

Y/E Index in a Swedish Population¹

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SUMMARY

The Y/E index (Y/16-18 chromosomes) has been studied in a Swedish population of 74 men. The following results have been obtained: $M = 0.734 \pm 0.0238$ with a range from 0.57 to 0.90. The values agree well with those of a Finnish population previously described. The use of the Y/E index in 15 paternity cases is exemplified.

After the initial report on an exceptionally long Y chromosome in a normal man (Bender and Gooch, 1961) much interest has been drawn to the variation on the human Y chromosome.

The long Y chromosome has been studied by numerous workers (Tonomura and Ono, 1963; Van Wijck et al, 1963; Gripenberg, 1964; Makino and Muramoto, 1964; Makino et al, 1964; Court Brown et al, 1965; Cohen et al, 1966) and it is now accepted that the variation in length does not influence the phenotype. It has also been shown, by family data, that the length of the Y chromosome is an heritable character (Bishop et al, 1962; Makino et al, 1963; Gustafsson et al, 1964). In one case it has even been possible to trace a large Y chromosome in three generations (De la Chapelle et al, 1963).

Nuzzo et al described in 1966 a case in which the findings of a long Y chromosome led to an exclusion of paternity. No Y/E indices were given. The exclusion was confirmed by the blood group determination. Nuzzo regarded the practical importance of this test as little, but thought that the test could be valuable if techniques were refined.

Unnérus et al (1967) introduced the Y/E index (E group = 16-18 chromosomes). In a series of 30 Finlanders they found highly significant interindividual differences, the mean values ranging from 0.55 to 0.88 (Y/E ratio). The mean value of the population was 0.7306 ± 0.012 . According to these authors the Y/E index could be used in paternity cases.

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Methodology and Material

The leucocytes were cultivated according to a modification of the method of Fröland (1962) and harvest after 48 hours. The slides were air dried and stained with Giemsa. Ten cells of good quality were selected for measurement. All the small (D-G) chromosomes should be identifiable and Y and E chromosomes should all be straight and oriented in the same plane.

For identification of the Y chromosome we have used the following criteria: (a) it is not satellited, (b) its short arms are relatively shorter than those of chromosomes 21 and 22, and (c) its long arms are seldom spread apart.

Estimates of Y chromosome length were derived by generating Y/E indices using the following formula:

$$Y/E = \frac{\text{total length of the Y chromosome}}{\text{average total length of the E chromosomes}}$$

During the period of August 1966 to October 1969 we have obtained well-spread cell preparations from 74 unrelated, phenotypically normal men attending the Department of Forensic-Anthropological Genetics. From the original material 6 men were excluded because of bad preparations. We have no reason to believe that this selection led to any bias.

Tab. 1. Y/E indices of 74 Swedes

N	Y/E ratio	N	Y/E ratio
1	0.57	3	0.73
2	0.61	5	0.74
2	0.62	3	0.75
2	0.64	4	0.76
2	0.65	6	0.77
1	0.66	5	0.78
3	0.67	3	0.79
6	0.68	6	0.80
2	0.69	2	0.81
2	0.70	2	0.82
3	0.71	1	0.83
6	0.72	1	0.87
		1	0.90
Total		74	0.734 ± 0.0238

Results

From each individual 10 cells were analysed. Mean length and standard errors were calculated (Y/E indices). The Y/E indices of 74 Swedes are given in Tab. I.

The mean value of the population, calculated from Tab. I, is 0.734 ± 0.0238 and the range 0.57 to 0.90. The distribution of the 740 observations is a Gaussian one.

The Y/E index has been determined in paternity cases at the department, since 1969, as a routine test. All cases had passed blood group analysis: at least ABO, MN, Rh with subgroups, and Hp and often also Gc and Ag(x), without any man being excluded. In every case anthropological traits, including fingerprints, were examined. Red cell acid phosphatase (RCAP) groups were analysed (Broman et al, 1971). As an example of the usefulness of the Y/E index, data from 15 paternity cases are shown in Tab. II.

