ANEMIA IN REMOTE INTERIOR COMMUNITIES IN SARAWAK, MALAYSIA

DD Sagin[1], G Ismail[2], M Mohamad[3], EKH Pang[4] and OT Sya[4]

[1]Faculty of Medicine and Health Sciences, [2]Faculty of Resources Sciences and Technology, [3]Center For Consultancy and Technology Transfer, Universiti Malaysia Sarawak, Kota Samarahan 94300; [4]Central Medical Laboratory, Sarawak General Hospital, Kuching, Sarawak, Malaysia

Abstract. A cross-sectional survey of 365 individuals, (51.9% males, 48.1% females; ages 5-85 years), from five remote interior communities in upper Rejang River basin Sarawak, Malaysia, found 24.4% were anemic. The range and mean of Hb concentration in male and female were: 7.2-17.0 mg/ml and 13.7 mg/ml and 7.9-15.7 mg/ml and 12.9 mg/ml respectively. Amongst the five tribes surveyed, the prevalence of anemia (range: 10.6-46.7%), was higher among the Penans (46.7%), Kenyahs (31.1%), Kajangs (27.8%) and Kayans (19.3%), than amongst the Ukits (10.6%). Anemia is more common among males > 40 years and among adolescents and young reproductive females, as well as elderly females > 61 years old. Of the 83 anemic individuals, 6.0% and 3.6% had *Trichuris trichiura* or hookworm respectively; however there is no clear association with intestinal worm infection.

INTRODUCTION

Anemia is a common health problem worldwide with an estimated 30% of the world's population being anemic (WHO, 2001a). This hematological disorder is prevalent in many poor rural and peri-urban communities, particularly those in the poorer developing countries, where it is one of the commonest causes of ill health (Ahmed, 2000). Its prevalence is most common among young children, adolescents and women of child-bearing age (Adish *et al*, 1999; Kuizon *et al*, 1982; Quintas *et al*, 1997). In developing countries its high prevalence is usually associated with various causes; such as malnutrition, of which, the root cause is poverty (Murila *et al*, 1999).

In West Malaysia, anemia was highly prevalent (> 65%) in some of the poorer rural areas in the 1960s, but in recent years, it has declined to about 30% (Tee *et al*, 1999). Pockets of high prevalence, usually associated with high parasitemia, poor nutrition and multiple pregnancies are, however, still found in some rural areas (Shahar *et al*, 1999). In Sarawak, Malaysia, the prevalence of anemia among the rural Ibans, coastal Malays and nomadic Penans in the late 1970s ranges from 20-35% (Anderson, 1978), however its current prevalence in poor remote communities is undetermined.

In the present study, the prevalence and distribution of anemia in five remote interior communities in upper Rejang River, Sarawak, Malaysia, was investigated, as part of a public health impact assessment of the proposed US$ 3 billion Bakun hydroelectric project (BHEP) development.

MATERIALS AND METHODS

The remote upper Rejang River basin in Sarawak, was selected for this study, because the area is undergoing large-scale human ecological changes brought about by the proposed US$3 billion BHEP development (Sagin *et al*, 2000). The area is sparsely inhabited (population ~10,000) by seven interior tribes in 16 villages along the Murum, Linau and Balui River valley. Seven villages were selected for this study, as they are relatively

Correspondence: Dominic D Sagin,
E-mail: dsagin@fhs.unimas.my

accessible by river transport in addition to being an approximate representation of the five interior tribes in the area (Sagin *et al*, 2001). For the purpose of this study, the villages were visited, and the villagers briefed during a community visit to explain the purpose of the study. Informed consent was obtained from those volunteering to take part in the study (Sagin *et al*, 2000). Venous blood sample was taken by experience medical laboratory technologist, and the hemoglobin concentration measured *in situ* using a portable Ames Minilab haemoglobinometer.

RESULTS

A total of 365 venous blood samples were taken from a cross section (51.9% males, 48.1% females) of the five communities surveyed. Their ages ranged from 5-85 years old (Table 1). The majority of the samples was obtained from the Kayans as they form the major community in the area. The range and mean of Hb concentration amongst males was 7.2-17.0 mg/ml and 13.7 mg/ml, whereas in females it was 7.9-15.7 mg/ml and 12.9 mg/ml respectively. Based on WHO criteria (WHO, 2001b) for anemia, 24.4% of the individual surveyed were anemic, however the anemia was predominantly mild (Hb range: 7.2-12.9 mg/ml in males and 7.9-11.9 mg/ml in females).

