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CO-RELATION OF HEIGHT WITH FOOTLENGTH, FOOTBREADTH AND FOOTHEIGHT OF AN INDIVIDUAL

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Abstract- Footlength has been found to be a simple & effective method in human growth monitoring. Studies have been carried out in estimation of height from footlength as measured from footprints or shoe size & regression equation are derived. However, little attention is given to footbreadth and footheight as anthropological parameters. Present study included all the three parameters in subject population which varied from fetuses to adults and the appropriate anthropometric instruments were used for these for these measurements. Such type of data can be great assistance in medico-legal studies and foot reconstruction surgeries.
Key Words- Footlength, Footbreadth, Footheight, Height of an individual

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Introduction

Growth is an essential feature in the life of an individual. Physical growth implies in size of body as a result of multiplication and increase at cellular level. Assessment of growth involves several considerations such as parameters to be used, techniques, reliability & validity of measurements etc. Footlength has been found to be a simple and effective parameter. In previous
Studies, much of the data is available showing co-relation of footlength with height of the individual and is used for anthropological and medico-legal purpose. Very little attention is given to Footbreadth and Footeight as individual parameters. In the present study all the three parameters viz. Footlength, Footbreadth and Footheight are used to co-relate them with the height of the individual.

Aims and Objectives

- To co-relate Footlength, Footbreadth and Footheight of an individual with his Height.
- To minimize error in multiplication factor in such studies.
- To study the variations in co-relation equation in males and females.

Material and Methods

Total number of 420 subjects was studied and they were divided into 7 groups, each of 60 individuals; of which 30 were males & 30 females. The groups were as follows: 1) Foetuses (20 to 30 weeks).2) Neonates (36 to 39 weeks).3) Age- 1to 3 years. 4) Age- 4 to 6 years. 5) Age- 7 to 15 years. 6) age- 16 to 25 years. 7) Age- More than 25 year. Instruments: Anthropometric rod with moving cross bar. Sliding caliper and Measuring Tape. Osteometric Board.
Height was measured as vertical distance from vertex to floor with anthropometric rod. Footlength was measured as straight distance between Pternion and acropodion. Pternion the most projecting point on calcaneal tubercie, Acropodion-the tip of distal phalanx of longest toe. These measurements were made with the help of Osteometric Board. Footbreadth was measured with Sliding Caliper as a distance between head of 1ST metatarsal and head of 5th metatarsal Footheight was measured with the 1st segment of Anthropometric rod and Moving cross bar as the distance between the highest point on longitudinal curve of tarsus and the lower surface where foot rests. The highest point longitudinal curve of tarsus corresponds with the most projecting point on the lateral malleolus.

Observations
Range: 14.4% - 16.8%

Discussion
Co-relation co-efficient of foot length and Height in the age group 1-3 years in the present study is 0.78 and significant. Whereas that established by Rutishauser is 0.90-0.98 which is highly significant. (Table 1) Ratio of Footlength to Height in all age groups in the present study (Table no.4), ranges from 14.7% to 16.8% This corresponds with the values estimated by Robbins for Foot-outline/ Stature viz.14.726% to 15.199% Percentage ratio of the present study also corroborates with findings of Pales and Olivier Viz. 15% Footbreadth shows significant co-relation with the height and co-relation co-efficient is .0.5 In all age groups. (Table 2) Footheight shows moderately significant correlation with height. (Table 3).
However no data is available for comparison of these two parameters, viz. Footbreadth and Footheight.

Table 1- Height with footlength Co-relation and regression

Age Group	Males		Females	
	'r'	reg.eq	'r'	reg.eq
Foetuses	0.97	H = 5.12FL+ 7.05	0.98	H= 5.15FL +6.99
Neonates	0.58	H = 3.91 FL+16.8	0.61	H = 2.59FL +28.1
1-3 yrs	0.8	H=5.42 FL+13.3	0.72	H=4.87 FL+20.1
4-6 yrs	0.64	H=5.82 FL+13.3	0.87	H= 4.42 FL+31.5
7-15 yrs	0.68	H=3.03FL+65.7	0.65	H=3.79 FL+86.9
16-25 yrs	0.67	H= 3.41 FL+83.9	0.67	H=3.41 FL+83.9
> 25 yrs	0.62	H=3.63 FL+ 75.4	0.62	H=3.21FL+80.4

Table 2- Height with Footbreadth Co-relation and regression

Age Group	Males	Males	Females	Females
	'r'	reg.eq	'r'	reg.eq
Foetuses	0.97	H = 5.12FL+ 7.05	0.98	H= 5.15FL +6.99
Neonates	0.58	H = 3.91 FL+16.8	0.61	H = 2.59FL +28.1
1-3 yrs	0.8	H=5.42 FL+13.3	0.72	H=4.87 FL+20.1
4-6 yrs	0.64	H=5.82 FL+13.3	0.87	H= 4.42 FL+31.5
7-15 yrs	0.68	H=3.03FL+65.7	0.65	H=3.79 FL+86.9
16-25 yrs	0.67	H= 3.41 FL+83.9	0.67	H=3.41 FL+83.9
> 25 yrs	0.62	H=3.63 FL+ 75.4	0.62	H=3.21FL+80.4

Table 3- Height with Footheight Co-relation and regression

Age Group	Males	Males	Females	Females
	'r'	reg.eq	'r'	reg.eq
1-3 yrs	0.71	H=14.93 FH +34.3	0.5	H=5.17 FH +71.5
4-6 yrs	0.5	H=6.16 FH +108.6	0.54	H=6.27FH+78.4
7-15 yrs	0.53	H=6.14 FH +90.3	0.46	H=6.50FH+88.6
16-25 yrs	0.46	H=6.86 FH +62.3	0.45	H=6.55FH +44
> 25 yrs	0.49	H=8.07FH +107.8	0.51	H=6.56FH+35

Table 4- Percentage Ratio of Foot Length with Height in Percentage

Age Group	Percentage ratio	
	Male	Female
Foetuses (2032wks)	14.40%	14.5.%
Neonate (3639wks)	16.80%	16.80%
1-3 yrs	15.80%	16%
4-6yrs	15.50%	15.60%
7-16 yrs	15.50%	15.90%
16-25 yrs	14.70%	14.70%
>25yrs (26-60 yrs)	14.90%	14.70%

Conclusions
A total of 420 subjects. All from Maharashtrian Population were studied in the various age groups. It was observed that: 1) there is a linear increase in dimensions with increasing age. 2) Footlength and Footbreadth show significant co-relation with height in various age groups. 3) However, there is need to establish standard values for Footbreadth as well as Footheight.

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