Polymorphism of Placental Phosphoglucomutase in Japanese

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OYA, M., SHIBATA, R., KIDO, A. and KOMATSU, N. *Polymorphism of Placental Phosphoglucomutase in Japanese*. Tohoku J. exp. Med., 1985, **146** (2), 189-192 — Polymorphism of PGM₁ and PGM₃ types was investigated in placental extracts from 127 unrelated Japanese parturients living in Yamanashi Prefecture. The gene frequencies were 0.787 for PGM₁¹, 0.213 for PGM₁²; 0.760 for PGM₃¹, 0.240 for PGM₃², respectively. There was no significant association between the PGM₁ and PGM₃ systems. The PGM₃² frequency in the present sample population was higher than those in Kanto District, but lower than those in Kinki District. ——— polymorphism; population study; placental phosphoglucomutase type; Japanese

Starch gel electrophoretic studies have shown that human red cell phosphoglucomutase (PGM) is separated into multiple isoenzyme components which are genetically controlled (Spencer et al. 1964). There have been three different autosomal loci found, PGM₁, PGM₂ and PGM₃, each determining a separate group of PGM isoenzymes (Hopkinson and Harris 1965, 1968).

Although the polymorphism of PGM₁ has been extensively investigated in the Japanese population, there have been only a few reports on that of PGM₃ (Ishimoto 1969; Mabuchi 1971; Ishizaki 1975; Yoshida et al. 1978; Akiyama and Abe 1983). Since the PGM₃ isoenzymes cannot ordinarily be detected in red cells, most of the work has been carried out using the placenta as the source of the enzyme. Data on the distribution of placental PGM types in a Japanese population of Yamanashi prefecture are presented in this report.

MATERIALS AND METHODS

Human term placentae from single birth of 127 unrelated Japanese parturients were provided by the Department of Obstetrics and Gynecology, Yamanashi Prefectural Central Hospital and stored at -20°C until use. A small piece of placental tissue was minced and homogenized in an equal volume of distilled water using an Ultra-Turrax homogenizer (Janke & Kunkel AG, Staufen im Breisgau, FRG). The homogenates were centrifuged at 3,000 rpm for 15 min and the supernatants were used for electrophoresis.

PGM typing was performed essentially as described by Hopkinson and Harris (1968).

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Starch gel electrophoresis was conducted at 4°C for 16 hr with a voltage gradient of 5 V/cm. After electrophoresis the gels were stained in a thermostatic dark chamber at 37°C using an agarose overlay technique. PGM₁ and PGM₂ isoenzymes were demonstrated after 30 min incubation, while PGM₃ isoenzymes were able to be detected after 120 min incubation.

RESULTS AND DISCUSSION

Fig. 1 depicts the typical electrophoretic patterns of PGM types in human placenta; all the placenta were typed as PGM₂. This is not surprising as the variation at the PGM₂ locus is extremely rare among the Japanese (Nishigaki et al. 1982; Satoh et al. 1984).

The results for the distribution and gene frequencies of PGM₁ and PGM₃ types are shown in Table 1. The samples studied included no rare variants. In both systems the observed numbers are in good agreement with the expected numbers on the basis of the Hardy-Weinberg law ($\chi^2=0.154$, d.f. = 1, $0.5 < p < 0.7$

Fig. 1. Starch gel electrophoretic patterns of PGM types in human placenta. Cathodal components, PGM₁; anodal components, PGM₃; intermediate components, PGM₂.

TABLE 1. *Distribution of PGM₁ and PGM₃ types in Japanese placenta*

	PGM ₁ 1	PGM ₁ 2-1	PGM ₁ 2	Total
PGM ₃ 1	45 (45.45)	30 (28.74)	3 (4.55)	78 (78.74)
PGM ₃ 2-1	25 (24.55)	17 (15.52)	2 (2.45)	44 (42.52)
PGM ₃ 2	1 (3.31)	4 (2.10)	0 (0.33)	5 (5.74)
Total	71 (73.31)	51 (46.36)	5 (7.33)	127 (127.00)

Gene frequency : PGM₁¹ = 0.787, PGM₁² = 0.213

PGM₃¹ = 0.760, PGM₃² = 0.240

TABLE 2. *PGM₃ gene frequencies in various Japanese populations*

Population	Source	No. observed	PGM ₁	PGM ₂	Reference
Mie	Placentae	370	0.809	0.191	Ishimoto 1969
Osaka	Placentae	625	0.806	0.194	Mabuchi 1971
Tokyo	Placentae	108	0.708	0.292	Ishizaki 1975
Kanagawa	Hair roots	248	0.621	0.379	Yoshida et al. 1978
Tokyo	Leucocytes	76	0.711	0.289	Akiyama and Abe 1983
Yamanashi	Placentae	127	0.760	0.240	Present study

for PGM₁; $\chi^2 = 1.279$, d.f. = 1, $0.2 < p < 0.3$ for PGM₃). There is no significant association between the PGM₁ and PGM₃ systems ($\chi^2 = 4.481$, d.f. = 4, $0.3 < p < 0.5$).

In Table 2 are summarized the gene frequencies of PGM₃ types so far reported for Japanese. The PGM₂ frequency in the present sample (0.240) is higher than those estimated in Mie (0.191) and in Osaka (0.194), but lower than those estimated in Tokyo (0.292), in Tokyo (0.289) and in Kanagawa (0.379). It may therefore be probable that the PGM₃ frequency is high in Kanto District and low in Kinki District, and the PGM₂ frequency in Yamanashi prefecture (Chubu District) lies between those in the above two districts. The population data accumulated up to now are so limited that at present it is premature to conclude that there exists a cline. Further population studies in various districts will solve this problem, particularly in the north-eastern and south-western parts of Japan.

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