40	57	_	_	_	_	_	_	_	(32)
22	_	91	80					49		39					(33)
23	174	_	78	_	28	16	60	48	54	41	_	40	_	_	(34)
24	170	_	_	85	_	_	_	49	57	58	43	_	_	_	(35)
25	171	94	81	67	40	_	58	50	57	48	_	_	35	_	(36)
26	166	88		60	37	_	56	46	54	43	35	_	37	_	(37)
27	178	95	_	66	_		58			45	37	46	37	29	(38)
29	175		81		24	37	58	48	52	44				26	(39)
Max	179	95	82	85	47	40	60	50	57	58	43	52	38	29	
Min	166	88	77	60	24	13	56	46	45	39	34	40	35	11	

the design and manufacture of comfortable furniture in the residents of Qazvin city with an average of 168.47 and 182 and the lowest height in the group women and men, respectively, were related to the study of Ayouzi et al with an average of 154.2 and 165.6. The comparison of the dimensions measured in the studies, according to the age comparison, was given in Tables 2 and 3.

Discussion

The results of this research showed that since 2014 onwards, 29 Iranian studies have been published in the form of anthropometric data that can be used in the design of work stations and work tools.

From the point of view of statistics, one of the main conditions for the generalizability of a variable to the entire population is the number of studied samples. In Iran, the largest

Table 3) Anthropometric dimensions of Iranian women

N	Height	Sitting height	Eye height (sitting)	Sitting shoulder height	Elbow height (sitting)	Thigh thickness	Buttock-Knee length	Buttock-Popliteal length	Knee height	Popliteal height	Width of seating area, sitting	Elbow-elbow breadth	Sitting shoulder-elbow length	Foot length	Reference
1	168	58	_	58	23	_	57	40	_	_	_	44	_	_	(14)
9	162	79	_	50	21		48	37	43	37		42	35	_	(20)
11	159	75	33	56	22	37	56	45	48	39		44	32		(21)
12	168	_		_	25	_	_	_	_	_	_	42	_	_	(23)
14	161	_	_	_	_	_	_	_	_	_	_	_	_	_	(25)
15	157	87	35	60	28	12	56	46	50	41	34		34	24	(26)
18	162	_		_		_	_	_	_	_	_	_	_	_	(29)
19	161														(30)
20	162	84	30	58	24	13	55	48	50	43	36	38	_	_	(31)
22		84	57					47	51						(33)
23	161	_	37	_	29	14	56	45	50	37	_	36	_	_	(34)
26	154	82		55	34		53	44	51	41	36	_	34	_	(37)
28	164	81										23			(39)
29	164		75		22		53	46	49	38				23	(40)
Max	164	87	75	60	34	14	56	48	51	43	36	38	34	24	
Min	154	81	30	55	22	12	53	44	49	37	34	23	34	23	

number of samples, respectively, related to Sadeghi's study (3720 anthropometric data for the working population of Iran with ethnic diversity) [22] and Mirmohammadi's study (anthropometry data of 529 workers hands)[21]. It is important to pay attention to the fact that the mentioned studies are related to a specific population (workers) and this point should be considered in the application of their results.

One of the advantages of the documents under review is that it is possible to report mainly anthropometric tables by gender or even in some cases according to different Iranian ethnicities. Previous studies have shown the effect of various social, cultural and demographic variables on people's body sizes. Designers use anthropometric data early in product design, which can increase comfort. Thus, this study revealed differences across gender, generations, and ethnicities in selected body measurements. In most of the measurements, the male samples had larger dimensions than the female samples. In the study with anthropometric data, the results show that each population, that is, male and female adults, have certain physical measurements. This can be attributed to many factors such as diet and lifestyle. This suggests that updating anthropometric data is needed.

It can be inferred from all the mentioned materials that currently at least 29 valid studies in the field of anthropometric data of Iranian adults are available in reliable scientific databases. According to the variety of research methodologies, the available anthropometric tables are mainly used for a specific population or occupational group. However, in many designs, due to the size of the intended community (users), access to dimensions that can be reliably attributed to the target community plays an important role in the effectiveness and applicability of the design. This point raises the need to prepare a comprehensive anthropometric database for the general population of Iran so that it can be used as a reference for the general designs of structures and widely used urban and occupational tools that are likely to be used by the entire Iranian people. It is suggested that the preparation of a comprehensive, up-to-date and non-specific database of anthropometric information of the general population of the country should be put on the agenda of researchers.

Conclusion: The results of the study showed that the use of existing data in the design for the general population of Iranian adults faces limitations. It is suggested that, in addition to correcting and updating existing anthropometric tables, prepare a comprehensive anthropometric data base for Iranian adults**.**

Acknowledgment

The authors thank all authors who worked on the reviewed studies.

Author contribution: EGh did all date research and wrote the first draft of the study. OA Supervised the review research and confirmed tht final manuscript.

Conflict of Interest: There was no conflict of interest to declare.

Ethical Permision: This study was conducted as a review research and all ethical pribcipals were considered in that.

Funding: This research did not receive any specific grant from funding agencies

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