

Research Note

Glucose-6-phosphate Dehydrogenase Deficiency in Solomon Islands

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An enzyme deficiency in the red blood cell has great implications on health in some countries (WHO working group, 1989). In Solomon Islands, South-west Pacific, where malaria is highly endemic, glucose-6-phosphate dehydrogenase (G6PD) deficiency is a serious problem. If the genetic deficiency is severe, hemolysis may occur spontaneously and also on drug use with such as an antimalarial drug primaquine. This restricts the use of it in the radical treatment of *Plasmodium vivax* infection and the use of it in chemotherapeutic malaria control activities (Matsuoka *et al.*, 1986, Doi *et al.*, 1989). To our knowledge there has not been published any result of examination of G6PD deficiency in the Solomon Islands.

We examined the prevalence of G6PD deficiency in Solomon Islands by the use of Fujii's method which is simple and suitable for field study (Fujii *et al.*, 1984). Once the agar gel plates mixed with reagents are prepared, it is only necessary to collect few drops of blood on filter paper. Dried then punched out filter paper is placed on the agar plate and kept for 8 hours at 37°C to develop black formazan ring. If any subject deficient in G6PD in the red blood cell, the ring fails to appear. The result

is easily read by naked eye and measured to record as shown in Fig. 1.

Among 326 middle and high school students gathered from different islands, 47 (14.4%) showed G6PD deficiency. Among 632 blood donors in the Central Hospital of Honiara, 53 (8.4%) was found G6PD deficient by methohaemoglobin reduction method including intermediate type. Overall agreement between the two methods was 94% (Table 1).

Ethnically, melanesians was the highest group showed 8.6% (50/582) deficiency followed by polynesians 6.0% (3/50). Twenty six micronesians did not show deficiency. Rates of deficiency varied greatly in each island ranging from 0 to 50%. In more than 50 islanders found deficient, Santa Ysabel islanders showed high deficiency rate of 17.0% (16/94) in students and 24.1% (14/58) in blood donors. Students from Central Province including Guadalcanal island showed 18.8% (12/64) deficiency rate and blood donors from Guadalcanal showed 14.6% (12/82). These rates of deficiency were remarkably high. Fortunately 89 students did not show anaemia with much high Hb level of 14.3 ± 1.9 g/dl in average. Hb level was measured by the use of Ames Minilab PC. In the Central Hospital some patients are admitted with hemolysis and anaemia do exist among blood donors. Hb level was measured by cyanmethohaemoglobin method and correlation between the two methods is presented in Figure 2. Among 47 blood donors, Hb level was 10.6 ± 3.8 in average in 12 G6PD deficient patients whereas 12.6 ± 1.5 in 35 normals. Blood transfusion to treat the hemolytic crisis faces problems because of the high rate of Hbs Ag positives (29% (41/140) in our study by Dr. Y. Okubo) and malaria infected

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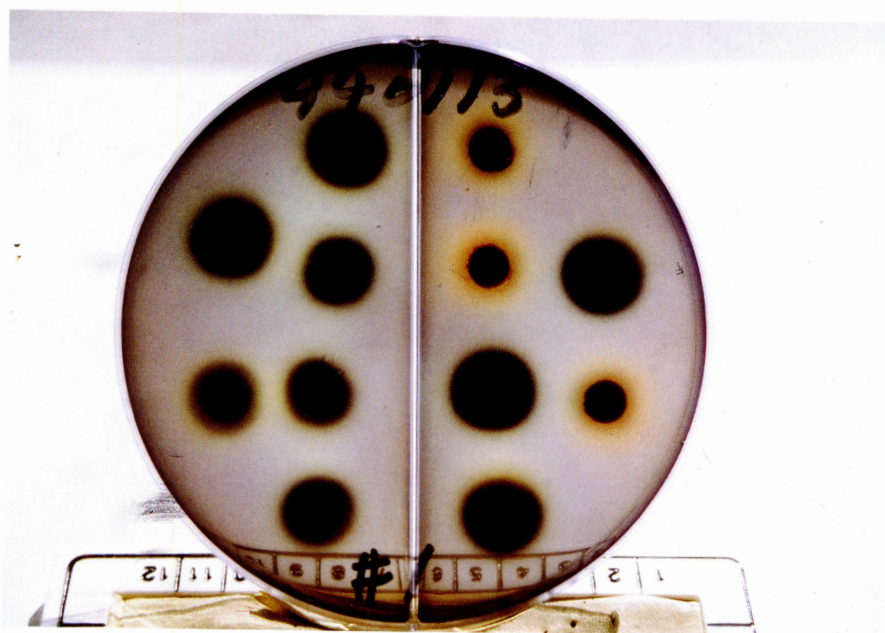


Fig. 1 A result of Fujii's method to examine G6PD deficiency in the red blood cell. Normal subjects develop black formazan ring larger than 9mm and deficient subject only show faint reddish colour around punched out blood soaked filter paper.

