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The Polymorphism of Plasminogen (PLG) by Ultrathin-Layer Isoelectric Focusing

Distribution in the Veneto Population (Italy)*,**

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Summary. The distribution of plasminogen phenotypes in the population of Veneto was investigated by ultrathin-layer isoelectric focusing. In our sample ($n = 1325$), the three common phenotypes PLG1, PLG2, PLG2-1 and two further phenotypes PLG1-V and PLG2-V were, observed and the following frequencies calculated: $PLG^1 = 0.84038$; $PLG^2 = 0.15811$; $PLG^V = 0.00151$. These gene frequencies are compared to those found in other populations. Analysis of 41 mother-child pairs was in agreement with an autosomal codominant inheritance.

Key words: Plasminogen, genetic polimorphism (PLG) in the Veneto population – Blood groups, plasminogen

Zusammenfassung. Die Verteilung der PLG-Phänotypen wurde bei der venetischen Bevölkerung mittels Isoelektrofokussierung untersucht. In unseren Stichproben wurde die PLG-Phänotypen PLG1, PLG2, PLG2-1 und zwei weitere Phänotypen PLG1-V und PLG2-V beobachtet und folgende Frequenzen berechnet: $PLG^1 = 0.84038$; $PLG^2 = 0.15811$; $PLG^V = 0.00151$. Diese Genfrequenzen wurde mit den bei anderen Bevölkerungsgruppen gefundenen Frequenzen verglichen. Die Untersuchung von 41 Mutter-Kind-Paaren zeigte eine autosomal-kodominante Relation.

Schlüsselwörter: Plasminogen (PLG), genetischer Polymorphismus (PLG), venetische Bevölkerung – Blutgruppen, Plasminogen

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Introduction

Plasminogen is a normal plasma protein which is converted into plasmina by urokinase or streptokinase.

The genetic heterogeneity of human plasminogen was independently reported by Hobart [1] and Raum et al. [2] who used, respectively, electrophoresis following by the zymogram technique and isoelectric focusing followed by the immunofixation technique. They reported the occurrence of two common alleles at a single autosomal locus which Hobart called PLG^1 and PLG^2, whereas Raum et al. called them PLGN*A and PLGN*B.

In this paper we report the frequencies of PLG system in the Veneto population studied with a fixing-staining procedure (10% sulfosalicylic acid and Coomassie) after IEF on ultrathin layer gel of untreated sera.

Materials and Methods

Sera from 1325 unrelated blood donors and 41 mother-child pairs, provided by the Transfusion Center of the Civil Hospital of Padua, have been studied. PLG typing was performed according to Pascali et al. [3] by ultrathin layer isoelectric focusing on polyacrylamide gels (250 × 120 × 0.2 mm) on a cooling plate (8°C) of an LKB Ultraphor chamber connected to the LKB 2297 Power Supply. Each gel was made to a final concentration of acrylamide 5% (w/v) sucrose 12% (w/v) and Ampholine in the pH 5–8 range 3%. After 15 min of degasation polymerization was achieved with ammonium persulfate 0.05% (w/v). The following solutions were used: 0.25 M L-arginine + 0.25 M histidine in ethylenedyamine 12% (catholyte).

After 60 min of prefocusing undiluted samples were applied at 1 cm from the anode end by means of small paper (Whatman 3 MM 7 × 4 mm), and focusing was carried out for 2 h (the paper was removed after 60 min) with the following maximal conditions 1800 V, 11 mA, 3 W.

