

ESTIMATION OF STATURE FROM FOOT DIMENSIONS OF SCHOOL AGE GROUP CHILDREN IN MAHARASHTRA STATE

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Abstract- The present study is based on measurement of foot length of 200 students of two age groups - 6 to 8 yr & 12 to14 yr. Foot length (heel to tip of each digit), foot width, foot girth at metatarsophalangeal joints & stature were the parameters. Collected data was analyzed. Standard deviation, co-relation coefficient, sexual dimorphism, regression formulae and multiple regression equations were predicted. This study suggest a significant relationship between the foot dimensions & stature. If either of the measurement is known, the other can be

predicted. This would be useful for anthropologist and forensic medicine experts.

Key words- Foot dimensions, foot length, foot width, foot girth, stature, correlation coefficient, regression equation, anthropology, sexual dimorphism

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Introduction

Dimensional relationship between body segments & the whole body has been the focus of scientist, anatomist and anthropologist for many years. [1] The stature is a measure of biological development and is determined by a combination of genetic and environmental factors. Foot dimensions deal with morphological features like size, shape, foot width, foot height and segmental length. Foot dimensions display a definite biologic co-relation

with stature & because of this relationship it is possible to predict the stature from foot length. This reliability was first suggested by Rutishauser[2]

Studying foot pattern and foot dimensions can reveal information regarding surgical and pathological conditions like talipes equinovarus, flat foot or varus metatarsal and other familial or acquired anomalies [3]. It also plays a vital role in medical rehabilitation, sport sciences and foot wear design[4].Foot dimensions also exhibit sexual dimorphism.

Stature is usually determined by employing mathematical or anatomical method. Main disadvantage of anatomical method is that nearly complete skeleton is needed for stature estimation. In this present study the mathematical method is utilized for stature estimation.[5]

Aim-To find out the relation between stature & foot dimensions in school children of western Maharashtra.

Objectives

- 1. Document the association between stature and foot measurement among different growing age groups.
- 2. Formulate stature estimation equations from foot measurements for the different growing age groups.
- 3. Find out sexual dimorphism in foot measurements.
- 4. Find out bilateral differences in foot measurements and its significance.
- 5. Find out correlation between the variables.

Material and Method

A total no. of 200 subjects were considered for this study. Sample1: Primary school children between 6 to 8 years Females-48 (sample 1-a) and males - 52 (sample 1-b). Sample 2: Secondary school children between 12 to 14 years Females- 51 (sample 2-a) and males -49 (sample 2-b)

Informed consent was taken from the concerned authority and the children were briefed about the procedure for their co-operation. Those who had deformed foot and history of injury were eliminated from the study. The measurements were taken at a fixed time of the day to eliminate diurnal variations.

Foot length (HTL-heel to toe length) was measured by anatomical method. In this, subjects were asked to stand in anatomical position on a white paper .Edge of a metal ruler was placed at the tip of toes (touching the pulp) and marked on the paper. 2nd point was marked at the back of the heel on its most prominent point. Foot length was measured by joining these two points at the level of each toe. Foot width (FW) was measured by taking the distance between most prominent point on the medial side (Metatarsal tibialae) and the lateral side (Metatarsal fibulae) using a vernier caliper [6] Metatarsophalangeal joint girth (MPJG) of the foot was measured using a measuring tape.[7]





Fig. 2- Metatarso- phalangeal joint girth (MPJG)

Observations, Analysis And Results

Table1-a -Sample 1-a: Age group 6 to 8 years female

Meas- urement	Mean		Standard deviatior	l 1	Minim	ım	Maxim	um
(in cm)	Left	Right	Left	Right	Left	Right	Left	Right
HT1L	17.975	17.956	1.8572	1.8989	11.5	11.8	20.7	20.6
HT2L	17.894	18.050	1.4882	1.4878	14.2	14.9	20.4	21.1
HT3L	17.300	17.415	1.3621	1.4572	14.2	142	19.7	20.2
HT4L	16.260	16.454	1.2535	1.2868	13.5	13.7	18.5	18.9
HT5L	14.913	15.171	1.0837	1.1495	12.5	13.1	17.1	17.6
FW	6.733	6.875	0.4764	0.4679	5.9	6.0	7.6	7.8
MPJG	16.958	16.667	1.8446	1.2604	14	14	23	20
STAT- URE	119.52		15.578		103		170	

