ABNORMAL HAEMOGLOBINS AND HEREDITARY OVALOCYTOSIS IN THE ULU JEMPUL DISTRICT OF KUALA PILAH, WEST MALAYSIA

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INTRODUCTION

The Ulu Jempul District of Kuala Pilah, in the state of Negri Sembilan in West Malaysia, was studied under a Rural Health Research Project by the Institute for Medical Research during the period 1973 to 1975.

While carrying out basic haematological investigations on the Malays in this area, haemoglobin electrophoresis on starch gel was carried out to determine the frequencies of abnormal haemoglobins in this area. The frequencies of abnormal haemoglobins among some of the main racial groups in Malaysia, particularly in the Malays, has been determined in several areas but there is no data on the frequencies of abnormal haemoglobins in this region. Further, most Malays in the Ulu Jempul District are descendants of Minangkabau migrants from Sumatra and consequently the population in this area is one of the most homogeneous in Peninsular Malaysia. It was therefore considered worthwhile to determine the frequencies of abnormal haemoglobins in this area and see how these frequencies compare with those found among Malays in other areas of Malaysia.

While examining peripheral blood films from persons in this area it was observed that there appeared to be a fairly high frequency of hereditary ovalocytosis. Subsequently the peripheral blood films of all persons examined was studied to determine the frequency of hereditary ovalocytosis in this area.

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MATERIALS AND METHODS

A total of 629 persons were examined. Of these 548 were school children, with ages ranging between 6 to 17 years, and 81 were mothers, with ages ranging between 16 to 45 years, who came to the Maternal and Child Health Clinic in that area.

Haemolysates were prepared from washed packed red cells by the addition of 1 volume of water and 0.5 volume of toluene. Electrophoresis of haemoglobin was done on starch-gel using tris-EDTA boric acid buffer at pH 8.6 and discontinuous tris boric acid buffer at pH 9.5.

Hereditary ovalocytosis was studied using peripheral blood smears stained with Leishman's stain: a blood smear was considered positive if more than 50% of the erythrocytes were oval or elliptical.

RESULTS

Since the number of mothers examined was small and their ages overlapped with those of the schoolchildren we did not analyse the results of the two groups separately. The frequencies of at least some of the abnormal haemoglobins and perhaps also of the hereditary ovalocytosis among children may be different from that in adults if these abnormal haemoglobins or hereditary ovalocytosis

exerted a protective influence against some disease that has been prevalent in the area e.g. malaria. But in this survey the number of adults examined is relatively too small to make any reliable comparison.

The findings in this survey are shown in Table 1.

Table 1

Abnormal haemoglobins and hereditary ovalocytosis in the Ulu Jempul District.

Number examined	629
Abnormal Haemoglobins :	
A + E (Hb E trait)	32 (5.09 %)
E/β-thalassaemia	1 (0.16 %)
A + A_2 + CoSp (Hb CoSp trait)	15 (2.38 %)
A + A_2 + A_2 Indonesia	5 (0.80 %)
A + A_2 + a fast moving Hb with a mobility between A and Bart's	4 (0.64 %)
A + A_2 + Q_1 + Q_2	1 (0.16 %)
Hereditary ovalocytosis	83 (13.20%)

DISCUSSION

A number of abnormal haemoglobins were found in this area, as can be seen from Table 1. The frequency of Hb E was 5.25% (5.09% of Hb E trait + 0.16% Hb E/β-thalassaemia). This frequency is within the range of values found among Malays in other parts of West Malaysia (Lie-Injo *et al.*, 1971). Thus the frequency of Hb E among Malays in Selangor was found to be 2 - 4% and the frequency in Perlis 4.4%. In Trengganu in the coastal villages which were free of malaria the frequency of Hb E was 7.8%, with much lower frequencies in adults than in children, while in the inland villages with a high prevalence of malaria the frequency was 7.8% among children and 13.3% among adults. In a survey of abnormal haemoglobins in North Sumatra Lie-Injo *et al.*,(1973) found 2 persons with Hb E among a small group of 65 Minangkabaus examined i.e. a frequency of 3% but this figure may not be very representative as the number of persons examined was very small. The one child who was found to have Hb E/β-thalassaemia had, as expected, a moderately severe haemolytic anaemia.

The frequency of 2.38% for Hb CoSp found in this area is similar to the value of 2.24% found among Malay blood donors in Kuala Lumpur, West Malaysia (Lie-Injo and Duraisamy, 1972). In their survey in North Sumatra, Lie-Injo *et al.*, (1973) found one Minangkabau with Hb CoSp out of 16 examined.

Hb A_2 Indonesia was found at low frequency (0.8%) in this area. This is to be expected because of the Minangkabau descent of the Malays in this area. Lie-Injo *et al.*, (1968) reporting on Hb A_2 Indonesia in Djakarta found all four of the carriers of Hb A_2 Indonesia to be among 84 migrants who originated from Sumatra. Subsequently in the survey in North Sumatra Lie-Injo *et al.*, (1973) found Hb A_2 Indonesia in 3 out of 65 (4.6%) Minangkabaus and in 2 out of 277 (0.7%) of Bataks but not at all in the other subjects examined. In a survey in West Malaysia, Lie-Injo (1970) found Hb A_2 Indonesia (then known as Hb B_2) in 2 out of 262 (0.8%) Malay blood donors and in one out of 873 West Malaysian aborigines. One of the Malay blood donors with Hb A_2 Indonesia had a mother originating from Sumatra. All the five persons found to have Hb A_2 Indonesia in this area were of Minangkabau descent.

