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Anthropometric measurement of the hand

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ABSTRACT

This study aims to get various anthropometric measurements of dominant hands of students from vocational high school of health and classifies them according to Krogman Hand Index to form a database

141 students (49 male, 92 female) who were healthy anatomically and had no other known disease attending to vocational high school of health of Baskent University were recruited. Right hand was dominant for all of the students. The length and width of the right hand of the students were taken after their height and weight were measured. The results were recorded as mm. The findings were classified according to Krogman index with the formula hand width / hand lengt X 100.

For males right hand length and width was 183.9±0.88mm; and 87.54±0.70mm; respectively, with hand index being 47.58 and classified as brachyeri according to Krogman hand index. For females, right hand length and width was 169.75±2.01 and 77.63±1.21mm respectively with hand index being 45.72 and classified as mesocheri according to Krogman hand index.

Measurements of body and body parts display variability due to age, gender, genetic and environmental factors across populations. Therefore; such data used in gender discrimination, identification and special ergonomic structures need to be population spesific.

Key Words: Right hand width, right hand length, hand index, Krogman index

Introduction

The hand is presented in a large area in cerebral cortex and controlled by a rich nerve network and it is like a psychologic, physicologic and aesthetic extention of the brain. The hand has a number of important functions like perception, management and self expression (1). With its nerve and vessel packages, channels and tunnels and musculosceletal components like ligaments, tendons and facias the hand has a unique biomechanic and architectural design (2). That the hand gets injured in 1/3 of industrial accidents reflects its functional importance. Besides; permanent damages occur in half of accidents. Some anthropologists believe that the hand causes the inconceivable development of the brain. In fact; the hand has been of great help for the formation of civilization, and to humankind for effectively changing his environment. The hand is open to traumas and gets widely affected in the course of diseases. 31% of all injuries affect upper extremity and 1/3 of these end up with an anatomic or a functional loss of the hand. (3,4,5,6). Besides all these clinical significances the hand helps draw a roadmap for gender and height prediction of people.

Determination of gender and height are important criteria for personal identification. Assessments regarding to age, gender, height and race can be made through anthropometric methods (7,8). Before DNA studies were performed for personal identification, anthropometric measurements (although they did not provide precise results) were widely used and when combined with other techniques they reduced the pool of people for identification which was helpful by way of human resources and money. These methods are beneficial when they are modified for a given society. Methods and regression formulas built for a single society may not be suitable for another (9). In mass deaths and criminologic cases identification of human remains is an important struggle for forensic experts (10,11,12). Valuable data can be provided about the height and gender of someone with the use of morphometric features. Determination of hand morphometry and the data obtained at the end can help build a database regarding to various populations. It can also support scientific studies and provide a valuable source of reference for scientists.

Material and Methods

141 students (49 male, 92 female) who were healthy anatomically and had no other known disease attending to vocational high school of health of Baskent University were recruited. Right hand was dominant for all of the students. The length and width of the right hand of the students were taken after their height and weight were measured. The results were recorded as mm. The findings were

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Table 1. The means, standard deviations and ranges of the parameters of the males and females

	Males (n=49)		Females (n=92)	
Parameters	Range	Mean±SD	Range	Mean±SD
Age (year)	(18-30)	20.0±3.3	(17-30)	20.0±2.6
BMI (kg/m2)	(16.7-37.6)	24.5±4.0	(16.3-68.4)	21.3±5.9
Hand Length (mm)	(153.2-199.4)	183.9±0.8	(115.1-332.5)	169.7±2.01
Hand Width (mm)	(579.0-996.0)	87.5±7.7	(126.0-917.0)	76.3±12.1

classified according to Krogman index with the formula hand width/hand length X 100. This study has been approved by Baskent University Ethics Comittee and supported by Baskent University Research Fund. In literature it is stated that measurements on dominant hand of a person gave more objective results. Therefore the measurements were taken from the right hand. After age, gender, height and weight of the students were taken, the hands were placed on a flat surface with fingers fully extended and the measurements were taken when the interphalangial and metacarpophalangial joint angles were 180 at the anatomical stand posture. Hand length and hand width of the students were taken consequtively. The anatomical landmarks for measurements were:

Hand Length: It is the length taken between the highest point of the middle finger and the intersection of the midpoints of radial and ulnar notches. (Figure 1.)