Table1-b -Sample 1-b: Age group 6 to 8 years male

Meas- urement	Mean		Standaro deviatio	i 1	Minim	um	Maxim	um
(in cm)	Left	Right	Left	Right	Left	Right	Left	Right
HT1L	18.348	18.323	1.0017	0.9845	16.5	16.2	20.3	20.1
HT2L	18.027	18.002	1.0162	1.0170	16	15.4	19.7	19.7
HT3L	17.523	17.515	1.0977	1.0984	15.5	15	19.7	19.5
HT4L	16.273	16.588	1.1882	0.9769	13.3	14.5	18.3	18.3
HT5L	15.254	15.371	0.8576	0.9300	13.5	13.5	16.9	17
FW	7.023	6.981	0.3833	0.6139	6.3	5.0	7.9	8.0
MPJG	17.481	17.442	1.1288	1.4741	16	14	20	20
STAT- URE	112.27		8.327		97		127	

Table1-c -Sample 2-a: Age group 12 to 14years female

Meas- urement	Mean		Standaro deviation	i 1	Minim	um	Maxim	um
(in cm)	Left	Right	Left	Right	Left	Right	Left	Right
HT1L	21.465	21.714	1.4408	1.5905	18.9	14.8	23.6	24.0
HT2L	21.086	21.369	1.3891	1.2802	18.5	18.9	23	23.5
HT3L	20.282	20.202	1.4722	1.2544	17.4	17.5	22.5	22.5
HT4L	19.061	19.067	1.6929	1.3386	15.4	14.6	22.1	21.5
HT5L	17.797	17.712	1.5583	1.1673	14.8	15.7	21.0	19.8
FW	8.094	8.214	0.6005	0.5138	7.2	7.3	8.9	9.0
MPJG	20.255	20.392	1.3834	1.2503	18	18	23	22
STAT- URE	148.33		7.456		130		162	

Table1-d -Sample 2-b: Age group 12 to 14years male

Meas- urement	Mean		Standaro deviation	i 1	Minim	um	Maxim	um
(in cm)	Left	Right	Left	Right	Left	Right	Left	Right
HT1L	23.369	23.301	2.2914	2.1509	15.5	15.2	28.0	26.7
HT2L	23.044	22.996	1.2573	2.0528	21.2	15.5	25.9	26.7
HT3L	22.225	22.281	1.1956	1.3017	20.3	19.7	24.9	25.4
HT4L	21.225	21.199	1.1846	1.3316	19.6	19	24.5	24.9
HT5L	19.715	19.552	0.9549	1.0202	18	18	21.8	21.8
FW	8.925	8.885	0.5502	0.4855	8.0	8.1	10.2	10.1
MPJG	21.333	21.188	1.9056	2.1503	18	17	25	26
STAT- URE	148.62		9.187		134		167	

Table [1] Displays mean, standard deviations, minimum and maximum values of stature and left and right foot measurements in different age group.

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Table- 2-a -Sample 1-a: Age group 6 to 8 years female

Measurements (in cm)	Mean difference (Left-Right)	Standard deviation	'ť' value	Signifi- cance
HT1L	-0.0187	0.3468	-0.375	0.710
HT2L	0.1562	0.3222	3.367	0.002*
HT3L	0.1146	0.6748	1.176	0.245
HT4L	0.1938	0.3284	4.088	0.000**
HT5L	0.2583	0.4616	3.877	0.000**
FW	-0.145	0.972	-1.632	0.212
MPJG	-0.2917	1.3362	-1.512	0.137

Table- 2-b -Sample 1-b: Age group 6 to 8 years male

Measurements (in cm)	Mean difference (Left-Right)	Standard deviation	'ť' value	Signif- icance
HT1L	-0.0250	0.3377	-0.534	0.596
HT2L	-0.250	0.4401	-0.410	0.684
HT3L	-0.0077	0.7778	-0.071	0.943
HT4L	0.3154	1.0494	2.167	0.035*
HT5L	0.1173	0.4950	1.709	0.094
FW	-0.0194	0.532	-0.367	0.729
MPJG	-0.0385	0.7660	-0.362	0.719

In 6 to 8 yrs. females, heel to toe length of 2nd, 4th, 5th toes are significantly larger on right side. But in the same age group in males the heel to toe length of only 4th toe is significant on right side.

