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HUMAN CHROMOSOMAL HETEROMORPHISMS IN AMERICAN BLACKS VII. CORRELATION (r) BETWEEN HEIGHT AND THE SIZE OF THE Y CHROMOSOME

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Summary Fifty normal American Blacks were selected to examine the correlation between the length of the Y chromosome and their height using QFQ technique. Chromosomes 19 and 20 (F group) and Y were measured directly from the film and Y/F indices were calculated as a parameter of Y length. The average length of the Y chromosome was 1.09. There was no correlation between the height of an individual with the length of his Y ($p > .01$). The biological and clinical significance of human Y chromosome heteromorphisms is discussed.

INTRODUCTION

The length variation (heteromorphism) of the long arm of the human Y chromosome is a long established fact (Denver Conference, 1960; Makino and Muramoto, 1964). Family studies indicate that Y chromosome length is an inherited feature (Bishop *et al.*, 1962; McKenzie *et al.*, 1972). The biological and clinical significance of the heteromorphic nature of the human Y chromosome is very poorly understood. Some investigators have found a longer Y in criminals (Soudek and Laraya, 1974) while others have not found any length difference between criminals and non-criminal controls (Benezich *et al.*, 1976 and Brogger *et al.*, 1977). Lubs and Patil (1975) suggested that there is a North/South gradient in the length of the Y in Europeans; men of Mediterranean origin having a longer Y. Further, they suggested that a long Y chromosome may be an important cause of fetal loss (Patil and Lubs, 1977). In the present communication the length of Y chromosome was compared with each individual's height to see if a correlation existed.

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MATERIALS AND METHODS

The fifty normal American Blacks selected were all healthy and between the ages of 25 and 65. The length of the Y chromosome was not known at the time of selection for the study. The height of each individual was recorded. All chromosome preparations were made from cultured peripheral blood (Verma *et al.*, 1977). In order to facilitate the accurate and rapid identification of the Y chromosome, QFQ cells were photographed on tri-X Pan film using a Zeiss Photomicroscope II (Verma and Lubs, 1975, 1976; Verma and Dosik, 1976). At least 20 to 30 cells were photographed from each individual with more than 1,500 cells photographed.

The five best differentiated cells were selected from each individual. Chromosomes were measured directly from the negative as there is a considerable amount of information lost during printing. Cells were projected by a Simmon Omega Point light source enlarger (Simmon Omega, Inc. NY, USA: magnification $\times$ 8000). All chromosomes 19, 20 (F group) and the total Y length were measured in the same cell. The value of F was based on the average lengths of chromosomes 19 and 20. From these measurements the Y/F ratio was determined for each cell and the average was taken from five cells.

In order to determine the "functional relationship" of one variable with another (*e.g.* height of the individuals *vs.* total length of Y chromosome), a regression coefficient analysis relation was performed. A "Function" is a mathematical relation enabling us to predict what value of a variable Y (Y/F index) corresponds to given values of a variable h (height). A Y-intercept (a), and regression coefficient (b) was calculated to determine the regression equation. A test of significance of regression coefficient was also performed. We also employed correlation coefficient (r) analysis to examine the degree to which two variables vary together. Once established, such an association is likely to lead to reasoning about causal relations between two variables. Test of significance and confidence limits for correlation coefficients were also calculated (Sokal and Rohlf, 1969).

RESULTS AND DISCUSSION

In order to examine the possible correlation between the length of the Y chromosome with the height of the individuals, we selected normal American Blacks. Because the black population has a longer Y than caucasians (Verma and Dosik unpublished) perhaps more meaningful conclusions can be drawn. The average height was 172.49 cm and average length of the Y chromosome was 1.09. A functional relation between two variables (*e.g.* height *vs.* length of the Y chromosome) was calculated by using regression coefficient analysis and a regression line was established (Fig. 1). The correlation coefficient (r) was also calculated and tested by the t-test. The correlation coefficient (r) was 0.2323 and the 95% confidence interval was com-

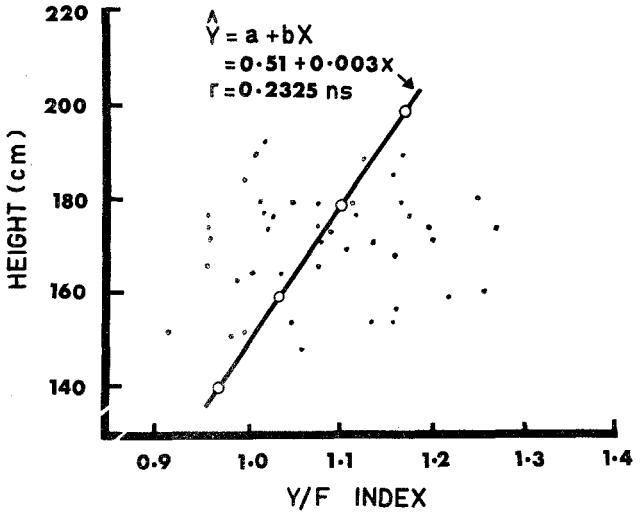

Fig. 1. The length of the Y chromosome (Y/F index) is plotted against the height of the individuals. Regression line is also shown: a, intercept; b, regression coefficient and r, correlation coefficient which is not significant.

puted to be 0.0230–0.5573. It was found that there was no significant correlation ($p > 0.01$) between height of an individual with length of his Y chromosome. The graphic plot is shown in Fig. 1.

It is concluded from our data that the length of the Y chromosome is not dependent on the height of the individuals. Thus, two variables vary independently. In man, only two genes have been assigned to the Y chromosome (McKusick and Ruddle, 1977). The TDF (testis determining factor) is located on the short arm, while H-Y (Y-histocompatibility antigen) gene is located in the non-fluorescent (nf) segment of the Y chromosome. The present study suggests that the variable size of the Y chromosome does not have any phenotypic effect. The reason for the heteromorphic size of the long arm of the Y chromosome is still not known for certain. Extremely short Y chromosomes are generally thought to be the result of deletion (Conen *et al.*, 1961; Muldal and Ockey, 1962; Nakagome *et al.*, 1965; Genest *et al.*, 1970). Muldal and his colleagues came to this conclusion, because of the lack of the distal portion of the Y chromosome.

Other clinical parameters like the size of testis, and secondary sex characteristics should be compared with the total length, fluorescent and non-fluorescent segments of the Y chromosome.

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ADDENDUM

Since the preparation of this manuscript (Yamada *et al.*) found some correlation of height and the fluorescent portion of Yq (Yq12) but not a significant correlation of height with Yq in a Japanese population. Further measurements will have to be performed in other populations to confirm their findings.