THE FREQUENCY OF THE A B O BLOOD GROUPS IN DUBLIN

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A RECENT analysis of the records of the National Blood Transfusion Association of Ireland has yielded the following numbers of people of groups *O*, *A*, *B* and *AB* living in the Dublin area. As far as is known, there has been no selecting of people of a particular group.

TABLE 1

The total data

Group	Number	Percentage
O	5050	*53·79207*
A	3079	*32·79719*
B	1019	*10·85428*
AB	240	*2·55646*
Total . .	9388	*100·00000*

TABLE 2

Numbers of men and women of groups O and A

	O	A	Total	$\frac{A}{A+O}\%$
Men . .	3279	2035	**5314**	38·295
Women .	1771	1044	**2815**	37·087
Total .	5050	3079	**8129**	...

$\chi^2 = 1{\cdot}14129$ for 1 degree of freedom
P $= 0{\cdot}30$ (or $0{\cdot}15$ if direction is taken into account)

While these relatively small numbers do not reveal any significant sex difference, it should be noted that the percentage difference of the $\frac{A}{A+O}$ ratio ($+1{\cdot}208$) is in the same direction and of the same order of magnitude as that discovered in an analysis of English data (Fisher and Roberts, 1943). In this latter study the large numbers involved revealed the difference to be significant.

Table 3 sets out the present data, together with independent data previously published for this area.

Thus the data may be considered homogeneous. From the totals for the *O*, *A* and *B* groups the gene frequencies and the expected number in group *AB* can be calculated, assuming a random mating system, by the method proposed by R. A. Fisher (Race and Sanger, 1950).

Frequency of gene $O = 0{\cdot}7278$
Frequency of gene $A = 0{\cdot}1982$
Frequency of gene $B = 0{\cdot}0740$

$1{\cdot}0000$

TABLE 3

Source	O	A	B	AB	Totals
Boyd and Boyd *	220	124	48	7	399
Sachs (1940)	1305	789	280	61	2,435
Hooper (1947)	2394	1557	569	123	4,643
Present data	5050	3079	1019	240	9,388
Totals	8969	5549	1916	431	16,865
Percentages	53·18114	32·90246	11·36081	2·55559	100·00000

χ^2 for 9 degrees of freedom = 11·26985
P = 0·25

* Cited by Weiner (1943).

Expected number in group $AB = 496{\cdot}4337$ with variance of 668·5923.

When the observed and the expected numbers of people in group *AB* are compared ; $\chi^2 = 6{\cdot}40385$ for 1 degree of freedom. P = 0·01. Thus there is a significant deficiency in group *AB*. It is worth enquiring specifically whether the four independent sets of data are homogeneous for deficiency in this group.

If *o*, *a* and *b* are the frequencies of genes *O*, *A* and *B* calculated from the grand totals for groups *O*, *A* and *B* (these frequencies are given above), and for any one set of data the observed total number in the 3 groups *O*, *A* and *B* is *n*, and the expected total number in all four groups is N, then :—

$$n = \mathrm{N}(1-2ab)$$

$$\mathrm{N} = \frac{n}{1-2ab}$$

Expected number of $AB = \mathrm{N}-n = \frac{2ab}{1-2ab}n$

This can be shown to have a variance of $\frac{2abn}{(1-2ab)(a+o)(b+o)}$

In this way the expected number of people of group *AB* can be

calculated for each set of data and then compared with the observed number by a χ^2 test. The agreement between the sets of data can be estimated by calculating the heterogeneity χ^2 as summarised in table 4.

TABLE 4

Source	AB observed	AB expected	AB observed − AB expected	Variance	χ^2
Boyd and Boyd	7	*11·8414*	− 4·8414	15·9479	1·46975
Sachs	61	*71·7131*	−10·7131	96·5826	1·18832
Hooper	123	*136·5389*	−13·5389	183·8893	0·99681
Present data	240	*276·3403*	−36·3403	372·1724	3·54839
Summed χ^2 (4 degrees of freedom)					7·20327
Total data	431	*496·4337*	−65·4337	668·5922	6·40385
Heterogeneity χ^2 (3 degrees of freedom)					0·79942

P = 0·85

Thus all the sets of data agree in showing a deficiency in group *AB*. It is emphasised that the calculation of the expected numbers in group *AB* implies a random mating system and no differential survival and it is probable that one of these assumptions is unjustified. The first possibility that presents itself is that the assumption of a random mating system is invalidated by the barriers that tend to prevent intermarrying of Roman-Catholics and Non-Roman-Catholics. It is a reasonable guess that the gene frequencies among the Non-Roman-Catholics (many of whom are descendants of English settlers) are roughly half-way between the average frequencies for England and Dublin. The gene frequencies for the Non-Roman-Catholics can then be calculated knowing that there are 498,233 Roman-Catholics and 52,492 Non-Roman-Catholics in the area (Census of Population, 1946), and assuming our total data to constitute a representative sample. The results of these calculations are set out in table 5.

TABLE 5

	o	*a*	*b*	Expected number in group AB
England (Dobson and Ikin, 1946)	0·6831	0·2569	0·0600	...
Dublin (present data)	0·7278	0·1982	0·0740	...
Dublin Non-Roman-Catholic	0·7055	0·2275	0·0670	49·0047
Dublin Roman-Catholic	0·7302	0·1951	0·0747	446·6659
				495·6706

Thus there is a slight tendency for the *A*'s and *B*'s to be separated by this division. The expected total number of *AB*'s is calculated assuming random mating within each group but no inter-marrying. This total (495·6706) is to be compared with the expected number assuming a completely random mating system (496·4337) and the observed number (431). Even allowing for considerable inaccuracies in the suggested gene frequencies in these two groups, it is clear that the religious barriers will not account for a deficiency in group *AB* of the magnitude of that observed. Further elucidation of the problem is not possible from the present data.

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