Table- 2-c -Sample 2-a: Age group 12 to 14 years female

Measurements (in cm)	Mean difference (Left-Right)	Standard deviation	't' value	Signifi- cance
HT1L	0.2490	0.7328	2.427	0.019*
HT2L	0.2824	0.7177	2.810	0.007**
HT3L	0.0804	0.9875	-0.581	0.564
HT4L	0.0059	1.0977	0.038	0.970
HT5L	0.0843	0.7311	-0.824	0.414
FW	0.67	0.71	1.531	0.244
MPJG	0.1373	0.06934	1.414	0.164

Table- 2-d - Sample 2-b: Age group 12 to 14 years male

Measurements (in cm)	Mean difference (Left-Right)	Standard deviation	'ť' value	Signifi- cance
HT1L	- 0.0679	1.2229	- 0.385	0.702
HT2L	- 0.0479	2.0445	- 0.162	0.872
HT3L	0.0479	0.5608	0.592	0.557
HT4L	- 0.0333	0.4813	- 0.480	0.634
HT5L	- 0.1625	0.4190	- 2.687	0.010*
FW	- 0.072	0.97	- 1.52	0.426
MPJG	- 0.1458	1.0717	- 0.943	0.351

Bilateral difference in heel to toe length in the age group 12 to 14 years of females are significant (at the level of 0.05) in 1stand 2nd toes. Right side is longer as compared to left. While in the same age group in males it is significant, only in 5th toe (at the level of 0.01), left being longer

Table 2 displays means, standard deviations and value of 't' of bilateral differences (left - right) in anthropometric measurements of foot.

Table- 3-a -Sexual dimorphism Sample no 3-a Age gro	oup 6 to 8	3
years		

	t - test for Equality of Means (95% Confi.)				
	т	df	Sig. (2-tailed)		
Foot Width R	963	98	338		
Foot Width L	-3.363	98	001*.		
MPJGRF	-2.817	98	006*		
MPJGLF	-1.723	98	088		
HT1LRF	-1.226	98	223		
HT1LLF	-1.263	98	.209		
HT2LRF	.190	98	.850		
HT2LLF	526	98	.600		
HT3LRF	393	98	.695		
HT3LLF	905	98	.368		
HT4LRF	591	98	.556		
HT4LLF	052	98	.959		
HT5LRF	961	98	.339		
HT5LLF	-1.753	98	.083		

years

		,				
	t-test for Equality of Means (95% Confi.)					
	т	df	Sig. (2-tailed)			
Foot Width R	-6.676	97	0.000*			
Foot Width L	-7.165	97	0.000*			
MPJGRF	-2.266	97	0.26			
MPJGLF	-3.236	97	0.02*			
HT1LRF	-4.191	97	0.000*			
HT1LLF	-4.980	97	0.000*			
HT2LRF	-4.762	97	0.000*			
HT2LLF	-7.336	97	0.000*			
HT3LRF	-8.094	97	0.000*			
HT3LLF	-7.211	97	0.000*			
HT4LRF	-7.914	97	0.000*			
HT4LLF	-7.327	97	0.000*			
HT5LRF	-8.331	97	0.000*			
HT5LLF	-7.331	97	0.000*			

Table- 3- c -Sexual dimorphism Sample no 3-c Age group	6 to	8
vears		

	t-test for Equality of Means (95% Confi.)			
	т	df	Sig. (2-tailed)	
Foot Width R	-6.676	97	0.000*	
Foot Width L	-7.165	97	0.000*	
MPJGRF	-2.266	97	0.26	
MPJGLF	-3.236	97	0.02	
HT1LRF	-4.191	97	0.000*	
HT1LLF	-4.980	97	0.000*	
HT2LRF	-4.762	97	0.000*	
HT2LLF	-7.336	97	0.000*	
HT3LRF	-8.094	97	0.000*	
HT3LLF	-7.211	97	0.000*	
HT4LRF	-7.914	97	0.000*	
HT4LLF	-7.327	97	0.000*	
HT5LRF	-8.331	97	0.000*	
HT5LLF	-7.331	97	0.000*	

Table 3 displays sexual dimorphism in various foot measurements

Measurements (in cm)	Left stature	foot/ Significan	ce Right foot / stature	Significance
HT1L	0.281	0.053	0.266	0.068
HT2L	0.297	0.040*	0.322	0.053
HT3L	0.281	0.053	0.285	0.050
HT4L	0.295	0.042*	0.385	0.007**
HT5L	0.232	0.112	0.410	0.004**
FW	0.189	0.198	0.079	0.594
MPJG	-0.030	0.842	0.105	0.476