Anemia was almost twice more common in male (29.2%) than in female (17.2%). Among the five communities surveyed, the prevalence of anemia ranged from 10.6-46.7%, with higher prevalence found among the Penans (46.7%), Kenyahs (31.1%), Kajangs (27.8%) and Kayans (19.3%) than among the Ukits (10.6%). Anemia was more common among male > 40 years and among adolescent and young reproductive

Table 1
Prevalence and distribution of anemia in five interior communities at upper Rejang River, Sarawak, Malaysia by ethnic group.

Ethnic group	Age range (yr)	Hemoglobin level (mg/ml)		
		Hb range	Mean	No. (% of low)[a]
Kayan (n=187)	5 - 84	7.9 - 16.4	13.5	36 (19.3)
Male (n=90)	5 - 84	9.2 - 16.4	14.1	24 (26.7)
Female (n=97)	14 - 77	7.9 - 15.7	12.9	12 (12.4)
Kenyah (n=45)	18 - 85	10.6 - 16.6	13.0	14 (31.1)
Male (n=19)	19 - 85	10.6 - 16.6	13.8	6 (31.6)
Female (n=26)	18 - 60	10.8 - 14.1	12.4	8 (30.8)
Kajang (n=72)	17 - 70	7.2 - 15.8	12.9	20 (27.8)
Male (n=35)	16 - 70	7.2 - 15.8	13.3	13 (37.1)
Female (n=37)	16 - 69	7.9 - 14.5	12.6	7 (18.9)
Penan (n=30)	13 - 55	10.0 - 17.0	12.7	14 (46.7)
Male (n=19)	14 - 55	10.0 - 17.0	12.9	10 (52.6)
Female (n=11)	13 - 47	10.9 - 13.8	12.4	4 (36.4)
Ukit (n=47)	13 - 17	10.3 - 16.8	14.0	5 (10.6)
Male (n=31)	13 - 70	10.3 - 16.8	14.1	4 (12.9)
Female (n=16)	13 - 50	11.4 - 14.9	13.9	1 (6.0)
Total (N=365)	5 - 85	7.2 - 17.0	13.3	89 (24.4)
Male (n=189)	5 - 84	7.2 - 17.0	13.7	57 (29.2)
Female (n=176)	13 - 69	7.9 - 15.7	12.9	32 (17.2)

[a]WHO criteria for anemia: Hb concentration < 11,12 and 13 mg/ml in children, adult female and male respectively.

Table 2
Distribution of anemia in five interior communities at upper Rejang River, Sarawak, Malaysia by age group and gender.

Age group (n)	Sex (n)	% anemic
<11 (2)	Male (2)	50.0
	Female (0)	0
11-20 (40)	Male (21)	4.3
	Female (19)	31.6
21-30 (101)	Male (40)	22.5
	Female (61)	11.5
31-40 (84)	Male (43)	11.6
	Female (41)	19.5
41-50 (34)	Male (19)	42.1
	Female (15)	20.0
51-60 (60)	Male (33)	39.4
	Female (27)	7.4
>61 (44)	Male (31)	42.0
	Female (13)	33.0
Total (365)	Male (189)	29.2
	Female (176)	17.2

Table 3
Relationship between anemia and intestinal parasitic infection in upper Rejang River Sarawak.

Worm	No. (%) positive
Ascaris lumbricoides	0 (0)
Trichuris trichiura	5 (6.0)
Hookworm	2 (2.4)
Others	1 (1.2)
No worm	75 (90.4)
Total[a]	83 (100)

[a]Six individuals did not provide stool samples.

females as well as elderly female > 61 years old (Table 2). Of the 83 anemic individuals identified in this study, 9.6% had intestinal parasitic infection, of which *Trichuris trichiura* is more common (6.0%) than hookworm (Table 3).

