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BODY STATURE AND FOOT GROWTH PATTERN IN RURAL SCHOOL CHILDREN (5-15 YEARS) IN VARANASI

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ABSTRACT

The present investigation has been aimed at studying the relationship between foot growth and body height at different ages in children and adolescents (5-15 yrs.). It was found that high positive correlation was found to exist between foot length and height (r = 0.97 girls, 0.99 boys), foot arch and height (r = 0.83 girls, 0.80 boys), foot length and arch height (r = 0.84 girls, 0.79 boys) in children of both sexes. The nature of such relationship was manipulated to assess the growth pattern in foot from height/body stature and vice-versa by fitting suitable regression equations. The foot arch height was also found to be a better predictor of height and foot length at different ages. In conclusion the findings of the study might be utilized in the field of sports particularly *where* higher heights (throw and jump events) and shorter heights (gymnastics and sprints) are preferred and the assessment of adult height becomes necessary at early childhood to introduce suitable training programmes for the sports persons.

Key words : *Foot growth, body height, foot arch height, children.*

The overall skeletal growth and maturity in children and adolescents are usually assessed from body stature at different ages. Stature in fact is much influenced by heredity and various environmental factors during childhood and adolescence (Tanner, 1962). Long and continued deprivation of the optimal nutrition affects skeletal growth and maturity in children (De and Nag Choudhary, 1996). This needs special mention in the fields of games and sports, orthopedics, military situations etc. where the estimation of adult growth from early growth is required. Hence assessment of these skeletal components (i.e. body height and foot growth) seems reasonable at different ages. The relationship that exists between foot growth and body height since early childhood to late adolescence seems to play a vital role in assessing the value of one component from the other (Satyavati *et. al,* 1981). Studies in this direction is almost scanty in Indian literature. The present investigation is therefore an attempt to relate the foot growth with the height pattern and to find out their nature in the early periods of life. It has also been aimed to study the utilization of early foot growth pattern in the prediction of adult height in the normal population.

MATERIALS AND METHODS

The present study was based on a cross sectional sample of 336- rural school children (141 girls and 195 boys) within 5-15 years age residing in Varanasi district (U.P) .All the children were from a poor socio-economic segment of the population. The age and sex- wise distribution of the children was shown in Table-1.

Measurements from all children were taken with utmost care to secure maximum accuracy in the data recorded. Height was measured to the nearest 0.1cm with a non-stretchable steel tape and weight was taken to nearest 0.1Kg with a portable spring balance.

Foot measurements included foot length and arch height -all taken on the left side of the children. Arch height was measured, with a sliding caliper, as the vertical height of navicular bone Prominence above the horizontal base plate and foot length was taken from the most prominent part at the back of the heal to the tip of the middle toe with a polymeter.

Statistical analysis of Data has made for - Mean, standard deviation (SD), correlation co-efficient (r) regression equations gradients (Table - II) and relative indices (Table-III). (Table-I), growth.

The calculations were,

$$\text{(a) Growth gradients} = \frac{\text{Mean Value}}{\text{Max. adult value in series}} \quad 100$$

$$\text{(b) Arch Index} = \frac{\text{Arch Height}}{\text{Foot length}} \quad 100$$

$$\text{(c) Foot length Index} = \frac{\text{Foot length}}{\text{Height}} \quad 100$$

RESULTS AND DISCUSSION

The absolute dimensions of body weight, height foot length and arch height in children were found to be gradually increasing with age (Table-1). Along with it, the growth spurts were also noted for foot lengths and heights for girls at 11-12 y and 14-15 y for boys respectively. Similar spurts in arch heights were seen earlier at 7–8 y for both sexes. Such studies were also carried out by earlier researchers (Rai and Bansal, 1978).

However, the male superior growth pattern was observed in all cases by 2- 5 % as boys were having higher values at all ages than the girls. But the sex difference maturity level was reflected differently as

Table-1 : Weight, height and foot growth in children and adolescents.