Table- 4-a -Sample 1-a: Age group 6 to 8 years female

Table- 4-b -Sample 1-b: Age group 6 to 8 years male

Measurements (in cm)	Left foot/ stature	Significance	Right foot / stature	Significance
HT1L	0.824	0.000**	0.848	0.000**
HT2L	0.844	0.000**	0.848	0.000**
HT3L	0.724	0.000**	0.808	0.000**
HT4L	0.480	0.000**	0.818	0.000**
HT5L	0.781	0.000**	0.763	0.000**
FW	0.486	0.000**	0.390	0.004**
MPJG	0.618	0.000**	0.570	0.000**

- 1. In females of 6 to 8 years age group correlation coefficients of foot length and stature are statistically significant on both sides. HTL of right 2nd and 4th toe is significant (at the level of 0.05). HTL of left 4th and 5th toe is highly significant (at the level of 0.01).
- 2. In males of 6 to 8 years correlation coefficients of all foot measurements and stature are statistically highly significant on both sides at the level of 0.01.

Table- 4-c -Sample 2-a : Age group 12 to 14 years female

Measurements (in cm)	Left foot/ stature	Significance	Right foot / stature	Significance
HT1L	0.010	0.944	0.093	0.515
HT2L	-0.044	0.757	0.032	0.822
HT3L	0.014	0.920	0.053	0.711
HT4L	-0.009	0.951	0.242	0.088
HT5L	-0.102	0.476	0.096	0.505
FW	0.241	0.089	0.328	0.019*
MPJG	0.376	0.007*	0.247	0.080

Table- 4-d -Sample 2-a: Age group 12 to 14 years male

Measurements (in cm)	Left f stature	oot/ Significance	Right foot / stature	Significance
HT1L	0.569	0.000**	0.568	0.000* *
HT2L	0.146	0.321	0.601	0.000* *
HT3L	0.549	0.000**	0.604	0.000* *
HT4L	0.551	0.000**	0.649	0.000* *
HT5L	0.527	0.000**	0.616	0.000* *
FW	0.596	0.000**	0.602	0.000* *
MPJG	0.163	0.269	0.266	0.067

- In females of 12 to 14 years group correlation coefficients of foot measurements and stature are statistically not significant. Only left side MPJG is highly significant at the level of 0.01.
- In males of 12 to 14 years group correlation coefficients of foot measurements and stature are statistically significant on both sides at the level of 0.01. Only MPJG and HT2LLF are not significant.

Table 4- displays correlation coefficients of various foot measurements with stature.

Table- 5-a -Sample	1-a: Age group	6 to 8 years	female
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Measure- ments (in cm)	Regression equation for left foot	Mean error	Regression equation for right foot	Mean error
HT1L	77.084+(2.361×HTIL)	15.110	80.352+ (2.181×HT1LR)	15.180
HT2L	63.830+(3.112×HT2L)	15.035*	58.756+(3.366×HT2L)	14.911*
HT3L	63.931+(3.213×HT3L)	15.112	66.520+(3.043×HT3L)	15.095
HT4L	59.990+(3.661×HT4L)	15.048*	42.821+(4.661×HT4L)	14.533*
HT5L	69.728+(3.339×HT5L)	15.316	35.230+(5.556×HT5L)	14.363*
FW	77.879+(6.184 FWL)	4.734	101.465+(2.626 FWR)	4.894
MPJG	123.758+(-0.250×MPJG)	15.740	97.795+(1.304×MPJG)	15.659

Table- 5-b -Sample 1-b: Age group 6 to 8 years male

Meas- urement s (in cm)	Regression equation for left foot	Mean error	Regression equation for right foot	Mean Error
HT1L	-13.348+(6.846×HT1L)	4.770**	-19.088+(7.169×HT1L)	4.463**
HT2L	-12.340+(6.912×HT2L)	4.517**	-12.661+(6.940×HT2L)	4.463**
HT3L	15.981+(5.495×HT3L)	5.798**	4.679+(6.143×HT3L)	4.959**
HT4L	57.535+(3.363×HT4L)	7.378**	-3.390+(6.975×HT4L)	4.838**
HT5L	-3.366+(7.581×HT5L)	5.255**	7.265+(6.831×HT5L)	5.437**
FW	30.051+(10.568) FWL	2.684**	75.380+(5.284 FWR)	1.767**
MPJG	32.569+(4.559×MPJG)	6.611**	56.114+(3.220×MPJG)	6.910**

In sample 1, Only FL is significant for calculation of stature. But in males of this age group FL, FW and MPJG all are highly significant.

