Surveys of Human Genetic Markers in Malaria Endemic Areas

Human blood polymorphic systems are important biochemical markers in anthropological surveys especially in relation to disease distribution. G-6-PD deficiency and certain haemoglobinopathies are known to confer a selective advantage to the subjects against falciparum malaria. However, certain antimalarials such as primaquine and other 8-aminoquinolines increase the oxidant stress in G-6-PD deficient individuals resulting in haemolytic crisis which can be fatal if not checked in time. Therefore, information on the frequency and distribution of these variants would help in the administration of proper drugs.

Haemoglobinopathies and G-6-PD Deficiency

Studies carried out by us on mapping of these disorders in various tribal/non-tribal groups living in malarious areas of the country have shown variable frequencies of G-6-PD deficiency (0–17.6%) among tribals of Andhra Pradesh, Assam, Gujarat, Madhya Pradesh, Orissa, Uttar Pradesh and Uttarakhand. Similarly, frequencies for sickle-cell haemoglobin (HbAS) ranged from 0 to 18.9% in various tribal groups and HbE (16.5%) was observed only among tribals of Assam. Fig. 101 shows the areas from where population samples have been screened and frequencies of G-6-PD deficiency, carriers of sickle-cell haemoglobin (HbAS), sickle-cell anaemia (HbAC), and haemoglobin E (HbE) have been recorded.

Fig. 101: Surveys of human genetic markers: Frequencies of G-6-PD deficiency (Gd) and haemoglobin (Hb) variants
cell (HbAS) and haemoglobin E (HbAE) (Joshi et al. 1985, 1987, 1991, 1998, 1999, 2001). Among non-tribals, G-6-PD deficiency and abnormal haemoglobins occurred in less than 1% of the population with a few exceptions. High incidence of genetic disorders among the tribal groups suggests probable selective role of these genes in the population in highly malarious areas.

A Simple Kit for the Detection of G-6-PD Deficiency

Keeping in view the importance of detecting G-6-PD deficiency in malaria chemotherapy, a simple kit was developed based on the principle of...
fluorescent spot method (Schmidt and Brosions 1978, US Deptt. HEW Pub No. (CDC) 78-8266, p. 77). The kit has been compared with the standard fluorescent spot and electrophoretic method using blood samples collected from Delhi and Sonapur, Assam. This kit has given satisfactory results till 2 weeks (16 days) under field conditions (30°C). Fig. 102 shows the results of evaluation of the kit at different storage conditions. Now the kit is being evaluated at many of the field units of NIMR to test its feasibility under field conditions.

**Ahaptoglobinaemia**

A high incidence of ahaptoglobinaemia (nontypable haptoglobin—HpO) was observed among malaria patients (Joshi et al 1987, 1998) (Fig. 103) and incidence increased with the increase in malaria attacks (Joshi et al 1991). Higher incidence of HpO was observed in the population during malaria epidemics (Joshi et al 1991, 1999). Antimalarial therapy in ahaptoglobinemic patients has shown normal levels of haptoglobins in about 75% of the subjects within 8–9 days of post-treatment. It is concluded from the study that association of HpO with *P. falciparum* and *P. vivax* malaria is present in Indian population. However, HpO cannot be used as an index to study malaria positivity because of its low reliability. Fig. 104 shows the areas from where population samples have been screened and incidence of HpO in the population was surveyed (Joshi et al 1985, 1987, 1991, 1998, 1999, 2001).