

Role of Hand and Foot Length and its Correlation of Both Sexes in Ergonomics

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Abstract

Background: Ergonomics is the science of designing the job to fit the worker, rather than physically forcing the worker's body to fit the job [1]. Stature and hand and foot length plays role in development of various working places. Foot length plays important role while designing foot wear and stability. Moreover, there can be anthropometric variations in different geographical areas. **Material and Method:** 336 students were measured with 157 male and 179 female candidates. **Result:** Foot length with hand length is highly correlated with pearson correlation 0.77 for left side and 0.78 for right side. **Conclusion:** Both hand length and foot length are linearly correlated with height of person.

Key Words: Stature; Hand Length; Foot Length; Pearson Correlation; Ergonomics.

Introduction

Adapting tasks, work stations, tools, and equipment to fit the worker can help reduce physical stress on a worker's body and eliminate many potentially serious, disabling work related musculoskeletal disorders (MSDs). Ergonomics draws on a number of scientific disciplines, including physiology, biomechanics, psychology, anthropometry, industrial hygiene, and kinesiology [1].

The study attempts to provide the anthropometric dimensions of the hand, foot for the students in tertiary institutions in Nigeria. The study is necessary because differences in these dimensions as a result of gender and nationalities to design and construction of handles, gloves, foot wears, brake pedals, ear-phones and so on [2].

Ilayperuma studied was carried out to investigate the relationship between personal stature and hand length among a group of male and female Sri Lankan

adults and to derive a linear regression formula between the handlength and height of an individual. total of 258 individuals with an age range of 20-23 years [3].

The present study has been designed to conduct measurements on male and female Kayastha inhabiting in different village or cities of Bundelkhand region in the age range of 20 to 40 years. Foot length and hand length shows highest correlation for estimation of stature [4].

Human beings are considered to be bilaterally symmetrical. However, there is an asymmetry in the length of the feet irrespective of sex or handedness. One hundred normal subjects (50 males and 50 females) ages of 19 to 25 years with no obvious deformities or previous history of trauma to the hands or feet were selected for the study [5].

Shekhar et al Right foot length and stature among males and females have good correlation in this tribal district of Andhra Pradesh [6].

Stature can be more accurately calculated by foot breadth than long bones. The findings are useful to anatomists, criminologists, human biologist and forensic medicine experts [7].

In this study we found that there is strong correlation between stature and hand length and the linear regression analysis of the obtained data has provided the regression equations for nearly accurate estimation of stature in Gujarati population. Estimation of stature from hand length in Gujarat region [8].

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100 males and 100 females each containing 50 North Indian and 50 South Indian males and females, aged 18 to 21 years. Present study shows higher mean values in each anthropometric dimension were obtained in males than in females. As far as the bilateral asymmetry is concerned, both hand length and width in North and South Indian males and females were statistically significant. In males the highest correlation co-efficient is exhibited by right hand length. Thus, hand length is the best parameter for estimating stature for males [9].

Materials and Methods

Ethical committee permission was taken prior to study. Written informed consent was obtained.

In this study total of 336 students of age group of 18 to 21 years taken with male and 179 female. Care is taken that no one has history of accident fracture of extremity and not suffering from diabetes.

For measurement of hand length, hands were measured with Calliper. Length was measured from tip of middle finger or the longest finger to the centre point of inter styloid line.

Foot length is the straight distance from the most posteriorly projecting the heel to the tip of the most anteriorly projecting toe when the subject is standing erect in cm.

Standing height was measured with the individual standing barefoot on the platform of the stadiometer with the upper back buttock and heels pressed against the upright position of the instrument. Head was positioned in the Frankfort horizontal plane, and the head plate was brought into firm contact with the vertex.

Descriptive statistical, t significance applied. And Correlation coefficient was calculated with regression equation by SPSS 19.

Observations

Descriptive analysis of data indicates significant difference in male and female parameters. Both one way ANOVA and t-test signifies values 0.000.

Range of male height in male population is 147 to 193 cm and female population is 141 to 175.34 cm. Normal distribution shows mesokurtic distribution of population. F value is 356 significant 0.000.

Hand length and Foot difference in length in both right and left hands with significant difference in both sexes.

Table 1: Height in (cm)

	Male	Female
Mean	172.18	158.31
Std. Dev.	7.30	6.15
Std. Er. Mean	0.58	0.46
Skewness	-0.313	0.009
Kurtosis	0.814	-0.161

Fig. 1: Graph of mean Height

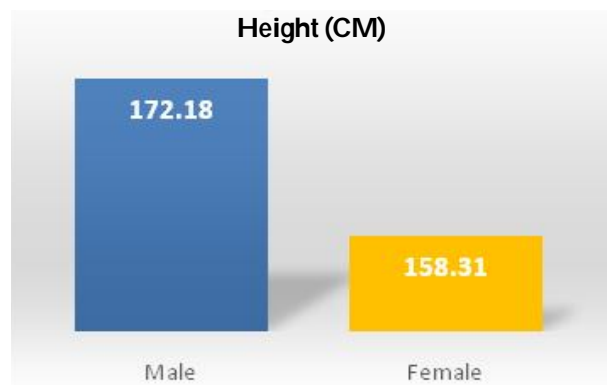


Table 2: Hand Length

	Male		Female	
	Right	Left	Right	Left
Mean	18.57	18.58	16.88	16.85
Std. Dev.	0.79	0.83	0.84	0.84
Std. Er. Mean	0.06	0.06	0.06	0.06
Skewness	0.159	0.196	0.43	0.24
Kurtosis	-0.27	0.096	0.391	0.033

Fig. 2: Hand Length Mean Values.