Table- 5-c -Sample 2-a: Age group12 to 14years female

Measure- ments (in cm)	Regression equation for left foot	Mean error	Regression equation for right foot	Mean error
HT1L	147.217+(0.052×HT1L)	7.531	138.845+(0.437×HT1L)	7.499
HT2L	153.353+(-0.238×HT2L)	7.524	144.309+(0.188×HT2L)	7.527
HT3L	146.855+(0.073×HT3L)	7.531	141.948+(0.316×HT3L)	7.521
HT4L	149.069+(-0.039×HT4L)	7.531	122.675+(1.346×HT4L)	7.308
HT5L	157.015+(-0.488×HT5L)	7.492	137.519+(0.611×HT5L)	7.497
FW	124.134+(2.990 FWL)	1.722	109.278+(4.755 FWR)	1.958
MPJG	107.338+(2.024×MPJG)	6.980*	118.241+(1.476×MPJG)	7.297

Table- 5-d -Sample 2-b: Age group 12 to 14 years male

Meas- urement s (in cm)	Regression equation for left foot	Mean error	Regression equation for right foot	Mean error
HT1L	95.356+(2.279×HT1L)**	7.640	92.064+(2.427×HT1L)	7.641**
HT2L	123.976+(1.070×HT2L)	9.187	86.819+(2.688×HT2L)	7.426**
HT3L	54.876+(4.217×HT3L)**	7.764	53.616+(4.264×HT3L)	7.401**
HT4L	57.852+(4.277×HT4L)**	7.747	53.686+(4.480×HT4L)	7.063**
HT5L	48.735+(5.067×HT5L)**	7.895	40.138+(5.549×HT5L)	7.315**
FW	59.783+(9.954 FWL)	1.977	47.389+(11.393 FWR)	2.228
MPJG	131.875+(0.785×MPJG)	9.163	124.506+(1.138×MPJG)	8.951

In sample 2, in age group 12 to 14 yrs. estimation of stature from FL is significant in males. But in females of this age group it is not significant.

Table 5: displays regression equations for estimation of stature through various length-breadth measurements of foot.

Discussion

The estimation of stature from various long bones, head length & hand length has been attempted by many workers. However, foot

International Journal of Medical and Clinical Research ISSN:0976-5530 & E-ISSN:0976-5549, Volume 3, Issue 2, 2012 dimensions have not frequently been used for this.

The present study uses mathematical method (division factors & regression analysis) to determine the stature from foot dimensions. The regression analysis gives better reliability of estimate in prediction of stature than the division factor

method [1]

Given study deals with the correlation of total standing height with different foot measurements in students of western Maharashtra in three different age groups.

Sample No 1 age group 6 to 8 years

As seen in table No 2-a and b, HTL of 2nd, 4th and 5th toes is significantly more on right side in females. But in the same age group in males the HTL of only right side is more. Sexual dimorphism is not significant statistically in this age group.

Correlation coefficient between stature and HTL of 2nd, 3rd and 4th toes on left side is statistically significant in females. While in males it is significant with HTL of right 4th toe. Regression equations for estimation of stature through various foot dimensions are seen in table no.5. The regression equation using HTL of 2nd and 4th toes on both sides in female is significant statistically. And in males all parameters are significant statistically.

Sample No.2 age group 12 to 14 years.

As seen in table no.2- c and d, the HTL of right 1st and 2nd toes is statistically more in females. And HTL of left 5th toe is more in males.

Sexual dimorphism in majority of the measurements is statistically significant, values being more in males.

Correlation coefficients of various foot measurements with stature are seen in table no.4. Correlation coefficients for all parameters are highly significant statistically on both sides in males except HTL of left 2nd toe and MPJG of both sides. In females it is significant only with right foot width and left MPJG.