Hand Width: It is the length between distal points of 2 and 5 metacarps Measurements were recorded as mm. The results were calculated according to the formula Hand Index=Hand width/Hand length x 100 and classified according to standart Krogman Index(3). (Figure 2).

Standart Krogman Index:

Hyperdolichocheri	x-40.9
Dolichocheri	41.0-43.9
Mesocheri	44.0-46.9
Brachycheri	47.0-49.9
Hyperbrachycheiri	50.0-x

Results

Mean valves of body mass index (BMI) was found to be 24.5 ± 4.0 kg/m^2 for males and 21.3 ±5.9 kg/m^2 for females. The average length of the right hand was 183.9±0.8 mm and 169.7±2.0 mm for males and females respectively. The average width of the right hand was 87.5±0.7 mm and 77.6±1.2 mm for males and females respectively, and the hand index was 47.5 for males and 45.7 for females. According to the Krogman hand index, the males are classified as bracycheri and the females as mesocheri (Table 1).

Discussion

Measurements of body and body parts and their association with age and gender are quite variable due to genetic and environmental factors across populations (3). Therefore, these types of data that are thought to be used in personal ergonomic designs for gender verification and identification, are suggested to be population-specific (7).

This study with many similar ones have displayed that there are differences regarding hand dimensions across communities (2-12-15). In literature, there are researches that have taken left hand or right hand measurements, and there are some that have taken both (14). When the latter is taken into account, it is reported that the association between both hand dimensions and height is studied. Agnihotri et al. (11) have reported that left hand length was associated with height prediction more than the right hand. On the other hand, Onat et al. (15) have stated in their report that the left hand length is greater than the right hand in both genders. In this study, we have made our measurements on cases that have their right hands dominant.

A review of literature shows that there are limited of studies for the identification of hand morphometry. Most of the researches on this subject are specific to Asian and African communities. Kanchan et al. (9) in their study, undertaken on Northern and Southern Indian population in 2009, have found the hand length to be 180.0 mm for males and 158.0 mm for females, and the hand width to be 72.0 mm and 64.0 mms for males and females respectively.

Ibeachu et al. (3) in their studies on a Nigerian population have reported hand length to be 190.5 mm for men and 176.5 mm for women. And hand width to be 85 mm for men and 79.6 mm for women. Khaled et al have reported hand length to be 194.7 mm for men and 181.3 mm for women and hand width 81.3 mm for men and 71.6 mm for women in an Egyptian population in 2011. Dean et al. (17) in their study in 2006 on a French population have reported hand length to be 190.8 mm for men and

Fig. 1. Hand length measurement

Fig.2. Hand width measurement

173.5 mm for women and hand width to be 87.3 mm for men and 77 mm for women. Naabeel et al. (18) have found hand length to be 191.2 mm and 171.3 mm for men and women respectively in a Jordanian population in 2008. On a Turkish population in 2014 Karadayı et al. (19) have reported hand length to be 192.0 mm for men and 178.5 mm for women and hand width to be 83.4 mm for men and 75.5 mm for women. Our study displayed hand length to be 183.9 mm for men and 169.7 mm for women and hand width to be 87.5 for men and 76.3 mm for women. As expected hand dimensions of men were greater than women in all these studies. These differences observed in hand dimensions between genders are used for gender verification through statistical models. There are also studies that have identified gender with various indexes formed after hand measurements being proportioned with each other (13-20,21). The present study has proved that once again anthropometric measurements are highly specific to populations. Hand dimension is thought to be useful for gender verification like skeleton and many other sites of the body. We believe data observed in this study will help identification and gender verification studies on Turkish population

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