Table 1 G6PD deficiency in the Solomon Islands

Islands	Middle and high school students	Blood donors Central Hospital in Honiara
Malaita	11/103 (11%)	11/275 (4%)
Ysabel	16/94 (17%)	14/58 (24%)
Central	12/64 (19%)	14/99 (14%)
Makira	3/26 (12%)	N
Temotu	5/20 (25%)	N
New Georgia	N	8/71 (11%)
Santa Cruz	N	2/20 (10%)
Santa Cristobal	N	1/43 (2.3%)
Ontong Java	N	3/6 (50%)
Others	0/19	0
Total	47/326 (14.4%)	53/632 (8.4%)

N: none

individuals (36% including adult in our study).

The G6PD deficient rates do not correspond to the present day malaria endemicity where some islands such as Malaita, Guadalcanal and Central Province are the major malarious areas. History of

habitation in each island by different ethnic groups and interrelation of them is considered to be the determinants of the present distribution of deficiency rates in those islands of anthropological interests.

Furthermore, these high rates of G6PD deficiency pose problems in malaria treatment and control in Solomon Islands. For the radical treatment to prevent relapse of *P. vivax*, they need to use primaquine. After the decision made by the Solomon Government not to use primaquine because of high rate of G6PD deficiency, they have met problems of increase of malaria incidence and difficulties in the treatment of malaria in these days.

Single 45 mg/kg dose primaquine is used in the chemotherapeutic control of malaria as tried in Thailand and proved effective in North Sumatra, Indonesia (Charoenlarp *et al.*, 1972, Matsuoka *et al.*, 1986, Doi *et al.*, 1989). To pursue the effect of gametocyte killing of primaquine in the transmission blocking of malaria which is reported to be successful in those countries, we must be careful to avoid hemolytic crisis in G6PD deficient subjects.

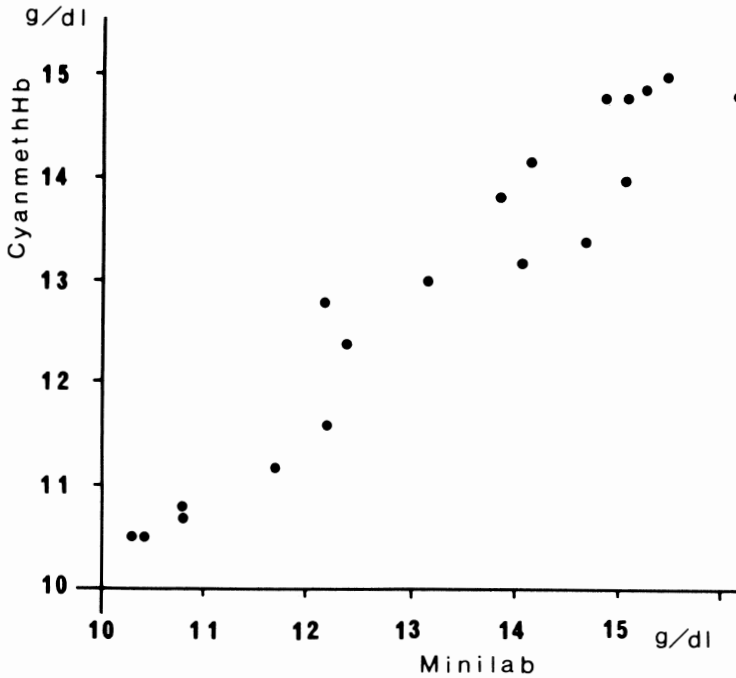


Fig. 2 Correlation between Minilab PC (Ames) and cyanmethohaemoglobin method.

Although the rate of hemolysis among deficient subjects is reported low up to 18% and practically caused no problem in Thai subjects (Charoenlarp *et al.*, 1972), we have to examine the state of G6PD deficiency in Solomon Islands not only for treatment but also for the control trial of malaria.

Fujii's method using agar gel plate is simple, easy and very useful in the field study in malarious areas. The cost of reagents for one examination is estimated about 1 Solomon dollar and one examination is enough because the result given is a life long information. Introduction of the method for the malaria problem in the Solomon Islands is highly recommended and should be encouraged to expand.

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