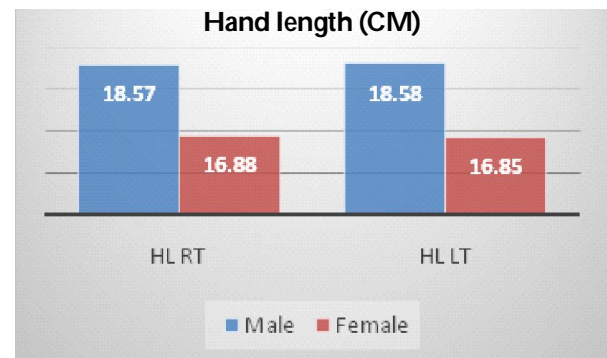


Fig. 3: Foot Length (cm)

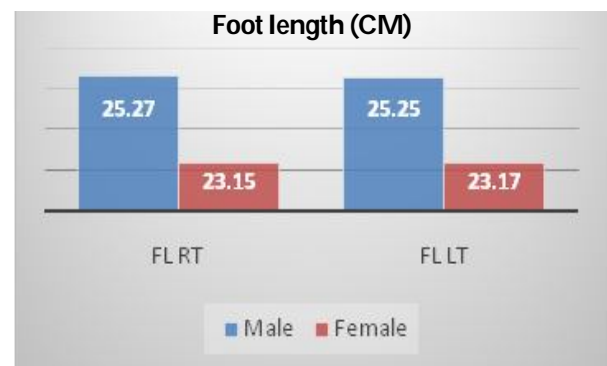


Table 3: Foot Length

	Male		Female	
	Right	Left	Right	Left
Mean	25.27	25.25	23.15	23.17
Std. Dev.	1.43	1.45	1.3	1.3
Std. Er. Mean	0.11	0.11	0.1	0.1
Skewness	-0.23	-0.3	0.97	0.71
Kurtosis	1.29	1.24	3.86	2.59

Pearson Correlation had been calculated with significant linear correlation between hand length and foot has observed, it is 0.77 on right side and 0.76 of left side.

Pearson Correlation had been calculated with significant linear correlation between hand length and foot length has observed, it is 0.77 on right side and 0.76 of left side.

Hand length with stature shows 0. right side and 0.80 on left side as compare to 0.51 on right and 0.50 on left side by Patel [8]; Ilayperuma shows of 0.58 on right and 0.59 on left side [3 Shrivastava 0.61 in male very low in female of 0.31 [4].

Foot length with stature obtain 0. right and 0.72 on left shrivastava similar to present study of 0.71 [4] and Shekhar Rao had also 0.77 [7].

Best value was obtained with hand and foot length on same side calculated all parameters together.

Using Hand length and Foot length

In Female

Eq.1: Height = 70.112 + 2.494 hand length + 1.653 * Left hand length + 0.558 * Right Foot length + Foot length (R= 0.68).

In Male

Eq.2: Height = 76.866 + 0. hand length + 3.574 * Left hand length 0.139 * Right Foot length + 1.598 * Left Foot length (R= 0.59).

Whole Data

Eq.3: Height = 43.678 + 1.652 * Right hand length + 3.431 * Left hand length + 0.455 * Right Foot length + 0.841 * Left Foot length (R= 0.81).

Discussion

Hand length has good ergonomic value in sports medicine and designing of hand held instruments so as to work efficiently.

Also helps in the estimation of stature of a criminal. The available data usually apply to Caucasians in Europe or North America.

Only few studies of other racial groups exist which emphasize the need to establish standards in different ethnic populations[1].

In this study students from central India have been calculated. Mean value for height is higher in male than in female population.

With statistically significant. Better predictive value with hand and foot length calculated together in both sexes. As also observed by Shrivastava, and Patel J, Shekhar et al. [3-6].

Hand length shows higher values in male than in female as in other studies. Correlation coefficient are on higher side in present study than in; Ilayperuma Isurani;Shrivastava, and Patel , Shekhar et al.; [3-6].

Regression equations had been calculated with multiple regression.

Conclusion

In this following inferences can be deduced Hand length is highly correlated with Foot length. Foot length is positively correlated with both hand length and height of person. Correlation is highly significant when data is analyzed combining both sexes together. Multiple correlation regression equation gives better predictive value for height when applied together. Following data and equations can be useful for forensic purpose and in designing of instruments or in ergonomics.

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