

Anthropometric Data of Hand, Foot and Ear of University Students in Nigeria

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Abstract

Anthropometric data is needed in the design of products as it varies between individuals and nations. These data for Nigerians is presently scant and this study is an attempt to provide data on hand, foot and ear for the improvements of hand gloves, handles, shoes, pedal dimensions, ear-phones and other related products.

A random sample of 500 students was taken and their ages were between 18 and 29 years (mean of 21.7 years). Two hundred and fifty of the samples were males and the same numbers were females. The dimensions measured were ▪ hand: length and breadth; ▪ foot: length, breadth and height; ▪ ear: height and breadth. The study presents the anthropometric data for the 5th, 50th and 95th percentiles for the above-presented variables.

The study established that foot breadths of the females were larger than those of the males while the males had larger foot lengths. There were no significant differences between the hand dimensions of the males and those of the females. Similarly, there were no significant differences between the ear dimensions of males and the females

Keywords

Anthropometry; Hand; Foot; Ear; Nigeria.

Introduction

Anthropometric data is a collection of the dimensions of the human body and are useful for apparel sizing, forensics, physical anthropology and ergonomic design of the workplace. The importance of anthropometric data was stressed by [1] when he stated that a piece of equipment designed to fit 90 percent of the male United States population would fit about 90 percent of Germans, 80 percent of Frenchmen, 65 percent of Italians, 45 percent of Japanese, 20 percent of Thais and 10 percent of Vietnamese. Ashby [2] stated that reliable anthropometric data for a target population were necessary when designing for that population otherwise the product may not be suitable for the user. Roebuck et al [3] noted that anthropometric data vary considerably for individuals within a family or a nation and between nations. Similarly, Saha [4] observed that there were differences in anthropometric data of people from different regions in India. Moreover, a study conducted by [5] confirmed the existence of some differences in dimensions of body between elderly Chinese and Japanese. They found that Japanese elderly had larger dimensions of the head and extremities than their Chinese counterparts while the Chinese elderly had larger dimensions of the body trunk. A very useful anthropometric data were collected by [6] and he also provided a method of estimating unknown anthropometric dimensions from data on stature. Similarly, anthropometric dimensions of industrial populations were provided by [7]. Jung and Jung [8] surveyed the dimensions and characteristics of Korean ears and found that age, gender and different ethnic populations were determinants of ear dimensions. There are presently three main methods of obtaining anthropometric dimensions namely tailor's method, traditional anthropometry and very recently 3-D surface anthropometry.

The 3-D surface anthropometry used by [9] was said to provide data that allowed for effective design of better fitting clothes, protective equipment, better seats and workstations design. Unfortunately, the use of 3-D surface anthropometry is presently not available in Nigeria necessitating the use of traditional anthropometry.

Since anthropometric data should be established for the user population and anthropometric data for Nigerians is scant, the present study attempts to provide anthropometric data for the foot, hand and ear. The data may be necessary for product designer of shoes, brake pedals and foot controls for data on foot; handles, gloves and so on for data on hand; ear-phones, mufflers and so on for data on ear.

Material and Method

A study of randomly selected 500 students of a Federal University in Nigeria was undertaken with their ages between 18 and 29 years (mean of 21.7 years). 250 students were males and the other 250 students were females. Anthropometric dimensions of the hands, foot and ear were taken with the use of a Vernier Calliper. The measured dimensions were hand length (distance from the wrist to the middle finger); hand breadth (distance from across the hand at metacarpal); hand thickness at the metacarpal); foot length (distance from the back of the heel to the longest toe); foot breadth (distance across the foot at the base of the fingers); foot height (distance from the middle of the foot at the top (instep) to the sole); ear height (distance between incurved rim of the external ear and the lowest point on the inferior border of the ear lobe); and ear breadth (distance between the points where an imaginary line drawn perpendicular to the long axis of the external ear meets the most anterior point and the most posterior point of the external ear). The gathered data are presented in terms of 5th, 50th, and 95th percentiles. The standard deviations and standard errors of the sampled population are also presented. The anthropometric data of the males and females were compared using a 2-tailed T-Test with paired samples using SPSS 16.0 Statistical package.

Results

The anthropometric dimensions of the foot, hand and ear for the males are presented in Table 1 while those of the females are presented in Table 2.

Table 1. Anthropometric Data of Hand, Foot and Ear for Male

Parameter	Percentile			Standard Deviation	Standard Error
	5 th	50 th	95 th		
Age (Years)	20	25	28.7	1.25	0.13
Foot Breadth(cm)	7.9	8.6	9.5	0.55	0.06
Foot Length (cm)	24.8	26.4	27.5	1.2	0.12
Foot Height (cm)	5.2	5.9	6.7	0.54	0.05
Hand Breadth(cm)	8.8	9.6	10.0	0.49	0.05
Hand Length (cm)	18.5	19.5	20.1	0.59	0.06
Hand Thickness cm)	3.0	3.4	4.0	0.39	0.04
Ear Height (cm)	5.1	5.5	6.2	0.32	0.03
Ear Breadth (cm)	3.1	3.4	3.8	0.28	0.03

Table 2. Anthropometric Data of Hand, Foot and Ear for Female

Parameter	Percentile			Standard Deviation	Standard Error
	5 th	50 th	95 th		
Age (Years)	19	24	28	1.1	.11
Foot Breadth(cm)	8.0	9.0	10.0	0.59	.06
Foot Length (cm)	23.0	25.0	27.0	1.4	0.14
Foot Height (cm)	4.3	5.4	6.4	0.68	0.07
Hand Breadth(cm)	8.1	9.5	10.5	0.75	0.08
Hand Length (cm)	17.4	19.0	21.5	1.21	0.12
Hand Thickness (cm)	2.7	3.5	4.1	0.41	.04
Ear Height (cm)	3.2	5.5	6.2	0.88	0.09
Ear Breadth (cm)	2.5	3.0	3.4	0.23	0.02

The results of the T-Test showed that the foot breadth of the males differ significantly from those of the females ($t=-4.294$, $p=0.000$), those of the females were larger. Similarly, there were significant differences between the foot lengths of the males and those of the females ($t= 5.607$, $p=0.000$), those of the males were larger. For the foot heights also, there were significant differences ($t=5.702$, $p=0.000$), though the foot heights of the males were larger.

There were no significant differences between the hand dimensions of the females and those of their male counterparts ($t=0.261$, $p=0.795$ for hand breadth; $t=1.668$, $p=0.099$ for hand length; $t=1.722$, $p=0.088$ for hand thickness).

Significant differences were noted in the ear anthropometric dimensions of the females and those of the males ($t=4.112$, $p=0.000$ for ear height; $t=12.46$, $p=0.000$ for ear breadth).

Discussion

The results of our study are in agreement with the study of [10] that observed that Japanese women had smaller feet than those of their female counterparts but contradicts [11] found that Japanese women had larger feet than their male counterparts. It also supports the work of [12] that noted that foot length in males were larger than females but contradicts the same work in terms of foot breadth.

In terms of hand dimensions, the results do not agree with the work of [12] that observed that the hand lengths and breadths in males were larger than those of their female counterparts.

Conclusions

The study attempts to provide the anthropometric dimensions of the hand, foot and ear for the students in tertiary institutions in Nigeria. The study is necessary because differences in these dimensions as a result of gender and nationalities may consequences on the design and construction of handles, gloves, foot wears, brake pedals, ear-phones and so on. The data would provide better design and construction of the listed items for the Nigerian population.

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