Original Research Paper

Anatomy

AN EXAMINATION OF RELATIONSHIP BETWEEN ESTIMATION OF ARM LENGTH WITH DIFFERENT PARAMETERS

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ABSTRACT

Background : Human beings are considered to be bilaterally symmetrical. However there may be asymmetry in the lengths of arms, forearms, hands, and feet irrespective of sex or handedness. Application of anthropometrical studies is very vast. So the present study is carried out to estimate the arm lengths by different parameters.

Materials and Methods: The data was collected by taking measurements of 500 students between age group of 18 to 23 without any past history of major trauma or illness. Length of arm was measured as the distance between tip of acromion process of scapula and tip of olecrenon process of ulna of the same side, with arm by the side of body and forearm in midprone position. Both the lengths of right and left arms were measured. Instrument used-first segment of anthropometer rod.

Results : Mean arm-length in males is significantly higher in all age groups than that of females. For all age groups; p < 0.01. In males and females both, the correlation coefficient 'r' is statistically significant for majority of groups. (p < 0.01). This indicates that there exists positive correlation between two variables, i.e. arm length and height. So, linear regression coefficients were found out, which again were statistically highly significant; p < 0.01. However in the age group of 20-<21of males and 22 - <23 of males & females; the correlation coefficient and regression coefficient were not statistically significant. So the regression equation will not give us a good fit for these age groups. This indicates that, arm length can be estimated from height.

Conclusion : The data collected can be utilized for future anthropometrical studies. However there is a need to establish standard reference values for regression coefficients, which are derived from present studies.

KEYWORDS :

Introduction

Human beings are considered to be bilaterally symmetrical. However there may be asymmetry in the lengths of arms, forearms, hands, and feet irrespective of sex or handedness. However international consensus on measurements of human being was reached in 1912. The German congress in 1912 approved 'international agreement for unification of measurements on living subjects. [1,2,]

Application of anthropometrical studies is very vast. Anthropometrical measurements are utilized for designing proper equipments for industries, defence forces. Combining with physiologists, psychologists and engineers, anthropologists have helped in designing spaceships for convenience of astronauts. They have made valuable contribution in designing aircrafts, uniforms, chairs and other specialized equipment for defence-personnel. [3]

Anthropometrical surveys provide norms about physique of national population. Estimates for some physiological functions like basal metabolism, vital capacity, and nutritional requirements can be estimated by means of anthropometrical data. They help to indicate the need for medical and public health programs. An attempt is made to finalize correlation and regression formulae for the above said measurements. This could be of help for identification of body parts in medico legal cases and in war casualties. So the present study is carried out to estimate the arm lengths by different parameters . [4]

Materials and Methods

The data was collected by taking measurements of 500 students between age group of 18 to 23. The criterion for selecting subjects was normal healthy adults (males and females) between age group of 18 to 23 years without any past history of major trauma or illness.

Following measurements were taken: Length of right arm and left arm. Length of right forearm and left forearm. Height of an individual. Following instruments were used to take above measurements: Standard height measuring instrument like anthropometer rod, rod compass, marker pens and ruler were used.

Following procedure was followed while taking measurements: Same instruments were used for all students. All students were examined between 2-30 p.m. and 4-30 p.m. to avoid diurnal variations. Measurements were taken by the same person to avoid personal errors.

Length of arm was measured as the distance between tip of acromion process of scapula and tip of olecrenon process of ulna of the same side, with arm by the side of body and forearm in midprone position. Both the lengths of right and left arms were measured. Instrument used-first segment of anthropometer rod. [5,6]

Results :

Table 1: Distribution of arm length of left side in males and females

		Males			Females			't' value	'p' value
		Number	Mean	Sd	Number	Mean	Sd		
Age Group	18 - < 19	43	37	2.4	113	33.3	2.3	8.792	0.000
	19 - < 20	68	37.01	2.7	55	33.4	2.7	7.481	0.000
	20 - < 21	84	36.5	2.6	55	33.6	2.2	6.687	0.000
	21 - < 22	43	36.9	2.4	17	32.4	2.5	6.611	0.000
	22 - < 23	6	36.2	2.7	16	32.9	2.1	3.030	0.007