Age Yrs	Sex	Number	Weight Mean (Kgs)		Per cm height ± S.D.		Foot Length (Cms)		Foot Arch Height (Cms)	
	Female (F) Male (M)		Mean	± S.D.	Mean	± S.D.	Mean	± S.D.	Mean	± S.D.
(5-6)	F M	20 29	15.27 14.82	2.01 2.52	106.38 103.52	5.37 9.27	16.02 15.78	1.13 1.44	3.94 4.04	0.65 0.69
(6-7)	F M	20 24	17.95 16.32	2.56 2.01	115.00 110.50	8.13 5.99	17.40 16.67	1.79 1.01	3.77 3.75	0.24 0.25
(7-8)	F M	17 29	19.00 17.00	2.78 2.17	116.14 115.66	7.37 6.85	17.42 17.61	1.29 1.77	4.85* 5.13*	0.44 0.27
(8-9)	F M	20 30	19.44 19.45	3.10 2.52	116.84 119.45	8.67 7.79	17.50 17.90	1.61 2.46	4.02 4.45	0.51 0.72
(9-10)	F	17	20.80	2.75	118.60	9.74	18.25	1.06	4.00	0.50
	M	27	19.42	3.05	114.52	9.22	18.23	1.43	4.40	0.19
(10-11)	F M	26 29	19.82 20.98	2.24	120.21	7.29	18.18	1.31	4.04	0.24
				2.67	120.73	7.04	18.84	1.36	4.18	0.53
(11-12)	F M	21 27	21.26 22.73	2.87	125.71*	7.89	19.35*	1.39	4.70	0.24
				2.88	126.21	8.03	19.62	1.41	4.62	0.42
(12-13	F M	20 29	23.73 25.89	3.39	126.14	7.86	19.25	1.74	4.85	0.23
				3.29	131.47	7.24	20.26	1.28	4.92	0.32
(13-14)	F M	19 22	24.65 25.34	3.01	130.56	5.93	19.96	1.51	4.65	0.46
				3.43	132.93	6.80	20.41	1.39	5.23	0.43
(14-15)	F M	18 29	29.50 29.52	4.03	138.20	4.85	20.00	1.71	4.75	0.25
				4.09*	139.25*	7.07	21.50*	1.38	4.84	0.44
				6.47	149.41	7.89	22.81	1.29	5.29	0.58
Total	336	F: 141 & M : 195		*Development of growth spurts						

Calculated correlation co-efficient (r)				
Height (H) vs.	foot Length (FL)		Female	Male
Height (H) vs.	foot arch Height (AH):		0.97	0.99
FL Vs foot arch	Height (AH)		0.83	0.80
(P < 0.001 for all excepting ** P<0.01)			0.84	0.79**
Calculated Regression equation		:	Female	Male
AH*	Vs	FL** :	Yx = 7.36+2.54x,	Yx = 4.24+3.21x
AH*	VS*	H** :	Yx = 43.95+17.95x,	Yx = 28.79+20.63x
FL*	VS*	H**	Yx = 4.66+6.89x,	Yx = 3.80+6.30x
(* Independent Variable 'x'),				
(**Dependent Variable 'y')				

the girls were found to be early maturers than the boys. Then the foot lengths and heights were noted to have 90% maturity at 13-14 years (girls) and 14-15 v (boys), whereas the arch heights had earlier maturities at the same ages (12-13 years) for both sexes.

When the foot growth and arch height were considered together. the arch heights were 21-27 c,10 (girls) and 22-29% (boys) of the foot lengths at various ages. However, all of them had achieved the maximum growth of > 90% at the age of 7-9 y in both sexes.

This particular finding has been an important reflection of the growth pattern of arch height and foot length along with the overall stature in children. This in the other hand depicted a desirable early growth and maturity level in arch height required to support the longitudinal growth load of foot and stature in the subsequent years, Moreover, such maturity pattern might be taken as a guide to predict the adult stature and foot length from the early values by fitting suitable regression equations (Table-1), as the maturity level in arch growth (7-8 y) seems to be little influenced by adverse environmental factors in comparison to foot length, and body stature in subsequent years.

Therefore, arch height was supposed to be a better predictor than foot length in-the assessment of adult height.

In conclusion, the noteworthy aspect of the findings was a significantly high correlation ($P<0.001$) between the foot growth pattern and overall stature in boys and girls at all ages. The importance of such a correlation could be well explained in situations where the late adolescent values are needed to be predicted from the early childhood data. Such situations are very often encountered in the field of games and sports (throw and jump events, gymnastics and sprints) where higher and shorter values were counted much. Besides, such dimensional study in the foot growth pattern is of paramount importance in medical services such as orthopedics and radiology, Nonetheless, it has a useful role in the commercial production of befitting shoes and shocks for various population groups.

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