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APLICATION OF THE POLYMORPHISM OF PHOSPHOGLYCOLATE PHOSPHATASE IN FORENSIC MEDICINE

Phosphoglycolate phosphatase (PGP, EC. 3.1.3.18) found in red blood cells as well as in other tissues is considered to have an influence on oxygen transport by inactivating phosphoglycolate and increasing the level of 2,3-diphosphoglycerate(8).

The polymorphism of PGP was first described by Barker and Hopkinson(2). The six common phenotypes PGP 1,2,2-1,3,3-1 and 3-2 have been interpreted by these authors as a products of the different combinations of three alleles PGP^1, PGP^2 and PGP^3 at an autosomal locus.

Numerous population and family study (2,3,5,6) as well as possibility detectable PGP isozyme in blood stains material (4) proved that this genetic marker may be useful in the forensic serology.

This paper reports on phenotype and gene frequencies in a population sample from North Poland and detemination of PGP phenotypes from bloodstains.

Material and method.

Blood samples of 631 healthy and unrelated adults were investigated according to the method of Barker and Hopkinson (2) with following modyfications: the buffer system used was a 0,2 M TEMM pH 7,2. The gel buffer was prepared by diluting the stock buffer 1 in 15. The starch gel were made with 11% hydrolysed starch and 1 mM 2-mercaptoethanol. Electrophoresis was carried out at 110V 40mA for 22 h at $4^{\circ}C$. The staining procedure was the same as the original method. The mode of inheritance of PGP

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factors was observed in 174 mother-child pairs.

Determination of PGP phenotypes from blood stains has been obtained. 20 samples of blood with known PGP phenotypes were poured on strips of white cloth and dried at room temperature. Strips of the stained cloth of size of about 4 square mm were put directly on the starch gel with a drop of the electrophoresis buffer. Electrophoresis conditions and staining were the same as the method used for fresh blood.

Result and discussion.

PGP isoenzyme bands are found between 6 and 8 cm from the origin on the anodal side of gel. Six isoenzyme patterns 1,2, 2-1,3-1,3-2 and 3 were recognized. Basing on phenotype frequencies, frequency of PGP genes in the Polish population were calculated. The results of the present investagation are given in Tabele 1.

Tabele 1. Phenotypes and gene frequencies of PGP in a population sample of North Poland.

Phenotyp	Phenotypes frequencies				Gene frequencies
	Observed		Expected		
	n	%	n	%	
1	462	73.22	456	72.27	
2-1	118	18.70	123	19.49	PGP^1=0.8502
2	10	1.58	8	1.27	
3-1	31	4.91	34	5.39	PGP^2=0.1165
3-2	9	1.43	4	0.63	
3	1	0.16	6	0.95	PGP^3=0.0333
Total	631	100.oo	631	100.oo	

Observed and expected values are in good agreement under Hardy-Weinberg conditions. The estimate for the gene frequency of PGP a comparison of different caucasian gene frequency data shows that there are no significant differences between our re-

sults and the values reported by other authors (1,2,3,4,5,6,7). Tabele 2 presents the distribution of PGP phenotypes in 174 mother-child pairs.

Tabele 2. Determination of the PGP types in mother-child pairs.

Mother	Child						Total
	1	2-1	2	3-1	3-2	3	
1	102	18	-	2	-	-	122
2-1	15	12	2	3	2	-	34
2	-	4	-	-	-	-	4
3-1	5	2	-	4	-	-	11
3-2	-	3	-	-	-	-	3
3	-	-	-	-	-	-	-
Total	122	39	2	9	2	-	174

Investigation of mother-child pairs didn't reveal any deviation from Mendelian proportions. A mother-child exclusion was not observed. Up to now no "silent" allele and rare variants has been found in our material. The possibility to exclude non-father from paternity by means of the PGP-system is 12.6% in the Polish population.

In the material interpreted experimental stains the correct determination of PGP phenotypes was possible in all the cases of absorbed bloodstains up to 5 weeks old. In 3 cases it was also possible to determine PGP phenotypes in older blood stains - up to 7 weeks old, Tabele 3.

Tabele 3. Summary of experimental bloodstains of known PGP phenotypes.

No. of stains	Stain substrate	Age of stains		Correctly typed
		35 days	49 days	
20	cloth	17	3	20

There are several advantages of PGP polymorphism with respect to its application in forensic serology:

1 - the isozyme types can be detected by simple method in starch gel electrophoresis;

2 - good distribution PGP alleles in the population studies and its established formal genetics;

3 - high relative chance of exclusion non-father of this system;

4 - possibility detectable isozyme types in bloodstains material.

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