Table 2 : Distribution of Arm-length of Right side in Males and Females

		Males			Females			't' value	'p' value
		Number	Mean	Sd	Number	Mean	Sd		
Age Group	18 - < 19	43	37.05	2.384	113	33.33	2.351	8.802	0.000
	19 - < 20	68	37.06	2.713	55	33.38	2.670	7.534	0.000
	20 - < 21	84	36.53	2.624	55	33.64	2.183	6.727	0.000
	21 - < 22	43	36.95	2.373	17	32.44	2.472	6.553	0.000
	22 - < 23	6	36.23	2.791	16	32.95	2.166	2.933	0.000

Table : 3 Distribution of mean arm length in males and females

		Males			Females			't' value	'p' value
		Number	Mean	Sd	Number	Mean	Sd		
Age Group	18 - < 19	43	37.029	2.402	113	33.304	2.347	8.798	0.000
	19 - < 20	68	37.041	2.716	55	33.374	2.663	7.509	0.000
	20 - < 21	84	36.501	2.625	55	33.616	2.180	6.708	0.000
	21 - < 22	43	36.933	2.366	17	32.411	2.477	6.583	0.000
	22 - < 23	6	36.233	2.752	16	32.921	2.156	2.982	0.000

Mean arm-length in males is significantly higher in all age groups than that of females. For all age groups; p < 0.01.

In males and females both, the correlation coefficient 'r' is statistically significant for majority of groups. (p < 0.01). This indicates that there exists positive correlation between two variables, i.e. arm length and height. So, linear regression coefficients were found out, which again were statistically highly significant; p < 0.01.

However in the age group of 20-<21of males and 22 - <23 of males & females; the correlation coefficient and regression coefficient were not statistically significant. So the regression equation will not give us a good fit for these age groups.

This indicates that, arm length can be estimated from height

In males and females both, the correlation coefficient 'r' is statistically significant for almost all age groups. (p < 0.01). This indicates that there exists positive correlation between two variables, i.e. arm length and forearm. So, linear regression coefficients were found out, which again were statistically highly significant; p < 0.

Only in the age group of 22 - <23 males; the correlation coefficient and regression coefficient were not statistically significant. So the regression equation will not give us a good fit for these age groups.This indicates that, arm length can be estimated from forearm length.

Table 4: Ratio of Arm Length to Height

		Males			Females		
		Number	Mean	Sd	Number	Mean	Sd
Age Group	18 - < 19	43	.216283	.0097498	113	.210262	.0119572
	19 - < 20	68	.215147	.0132309	55	.210743	.0114105
	20 - < 21	84	.225004	.1161629	55	.212675	.0104198
	21 - < 22	43	.214507	.0099029	17	.208169	.0141859
	22 - < 23	6	.216552	.0133558	16	.208835	.0124859

Discussion

To assess the height of an individual from measurements of different parts of body has always been of particular interest to the anthropologists for a long time. In forensic medicine also the estimation of height from the hand length forms an important piece of evidence in court of law.

Present study is undertaken to find out correlation between height and arm length, forearm length, among age group 18 to 23, males as well as females. Anthropological studies were carried out earlier to find correlation between hand lengths and foot lengths to height. Majority studies have correlated only one parameter like foot lengths with height or length of clavicle with height. So the data available for comparison is restricted to few parameters. Hence present study is undertaken to find out correlation of arm length, forearm length, with height. Attempt is made to find correlation of these three parameters with each other.

Athawale[7] (1963) derived a regression equation between height of an individual and length of forearm bones. He had done study of 100 male Maharashtrian adults. He used X rays to calculate length of bone.

Patel, Joshi and Dongre [8] (1964) have derived a regression equation between tibial length and height in male adult Gujarati population.

However the parameters taken in these studies are different from our parameters.

Anitha Oommen[9] et al (2005) found correlation between hand length and foot length. The result showed highly significant correlation, p < 0.01) between hand length and foot length on both sides of both sexes. The differences in various studies occur due to difference in races, different ethnic origins and difference in level of nutrition,

Regression equations derived can be of help in artificial limb centres for construction of prosthesis required in cases of amputations following gangrene, trauma, frostbite etc. The different formulae derived can be useful for corrective surgeries for leprosy patients. Correlation between various parameters can help in medico legal cases for identification of body parts as well as for identification in war casualties.This study can help to provide database for biometrics. The data collected can be utilized for future anthropometrical studies.

However there is a need to establish standard reference values for regression coefficients, which are derived from present studies.

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