In males all regression equations using FL are highly significant but FW & MPJG of both sides is insignificant. And in females only left side MPJG is significant in calculation of stature. The mean error was always less than 0.01 for any measurement in any given age group. So this shows that estimation of stature can be done with different measurements, more so with FL and FB. This study is comparable with similar such studies done by Sen Jaydip et al 2008 [8]and Patel S.M. et al 2007 [9].

Conclusion

It is worthwhile to mention here that the present study is a pioneering study in forensic anthropology to correlate between foot dimensions & the stature in western Maharashtra. The study result showed a significant relationship between these two parameters. Sexual dimorphisms as well as bilateral differences in various foot measurements are also seen.

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Table- 6-a -Sample1-a: Age group 6 to 8 years female

M equation:

1) Multiple regression equation for right foot : Y = 24.124 + 6.517 (Foot width Rt) + (-5.908)×MPJGRF +(-2.944)×HT1LRF + (16.544)×HT2LRF + (-29.854)× HT3LRF + (24.510)× HT4LRF + (1.313)× HT5LRF

2) Multiple regression equation for left foot :

Y = 81.439 + (6.554)× Foot width Lt + (-4.976) × MPJGLF + (-2.790) × HT1LLF + (1.055)× HT2LLF + (6.928)× HT3LLF + (12.779) × HT4LLF + (-14.622) × HT5LLF

Table- 6-b -Sample1-b: Age group 6 to 8 years male

M equation:

 Multiple regression equation for right foot : Y = (-19.424) +(-2.359)× Foot width Rt + (-0.233)× MPJGR +(3.920)× HT1LRF + (2.482)×HT2LRF + (1.215)× HT3LRF + (-0.093) ×HT4LRF + (1.039) ×HT5LRF
Multiple regression equation for left foot : Y = (-10.257) + (-6.803)× Foot width Lt + (1.184)× MPJGLF + (0.976) ×HT1LLF + (6.013)×HT2LLF + (-1.154)×HT3LLF + (0.837)× HT4LLF + (1.966) ×HT5LLF

- 1. In age group of 6 to 8 years female using right foot measurements percentage of dependency of these factor on estimated stature is 40%
- 2. In age group of 6 to 8 years female using left foot measurements percentage of dependency of these factor on estimated stature is

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- 3. In age group of 6 to 8 years male using right foot measurements percentage of dependency of these factor on estimated stature is 76%
- 4. In age group of 6 to 8 years male using left foot measurements percentage of dependency of these factor on estimated stature is 76%

Table- 6-c -Sample2-a: Age group 12 to 14years female

M equation:

1) Multiple regression equation for right foot : Y = (73.267) + (4.960)× Foot width Rt + (0.604)× MPJGRF + (1.240)× HT1LRF + (-0.727)×HT2LRF + (0.374)× HT3LRF + (3.358)× HT4LRF + (-3.442)×HT5LRF

2) Multiple regression equation for left foot

Y = (-109.777) + (-9.254)× Foot width Lt + (8.848)× MPJGLF + (1.703) ×HT1LLF + (0.484) ×HT2LLF + (17.080)×HT3LLF + (-5.003)× HT4LLF + (-8.092) ×HT5LLF

Table- 6-d -Sample 2-b: Age group 12 to 14 years male

M equation:

1) Multiple regression equation for right foot :

 $Y = (5.084) + (7.232) \times$ Foot width $Rt + (-0.639) \times$ MPJGRF + (-2.084) \times HT1LRF + (3.368) \times HT2LRF + (1.122) \times HT3LRF + (-0.807) \times HT4LRF + (2.869) \times HT5LRF 2) Multiple regression equation for left foot

Y = (57.128) + (7.425)× Foot width Lt + (-0.745)× MPJGLF + (1.144) ×HT1LLF + (-1.073)×HT2LLF + (1.026)×HT3LLF + (0.220)× HT4LLF + (0.590) ×HT5LLF

- In age group of 12 to 14 years female using right foot measurements percentage of dependency of these factor on estimated stature is 25%
- 2. In age group of 12 to 14 years female using left foot measurements percentage of dependency of these factor on estimated stature is 66%
- 3. In age group of 12 to 14 years male using right foot measurements percentage of dependency of these factor on estimated stature is 58%

4. In age group of 12 to 14 years male using left foot measurements percentage of dependency of these factor on estimated stature is 50% Table 6- displays the multiple regression equations for estimation of stature using all the parameters and its accuracy is predicted