Transferrin Variants in Greeks
B. ANGELOPOULOS, A. KALOS, and E. DANOPoulos

From the Department of Pathological Physiology, Athens University, Athens 6, Greece

The transferrins are a group of iron-binding glucoproteins migrating in the β-globulin region on starch gel electrophoresis (Smithies and Hiller, 1959). Commonly, there is a single iron-binding band called transferrin C, but faster (B variants) and slower (D variants) migrating bands are occasionally present. They are termed in order of electrophoretic mobility towards the anode Bo, Bo-1, B1, B1-2, B2, B3, C, D0, D4, D1, D2, and D3 (Bearn and Parker, 1964).

Family studies have indicated that the different transferrins are genetically controlled by a number of autosomal genes (Smithies, 1958; Parker and Bearn, 1962; Arends, Gallango, Parker, and Bearn, 1962; Lai, 1963; Glen-Bott, Harris, Robson, Bearn, and Parker, 1964). Individuals with two transferrin bands, i.e., B1,C, are heterozygous for the genes controlling the B1 and C variants, while individuals with one transferrin band only are homozygous for the corresponding gene.

The phenotype B1,C occurs with a frequency of around 1% in Caucasian populations (Bearn and Parker, 1964). The phenotype Bo-1C with a frequency of 8% in Navajo Indians (Parker and Bearn, 1961a), the phenotype D1,C with a frequency of 12% among Negro populations (Neel, Robinson, Zuelzer, Livingstone and Sutton, 1961; Allison and Barnicot, 1960), and the phenotype Dci,C with a frequency of 6% among Chinese (Parker and Bearn, 1961b; Kirk and Lai, 1961). The remaining phenotypes appear to be rather rare. This paper reports the frequency of transferrin variants in Greeks.

Materials and Method

Sera were collected from 2050 healthy adults (medical students, soldiers and blood donors) and the samples were stored in deep freeze (−18°C.).

The sera were examined by starch gel electrophoresis using the vertical method of Smithies (1959) in borate buffer pH 8.6. Radioactive iron (59Fe) was added to the samples before electrophoresis. As usual the gel was sliced into three layers; the upper layer was not used, the middle layer was stained with amido-black 10-B to reveal proteins, and the lower one was used for the detection of transferrins by autoradiography. The Nitroso-R reagent of Smithies (1959) was also used to check the identity of the variants as iron-binding proteins.

Results and Discussion

In 2041 out of the 2050 people examined only transferrin C was found. In 6 Greeks a slow transferrin band was found in addition to transferrin C, while in 3 persons a faster-migrating band besides transferrin C was noticed. Therefore, 2041 (99.56%) people were of phenotype CC, 6 (0.29%) of phenotype CD1, and 3 (0.15%) subjects were of phenotype CB2.

On our findings the frequency of gene TfC is 0.9978 in the Greek population, of gene TfD1, it is 0.0015, and of gene TFb, it is 0.0007.

No case of transferrinaemia among the 2050 tested specimens was noticed. In 10 sera specimens no migration of radioactive iron to the anode during electrophoresis was observed. These sera have been preserved in deep freeze for more than six months. When fresh collected blood specimens from the same subjects were tested again, the migration of the radioactive iron was perfect and the 10 sera were found to be homozygous for transferrin C. We believe that denaturation of the iron-binding globulin during long preservation in low temperature is responsible for this phenomenon.

A comparison of the results obtained in the present study and the published reports on the distribution of transferrin phenotypes in Caucasians is illustrated in the Table.

As can be seen from the Table, the frequency of transferrin C in the Greek population is a little higher than in the English (Harris, Robson, and Siniscalco, 1958), American (Giblett, 1962), Canadian (Smithies, 1959), and Swedish populations (Beckman and Holmgren, 1961). Furthermore, the TfD1 gene frequency is twice as high as the TfB2.
gene frequency in the Greek population, while in the Caucasian the frequency of the latter gene is greater than of the former gene.

Few studies are available on the distribution of transferrin variants on populations of the Balkan area and Mediterranean basin. Blumberg, Murray, Allison, Barnicot, Hirschfeld and Krimbas, (1964) report the presence of TfC, TfD1, and TfB2 genes in the Greek population (649 specimens), while Ramot, Duvdevani-Zikert, and Kende (1962) and M. Boia (1965, personal communication) in their studies on the distribution of transferrins in Israelis (2334 specimens) and Rumanians (226 specimens), respectively, did not report the presence of any other transferrin variant except that of C.

No correlation was found between serum transferrin and serum haptoglobin types or between the transferrin types and the ABO, MN, and Rh red cell blood groups.

### Summary

Transferrin variants were studied in 2050 healthy Greek adults, by the vertical method of starch gel electrophoresis. The identification of transferrin variants was carried out by a combination of amido-black staining and autoradiography.

Of the 2050 people examined, 2041 were of phenotype CC, 6 of phenotype CD1, and 3 of phenotype CB2.

The phenotype CC occurs with a frequency of 99.56%, while CD1 and CB2 have frequencies of 0.29% and 0.15%, respectively.

In the Greek population, the frequency of gene C is 0.9978, of gene D1 it is 0.0015, and of gene B2 it is 0.0007.

Our results are compared with those already published.

### References


