Prevalence of G6PD deficiency in newborns in the south of Brazil

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Prevalence of G6PD deficiency in newborns in the south of Brazil

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Glucose-6-phosphate dehydrogenase (G6PD) deficiency is an X-linked disorder which causes neonatal jaundice in most cases, and in association with intake of drugs or certain foods (for example fava) can cause haemolytic crises. The aim of this study was to determine the prevalence of G6PD deficiency in Rio Grande do Sul (RS), the southernmost state of Brazil. We tested 2799 newborn blood samples. A commercial kit was used for the quantitative measurement of G6PD activity. Of the 2799 samples, 39 (1.4%) exhibited total deficiency, 178 (6.4%) exhibited intermediate deficiency and 2582 (92.2%) were normal. We found no correlation between G6PD deficiency and ethnic origin, but a high prevalence of patients with partial deficiency could be associated with the type of colonization of RS. The combined prevalence for both types of deficiency (complete and partial) was 7.9% among the newborn population. This finding is important as both types of deficiency must receive same kind of preventive care.

INTRODUCTION

Glucose-6-phosphate dehydrogenase (G6PD; EC 1.1.1.49) deficiency is a genetic disorder, which causes neonatal jaundice in most cases, and in association with drug or fava bean intake can induce haemolytic crises. It is one of the most common enzymopathies throughout the world. The disorder occurs most frequently in individuals of Mediterranean, African and Asian origin, with an incidence as high as 25% in some populations.[1] Inheritance of G6PD shows a characteristic X-linked pattern. In heterozygote females, the residual enzyme activity is 20–60% of that found in normal individuals. This is called 'partial deficiency' and these cases are also susceptible to severe haemolytic episodes, under unfavourable circumstances.

Data available in the literature are discrepant regarding the actual prevalence of G6PD deficiency in different regions of Brazil, suggesting values close to 7%.[2,3] The aim of this study was to determine the prevalence of G6PD deficiency in Rio Grande do Sul (RS), the southermost state of Brazil, by using more sensitive and specific tests than those used in earlier studies.[2,3]

MATERIALS AND METHODS

Blood specimens spotted on SS903 filter paper from newborns referred to the Neonatal Screening Reference Laboratory of RS, at the School of Pharmacy, UFRGS, were collected between January and November 2003. Samples were stored at 4°C until analysis. Enzyme activity was measured within three days of collection.

G6PD Deficiency Neonatal Screening Test Kit (Interscientific Corporation, Cat. No. 3570-050) was used for the quantitative measurement of G6PD activity, as previously described.[4] A blood spot paper disk (3 mm of diameter) was placed in a 96-well microplate. Elution buffer was added for the lysis of red blood cells. A measure of 15 µL of eluate were transferred to a new microplate and 75 µL of the working reagent was added. After 10 min, the whole microplate was measured once at 405 nm to evaluate the haemoglobin (Hb) content of each sample. Then a colour reagent was added and the plate was read at 570 nm in kinetic mode (ΔOD/min) to measure the nicotineamide adenine dinucleotide phosphate (NADPH) produced per minute. The samples were normalized for their Hb content and then compared with the reference samples (supplied by Interscientific) with three levels of G6PD activity: normal = 15.8 U/g Hb, intermediate = 4.7 U/g Hb and deficient = 1.3 U/g Hb (at 37°C). Statistical analysis was performed using SPSS v 11.0, using Student's *t*-test with statistical significance stated as $P < 0.05$.

RESULTS

Two thousand seven hundred ninety-nine newborns participated in this study. The distribution of values of G6PD according to gender and ethnic origin is shown in Table 1. Of the 2799 samples, 39 (1.4%) showed total deficiency, 178 (6.4%) showed intermediate deficiency, and 2582 (92.2%) were normal.

DISCUSSION

Although previous reports have shown that the prevalence of G6PD deficiency in several regions of Brazil is around 10% among men of African origin, and between 1% and 6% in Euro-descendent males, the present study reveals a combined prevalence of 7. 9% for the two forms of G6PD deficiency (complete and partial) in RS, South of Brazil, with a higher prevalence of partially deficient patients. This is a subtropical region, non-endemic for malaria, so our results would only reflect the gene pool of the ancestors.

Early in the 19th century, the most important groups that contributed to the colonization of RS were of Indian, African, Portuguese, Spanish, German and Italian origin, followed by Polish, Jewish, Syrian, Lebanese and Japanese

Table 1 Distribution of G6PD activity values in newborns according to gender and ethnic origin for the two major ethnic groups found in RS

	Gender			Ethnic Origin		
G6PD activity	Male (%)	Female (%)	*P*	Caucasians (%)	Afro (%)	*P*
Deficient (<2.0 U/g Hb)	25(1.7)	12 (0.9)	0.101	25 (1.1)	5 (3)	0.089
Partially deficient (2.0–6.0 U/g Hb)	99 (6.9)	82 (6.1)		146 (6.5)	13 (7.7)	
Normal (>6.1 U/g Hb)	1309 (91.3)	1245 (93)		2,080 (92.4)	151 (89.3)	
Total	1433 (100)	1339 (100)		2251(100)	169 (100)	

*Samples collected between January and November 2003, referred to the Neonatal Screening Programme Reference Laboratory of RS

settlers.[5] The high proportion of partial deficiency of G6PD on this study suggests the predominance of variant A–, which is characteristic of people with African origin[6] but also frequent in populations from Southern Italy, Spain, Portugal and Arabic Peninsula.[1] Although RS received immigration waves of Mediterranean people in the past, the proportion of complete G6PD deficiency was lower than the proportion of partially deficient found in the study. These findings can be explained by the fact that the waves of Italian immigrants that arrived in RS came, predominantly, from the North of Italy, where the frequency of G6PD deficiency is significantly lower than that observed in the Southern part of Italy, Sardinia and Sicily.[7] We should point out that the ethnic classification in this study was established by data collectors, so the lack of correlation among G6PD deficiency and ethnic origin may be due to the fact that the skin colour is not a true indicator of ethnic origin in Brazil.[8]

Moreover, these findings are of great practical significance because the prevalence of G6PD deficiency in women has been infrequently studied, and for many years G6PD-deficient heterozygotes were not regarded as being at risk. It has been shown that heterozygotes can develop severe neonatal hyperbilirubinaemia, being at risk as hemizygous males.[9,10] Despite being an X-linked disorder, G6PD deficiency is not uncommon among women. Because X-inactivation may be non-random, there may be varying phenotypes, and the red blood cells of heterozygotes may exhibit normal, intermediate or grossly deficient G6PD activity.[11] The method used to diagnose the G6PD-deficient individuals is important because a qualitative enzyme measurement is likely to pick up hemizygotes, heterozygotes and even individuals with less severe enzyme deficiency.[9] The quantitative measurement of enzymatic activity used in this study can give a satisfactory guide for the severity of G6PD deficiency in heterozygous females.

In conclusion, this study demonstrated that the prevalence of G6PD deficiency was 7.9% among the RS newborn population and it is important to consider that both types of deficiency should receive some kind of preventive care.

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