The fast moving haemoglobin with a mobility between Hb A and Hb Bart's may be Hb J but no structural studies were carried out.

Hb Q, a haemoglobin which can combine with α-thalassaemia and cause Hb Q-H disease, was found in one child in this area.

This child had inherited the Hb Q from his father who was of Minangkabau descent. This is, as far as we know, the first time that Hb Q has been found among Malays in this country although Hb Q has been found at low frequencies among the Chinese in East and West Malaysia. We have also so far not seen any report on Hb Q among Minangkabaus in North Sumatra.

Hereditary ovalocytosis was found at a high frequency (13.2%) in this area. In West Malaysia,(Lie-Injo, 1965; Lie-Injo *et al.*, 1972; Baer *et al.*, 1976) hereditary ovalocytosis has so far been found at high frequencies among the aborigines, 6.6% in the Temiar, 20.9% in the Semai, 39.0% in the Temuan and 19.0% in the Jakun but the frequency among the main racial groups in West Malaysia i.e. the Malays, Chinese and Indians, has been found to be low, 0.3%. The frequency of hereditary ovalocytosis was also found to be high among the Dayaks of Sarawak, East Malaysia, 12.7% in the Land Dayaks and 9.0% in the Sea Dayaks(Ganesan *et al.*, 1975). In a survey of hereditary ovalocytosis in Medan, North Sumatra a frequency of 7.2% (6 out of 83) was found among the Minangkabaus (Sembiring *et al.*, 1975). In this study the frequency of 13.20% is much higher than that found in Medan but this difference may be partly due to the smaller sample examined in Medan.

In those exhibiting hereditary ovalocytosis most of the erythrocytes were oval, a few elliptical and a few irregularly shaped. This was also the finding in persons with hereditary ovalocytosis among the West Malaysian aborigines and among the Dayaks. None of the 83 persons with hereditary ovalocytosis had clinical or haematological features suggesting haemolysis.

SUMMARY

A survey of abnormal haemoglobins and hereditary ovalocytosis was carried out among 629 Malays of Minangkabau descent in the Ulu Jempul District of Kuala Pilah, in the state of Negri Sembilan in West Malaysia. Several abnormal haemoglobins were found with the following frequencies: Hb E 5.25%, Hb CoSp 2.38%, Hb $A_{2\ \text{Indonesia}}$ 0.80%, a fast moving Hb with a mobility between A and Bart's 0.64% and Hb Q 0.16 %. Hereditary ovalocytosis was found in 13.2% of these people. None of the persons with hereditary ovalocytosis had any evidence of haemolysis.

REFERENCES

BAER, A., LIE-INJO, L.E., WELCH, Q.B. and LEWIS, A.N., (1976). Genetic factors and malaria in the Temuan. *Amer. J. Hum. Genet.*, (in press).

GANESAN, J., LIE-INJO, L.E. and ONG, B.P., (1975). Abnormal haemoglobins, glucose-6-phosphate dehydrogenase deficiency and hereditary ovalocytosis in the Dayaks of Sarawak. *Hum. Hered., 25* : 258.

LIE-INJO, L.E., (1965). Hereditary ovalocytosis and haemoglobin E-ovalocytosis in Malayan aborigines. *Nature, 208* : 1329.

LIE-INJO, L.E., (1970). Haemoglobin B_2 in West Malaysia. *Southeast Asian J. Trop. Med. Pub. Hlth., 1* : 58.

LIE-INJO, L.E. and DURAISAMY, G., (1972). Slow-moving Hb X components in Malaysians. *Hum. Hered., 22* : 118.

LIE-INJO, L.E., FIX, A., BOLTON, J.M. and GILMAN, R.H., (1972). Haemoglobin E-hereditary elliptocytosis in Malayan aborigines. *Acta Haemat.* (Basel), *47* : 210.

LIE-INJO, L.E., KOSASIH, E.N. and SIREGAR, A., (1973). Abnormal haemoglobin, glucose-6-phosphate dehydrogenase deficiency and hereditary ovalocytosis in North Sumatra, Indonesia. *Southeast Asian J. Trop. Med. Pub. Hlth., 4* : 560.

LIE-INJO, L.E., MCKAY, D.A. and GOVINDASAMY, S., (1971). Genetic red cell abnormalities in Ulu Trengganu and Perlis (West Malaysia). *Southeast Asian J. Trop. Med. Pub. Hlth., 2* : 133.

LIE-INJO, J.E., POEY-OEY, H.G. and MOSS-BERGER, R.J., (1968). Haptoglobins, transferrins & haemoglobin B_2 in Indonesians. *Amer. J. Hum. Genet., 20* : 470.

SEMBIRING, P., SIREGAR, A. and KOSASIH, E.N.,(1975). Frequency of ovalocytosis in Medan (North Sumatra). Abstract. Third meeting of the Asian Pacific Division of the International Society of Haematology, Jakarta, June 1975.