DISCUSSION

We suspected that anemia is common among the remote interior communities in upper Rejang River Sarawak, Malaysia. This is based on the observation that their remoteness and relative poverty (Sagin *et al*, 2000; 2001) predisposes them to various risk factors associated with anemia (Rajaratnam *et al*, 2000; Sagin *et al*, 2000; Milman *et al*, 2001). The present data confirmed that anemia is indeed relatively common (range: 10.6-46.7%), however its prevalence, except for the Penans community, is within the 20-35% range found among the rural Ibans, coastal Malays and nomadic Penans of Sarawak two decades ago (Anderson 1987). Additionally, the prevalence rate is similar to the 30% rate found in parts of rural West Malaysia, and the 26-48% range found in parts of rural of Sabah (UKM 1989; Tee *et al*, 1999; Shahar *et al*, 1999).

The finding that anemia is almost twice more common in males (29.2%) than in females (17.2%), except for the adolescent and young reproductive females (31.6%) is not unusual. The anemia in adolescent and young reproductive female may be associated with the increase in nutritional demand for physical and cognitive development in the former, and child bearing in the later group (Bondevik *et al*, 2000; Kilbride *et al*, 1999; WHO, 2001c). In the traditional poor rural cultures in many poor developing countries, women tend to have multiple pregnancies, with inadequate interval to replenish their nutritional store (Quintas *et al*, 1997; Rajaratnam *et al*, 2000). In remote rural communities, the modern concept of family planning and contraceptive usage is still generally unacceptable to their traditional conservative culture. This is particularly so, if their general literacy rate is very low. To reduce the negative health impact of anemia on mothers and infants, it has become common practice to give iron-folate supplements to poor pregnant rural mothers during their pregnancies.

The high incidence of anemia in males > 40 years old may be due to various factors such as nutritional deficiency and alcoholism

as found in other studies (Shahar *et al*, 1999; Milman *et al*, 2001). Factors that may impact on nutritional deficiency include large-scale developmental pressure, which may directly or indirectly affect the supply of fish, wild meat and jungle vegetable. Reduction in fish supply may results from increase demand, and is exacerbated by water pollution, following large-scale commercial forestry activities in the area. The scarcity of aquatic resources was made worst, as some communities have resorted to destructive fishing methods; such as bombing, electric shock and chemical poisoning. These developmental pressures when considered together with other predisposing factors may cause dietary changes and reduce iron intake and absorption.

In the present study, we found that anemia is more common among the semi-nomadic Penans (46.7%) than among the other tribes. The data seem to indicate that the Penans is at an early stage of adaptation to their fast changing environment. Whilst a few decades ago their diet consists of wild animal meat and fish, from their immediate environment, the on-going socio-economic developmental pressure has introduced, hitherto alien, processed and canned food into their diet. It is noted that the elderly preferred their fresh locally produced aromatic rice, rather than the imported processed and polished rice, because its undesirable smell makes it rather unappetizing. In contrast, the Kenyahs, Kajangs and Kayans communities have already been adapting to a variety of modern diet for many decades. Therefore, they may have already achieved some kind of dynamic equilibrium with their changing physical, biological and socio-economic environment.

The low incidence of anemia among the small (pop ~ 100) and only Ukit (Hill) community in Sarawak maybe surprising to outsiders. However, it should be noted that this unique community has already been visited and studied by many local and foreign researchers for about a century. The observed low anemia rate may be attributable to the summative effect of their adaptation to various planned or incidental intervention measures introduced into the community by visitors, researchers, government agencies, as well as non-government agencies, over the last 100 years. It should also be noted that in the past decades, this community has been provided with regular flying doctor services.

We have investigated the relationship between anemia and intestinal parasitic infection, because high intensity trichuriasis and hookworm infection may potentially cause severe iron loss leading to iron deficiency anemia (Stoltzfus *et al*, 1997). The finding that only 9.6% of the 83 anemic individuals identified in this study was infected with *T. trichiura* or hookworm appear to suggest that the mild anemia is not significantly associated with intestinal parasitic infection as most of those infected may carry low parasitic burden (Sagin *et al*, 2000).

We conclude that the present data, when interpreted in the context of other relevant data, appear to suggest that despite significant improvement in health care services and facilities, in addition to socio-economic development, anemia remain relatively common in upper Rejang River area. As most of the communities surveyed are now resettled elsewhere, follow-up study is needed to determine their current health status as they adapt to the various physical, biological, social and economic peculiarities of their new environment.