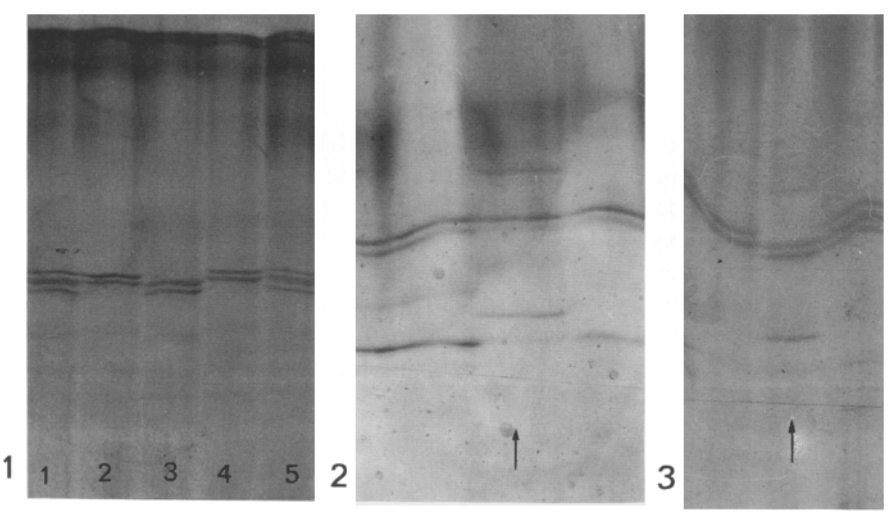

Fig. 1. PLG banding patterns after isoelectric focusing on polyacrylamide gel. From left to right: 1 (2/1), 2 (1), 3 (2), 4 (1), 5 (2/1) (anode on the top); **Fig. 2.** PLG1/v; **Fig. 3.** PLG2/v

Focused gels were fixed in 10% sulfosalicylic acid in water and stained with Coomassie. Fixing and staining required about 60 min on the whole.

Results and Discussion

The pattern of bands resulting from PLG typing on ultrathin-layer isoelectric focusing is shown in Figs. 1–3.

The distribution of PLG phenotypes and gene frequencies is shown in Table 1. The distribution of phenotypes is in good agreement with the Hardy-Weinberg law as shown by the χ^2 test.

Our results were compared to those obtained in other Italian regions and in other countries. All these gene frequencies are reported in Table 3.

The frequency of PLG^1 allele in the Veneto population is similar to that found in three other Italian localities: Arezzo, Roma, and Benevento [3] in

Table 1. The distribution of PLG phenotypes and gene frequencies in the Veneto popolation

PLG phenotypes	No. observed	Observed (%)	No. expected
1	936	70.64	935.76
2	33	2.49	33.13
2-1	352	26.57	352.12
1-V	3	0.23	3.36
2-V	1	0.07	0.63
V-V	0	0.00	0.00

Gene frequencies 1 = 0.84038; 2 = 0.15811; V = 0.00151;
$\chi^2 = 0.00057$ for 3 df $P > 0.99$

Table 2. Comparison of PLG alleles frequencies is several population groups

No. of cases		1	2	V
1325	Veneto (this study)	0.840	0.158	0.001
2116	Arezzo [3]	0.83	0.16	0.01
	Roma [3]	0.81	0.18	0.01
	Benevento [3]	0.81	0.18	0.01
	Lucania [3]	0.78	0.21	0.01
327	English [1]	0.71	0.29	–
89	Gambians [1]	0.86	0.14	–
258	Japanese [5]	0.958	0.020	0.022
400	Japanese from Tokyo [4]	0.969	0.031	–
1501	USA (Whites) [8]	0.665	0.304	0.030
576	Cologne area [7]	0.69	0.27	0.03
957	Southern Germany [6]	0.717	0.278	0.005

Table 3. Distribution of PLG phenotypes in 41 mother-child pairs

Mothers		Children			
		1	2	2-1	
1	18	17	–	1	18
2	15	–	11	4	15
2-1	8	1	3	4	8
	41				41

Gambians [2]; however, it is lower than that found in some Japanese population groups [4–5] and higher than that found in samples from Southern Germany [6], the Cologne area [7], England [2], the USA [8], and Lucania [3]. The PLG^2 allele has a frequency of 0.15811, which is very similar to those found in Roma, Arezzo, and Benevento [3], higher than those obtained in some Japanese populations [4–5], but lower than those found in England, Southern Germany [6], the Cologne area, and the USA. The PLG^V allele has a frequency lower than those found in all populations named above.

Finally, 41 mother-child pairs were investigated (Table 2). The segregation of PLG phenotypes was in accordance with the genetic model of an autosomal codominant mode of inheritance.

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