Tab. II. Y/E indices compared with RCAP groups in 15 paternity cases

Case	Y/E index	<i>t</i>	<i>P</i>	RCAP genotypes	Excluded by RCAP
S 58/65 mother				CB	
boy	0.79 ± 0.032			CB	
man 1	0.78 ± 0.022	0.81	0.4 < <i>P</i> < 0.5	BA	
man 2	0.65 ± 0.023	11.2	<i>P</i> < 0.001	BA	
S 37/66 mother				CA	
boy	0.78 ± 0.023			CA	
man 1	0.69 ± 0.026	6.35	<i>P</i> < 0.001	B	excluded
man 2	0.77 ± 0.035	0.76	0.4 < <i>P</i> < 0.5	A	
S 69/68 mother				BA	
boy	0.73 ± 0.022			A	
man 1	0.80 ± 0.027	6.31	<i>P</i> < 0.001	A	
man 2	0.80 ± 0.037	5.20	<i>P</i> < 0.001	B	excluded
man 3	0.72 ± 0.020	1.11	0.2 < <i>P</i> < 0.3	BA	
S 6/69 mother				BA	
boy	0.71 ± 0.026			BA	
man 1	0.80 ± 0.023	8.1	<i>P</i> < 0.001	BA	
man 2	0.70 ± 0.022	0.93	0.3 < <i>P</i> < 0.4	B	
S 9/69 mother				BA	
boy	0.82 ± 0.024			A	
man 1	0.64 ± 0.026	17.1	<i>P</i> < 0.001	B	excluded
man 2	0.82 ± 0.029			BA	
S 14/69 mother				A	
boy	0.77 ± 0.019			BA	
man 1	0.78 ± 0.017	1.12	0.2 < <i>P</i> < 0.3	B	
man 2	0.77 ± 0.020			B	
S 15/69 mother				B	
boy	0.76 ± 0.020			B	
man 1	0.77 ± 0.021	1.1	0.2 < <i>P</i> < 0.3	B	
man 2	0.78 ± 0.025	1.98	0.05 < <i>P</i> < 0.1	BA	
man 3	0.79 ± 0.028	2.8	0.01 < <i>P</i> < 0.02	BA	

Tab. II. *Continued*

Case	Y/E index	<i>t</i>	<i>P</i>	RCAP genotypes	Excluded by RCAP
S 23/69 mother				BA	
boy	0.81 ± 0.028			BA	
man 1	0.81 ± 0.026			B	
man 2	0.68 ± 0.033	9.6	<i>P</i> < 0.001	B	
S 26/69 mother				BA	
boy	0.79 ± 0.027			A	
man 1	0.61 ± 0.021	16.9	<i>P</i> < 0.001	CB	excluded
man 2	0.81 ± 0.026	1.69	0.1 < <i>P</i> < 0.2	A	
S 27/69 mother				CB	
boy	0.89 ± 0.024			CB	
man 1	0.66 ± 0.026	20.0	<i>P</i> < 0.001	B	
man 2	0.87 ± 0.013	2.3	0.02 < <i>P</i> < 0.05	B	
S 41/69 mother				A	
boy	0.74 ± 0.025			BA	
man 1	0.74 ± 0.019			BA	
man 2	0.79 ± 0.018	5.1	<i>P</i> < 0.001	BA	
S 52/69 mother				CB	
boy	0.82 ± 0.022			CB	
man 1	0.73 ± 0.021	9.2	<i>P</i> < 0.001	BA	
man 2	0.82 ± 0.023			BA	
S 56/69 mother				BA	
boy	0.67 ± 0.025			CA	
man 1	0.90 ± 0.022	21.4	<i>P</i> < 0.001	B	excluded
man 2	0.67 ± 0.021			CA	
S 58/69 mother				BA	
boy	0.80 ± 0.025			B	
man 1	0.79 ± 0.025	0.79	0.4 < <i>P</i> < 0.5	BA	
man 2	0.67 ± 0.035	12.4	<i>P</i> < 0.001	CA	excluded
S 62/69 mother				CB	
boy	0.69 ± 0.18			B	
man 1	0.69 ± 0.026			B	
man 2	0.78 ± 0.016	10.9	<i>P</i> < 0.001	A	excluded

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RIASSUNTO

L'indice Y/E (cromosomi Y/16-18) è stato studiato in una popolazione svedese di 74 uomini, con i seguenti risultati: $M = 0.734 \pm 0.0238$, con una variazione da 0.57 a 0.90. I valori concordano con quelli di una popolazione finlandese precedentemente descritta. Viene esemplificato l'uso dell'indice Y/E in 15 casi di paternità.

RÉSUMÉ

L'index Y/E (chromosomes Y/16-18) a été étudié chez une population suédoise de 74 hommes avec les résultats suivants: $M = 0.734 \pm 0.0238$ avec une variation de 0.57 à 0.90. Ces valeurs sont assez bien en accord avec les valeurs d'une population finlandaise précédemment étudiée. L'utilité de l'index Y/E est illustrée en 15 cas de paternité.

ZUSAMMENFASSUNG

Bei einer schwedischen Bevölkerung von 74 Männern wurde den Y/E-Index (Y/16-18 Chromosomen) untersucht. Ergebnisse: $M = 0.734 \pm 0.0238$ mit einer Variation von 0.57 bis 0.90. Die Indexwerte stimmen ziemlich mit denen einer finnischen Bevölkerung überein. Die Anwendung des Y/E-Indexes wird an 15 Vaterschaftsfällen erläutert.

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