ACKNOWLEDGEMENTS

We wish to acknowledged the support of The Sarawak Government in this study. DDS, GI and MM are the public health impact assessment consultants for the Bakun HEP development. We thank the Director of the Sarawak Health Services Department for extending to us the temporary use of their various health facilities in Belaga, Kapit, Sibu and Kuching. We thank the villagers for their consent, assistance, support and cooperation for this work.

REFERENCES

Adish AA, Esrey SA, Gyorkos TW, Johns T. Risk factors for iron deficiency anemia in preschool children in northern Ethiopia. *Public Health Nutr* 1999; 2: 243-52.

Ahmed F. Anemia in Bangladesh: a review of prevalence and aetiology. *Public Health Nutr* 2000; 3: 385-93.

Anderson AJU. "Subsistence of the Penans in the Mulu area of Sarawak", Report of the Sarawak Medical Services 1987.

Bondevik GT, Ulstein M, Lie RT, Rana G, Kvale G. The prevalence of anemia in pregnant Nepali women- a study in Kathmandu. *Act Obstet Gynecol Scand* 2000; 79: 341-9.

Kilbride J, Baker TG, Parapia LA, Khoury SA, Shuqaidef SW, Jerwood D. Anemia during pregnancy as a risk factor for iron-deficiency anemia in infancy: a case-control study in Jordan. *Int J Epidemiol* 1999; 28: 461-8.

Kuizon MD, Natera MG, Ancheta LP, Platon TP, Desnacido JA, Macapinlac MP. Assessment of the iron status of Filipino adolescents. *Southeast Asian J Trop Med Public Health* 1982; 13: 81-5.

Milman N, Byg KE, Mulvad G, Pedersen HS, Bjerregaard P. Iron status markers in 224 indigenous Greenlanders: influence of age, residence and traditional foods. *Eur J Haematol* 2001; 66: 115-25.

Murila FV, Macharia WM, Wafula EM. Iron deficiency anemia in children of a peri-urban health facility. *East Afr Med J* 1999; 76: 520-3.

Quintas ME, Requejo AM, Ortega RM, Redondo MR, Lopez-Sobaler AM, Gaspar MJ. The female Spannish population: a group at risk of nutritional iron deficiency. *Int J Food Sci Nutr* 1997; 48: 271-9.

Rajaratnam J, Abel R, Ganesan C, Jayaseelan SA. Maternal anemia: a persistent problem in rural Tamil Nadu. *Natl Med J India* 2000; 13: 242-5.

Sagin DD, Ismail G, Nasian LM, Jok JJ, Pang EKH. Rickettsial infection in five remote Orang Ulu villages in upper Rejang River, Sarawak Malaysia. *Southeast Asian J Trop Med Public Health* 2000; 31: 733-5.

Sagin DD, Ismail G, Fui JNF, Jok JJ. Schistosomiasis malayensis-like infection among the Penans and other interior tribes (Orang Ulu) in upper Rejang River basin Sarawak Malaysia. *Southeast Asian J Trop Med Public Health* 2001; 32: 27-32.

Sagin DD, Mohamed M, Ismail G, Jok JJ, Lim LH, Fui JNF. Intestinal parasitic infection among five interior communities at upper Rejang River, Sarawak, Malaysia. *Southeast Asian J Trop Med Public Health* 2002; 33:18-22.

Shahar S, Earland J, Powers HJ, Rahman SA. Nutritional status of rural elderly Malays: dietary and biochemical findings. *Int J Vitam Nutr* 1999; 69: 277-84.

Stoltzfus RJ, Chwaya HM, Tieslsch JM, Schulze KJ, Albonico M, Savioli. Epidemiology of iron deficiency anemia in Zanzibar school children: the importance of hookworms. *Am J Clin Nutr* 1997; 65: 153-9.

Tee ES, Kandiah M, Awin N, *et al*. School-administered weekly iron-folate supplements improve hemoglobin and ferritin concentrations in Malaysian adolescent girls. *Am J Clin Nutr* 1999; 69: 1249-56.

Universiti Kebangsaan Malaysia (UKM). Environmental Impact Assessment of the Liwagu Hydroelectric project in Ranau Sabah. 1989.

WHO. Iron deficiency anemia. @http://www. who.int/nut/ida/research.html. 2001a.

WHO. Anemia in children. @http://www. who.int/chd/publications/newslet/dialog/9/anemia.html. 2001b.

WHO. Adolescent nutrition: a neglected dimension. @http://www.who.int/nut/ado.html. 2001c.