

Heritability Estimates of Anthropometric Trait Using Twins Data

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ABSTRACT Heritability estimates of some anthropometric measurements have been made using data of like sexed twin pairs (15 MZ and 34 DZ) of Delhi. This has been done by a comparison of squares of the differences between monozygous twin pairs (V_{MZ}) with that of between dizygous twin pairs (V_{DZ}). These estimates re-establish that genetic component is high in the measures of bone lengths and low in the measures of soft tissues.

The use of twin studies of the measurement of the degree of heritability of a continuously varying character is based on a comparison of the variance of differences between monozygous twin pairs and the differences between dizygous twin pairs (Cavalli-Sforza and Bodmer, 1971). The estimates have been found to be more stable for measurements which are likely to be influenced by various environmental excesses such as obesity or malnutrition. Several studies have been found to be less influenced by environmental components than measures of width or girth (Clark et al., 1980; Dupea et al., 1982; Osborne and De George, 1959; Susanne, 1975; Vandenberg, 1962).

The present study is an attempt to understand the degree of heritability of some morphological traits as completely as possible in monozygous and dizygous twin pairs.

MATERIAL AND METHODS

Twins were identified after an exploratory study of house to house survey of 10,000 households in Govindpuri area in South Delhi. In all 49 like sexed twin pairs were identified ranging in age from one year to 17 years. Estimation of Zygosity was done on the basis of a number of genetic markers (Siemens, 1927; Verschuer, 1939), 15 Monozygous (9 males and 6 female

pairs) and 34 Dizygous (22 males and 12 female pairs) twin pairs were identified. Anthropometric measurements such as height vertex, body weight, sitting height vertex, biacromial breadth, bi-cristal breadth, maximum head breadth, maximum head length, skinfold at biceps and skinfold at triceps were taken on all the twin pairs using standard anthropometric techniques (Singh and Bhasin, 1989).

Heritability estimate of the above anthropometric characters were obtained by a comparison of the means of the squares of the differences between members of monozygous twin pairs (V_{MZ}) and the means of the squares of the differences between dizygous twin pairs (V_{DZ}). Since the two data sets (both MZ and DZ twin pairs), belong to the same environmental and socio-economic situations, we assume that the environmental influences on the two types of twins to be equivalent. Hence, V_{MZ} should be an estimate of the portion of V_{DZ} that is due to environmental variation. Thus, the quantity H , defined by $H = (V_{DZ} - V_{MZ}) / V_{DZ}$, is a measure of the proportion of the variance of the differences between dizygous twin that can be attributed to genetic variation. It is, then, in this limited sense, a measure of the degree of heritability of the trait concerned (Cavalli-Sforza and Bodmer, 1971). To test the significance of the H estimates, t-test was employed.

RESULTS AND DISCUSSION

Table 1 shows the H estimates and t-values for the anthropometric characters among the MZ and DZ twin pairs of Delhi. As expected, the H estimates for most of the linear measurements show a comparatively higher genetic variation than those in skinfolds at biceps and triceps in both the sexes. High H values have been found in height vertex, body weight, sitting height vertex, biacromial breadth and bicristal breadth. H estimates for skinfold at biceps and triceps have not been found to differ significantly from zero.

t-values on the basis of the means of differences between MZ and DZ twin pairs show significant differences in height vertex, sitting height vertex, bicristal breadth and maximum head breadth in both the sexes. In other measurements such as body weight and biacromial breadth, significant differences has been found in males and non-significant differences in female twin pairs.

The heritability estimates and corresponding values reestablish some of the findings by earlier workers. (Kaur and Singh, 1981; Muller, 1977; Mueller and Tit Comb, 1977; Mueller and Malina, 1980; Osborne and De George, 1959; Rama and Reddy, 1983). It has been seen that the genetic component has been found to be higher in bone lengths than in the measures of soft tissues. The genetic contribution to adolescent spurt have been studied among 55 Punjabi twin pairs (Sharma, 1978) and a comparatively higher values for stature, sitting height and some other length measurements have been found. The low values for skinfolds at biceps and triceps indicate the higher environmental influence on them than the length measurements.

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Table 1: Heritability estimates and t-values for some anthropometric measurements among monozygous and dizygous twin pairs

S. Anthropometric No. Measurements	Males		Females	
	H	t(df=29)	H	t(df=16)
1. Height Vertex	0.859	4.479*	0.960	3.348*
2. Body Weight	0.953	2.175*	0.971	1.672
3. Sitting Height Vertex	0.907	2.913*	0.959	6.727*
4. Biacromial Breadth	0.785	1.898	0.914	2.955*
5. Bicristal Breadth	0.882	2.779*	0.901	3.202*
6. Maximum Head Length	0.815	2.035	0.227	0.626
7. Maximum Head Breadth	0.791	2.769*	0.650	3.920*
8. Skinfold at Biceps	0.071	0.171	0.061	2.000
9. Skinfold at Triceps	0.593	1.985	0.308	0.113

* Significant at 5% level