East African Medical Journal Vol. 76 No 5 May 1999
PREVALENCE OF ANAEMIA IN PATIENTS ATTENDING AN OUTPATIENT CLINIC IN WESTERN RIFT VALLEY IN KENYA DURING A LOW MALARIA SEASON
J.Y. Carter, MBBS, FRCP(C), Head, Laboratory Programme, O.E. Lema, MSc, Chief Laboratory Technologist, H.K Mukunza, DMLT, Laboratory Technologist, African Medical and Research Foundation, P.O. Box 30125, Nairobi, Kenya, H.N. Varia, Final Year Medical Student, Nottingham, England, A.S. Munyere, K.R.N, Project Assistant, Entasopia Health Centre, Kajiado District, P.O. Box 31, Magadi, Kenya, Watkins W.M PhD, Director, Wellcome Trust Research Laboratories, P.O. Box 43540, Nairobi, Kenya, and Kenya Medical Research Institute, Nairobi, Kenya, K.M. Watkins, Biological Sciences Undergraduate, Imperial College, London, England

Request for reprints to: Dr. J.Y. Carter, Head, Laboratory Programme, AMREF, P.O. Box 30125, Nairobi

PREVALENCE OF ANAEMIA IN PATIENTS ATTENDING AN OUTPATIENT CLINIC IN WESTERN RIFT VALLEY IN KENYA DURING A LOW MALARIA SEASON

J.Y. CARTER, O.E. LEMA, H.K MUKUNZA, H.N. VARIA, A.S. MUNYERE, W.M. WATKINS and K.M. WATKINS

ABSTRACT

Objective: **To assess the prevalence of anaemia in outpatients attending a rural health clinic in an area of seasonal malaria, during the low transmission season.**
Methods: **Haemoglobin estimation and blood slide examination for malaria parasites were performed on 280 consecutive patients attending outpatient curative services at Entasopia Health Centre, Kajiado District, Kenya, between April-May 1996. Anaemia was defined according to World Health Organisation guidelines for age, sex and pregnancy status.**
Results: **In all groups except adult males, more than half of the patients tested had haemoglobin values below the lower reference limits, suggesting that anaemia is widely present in this population even during the low malaria season. Only 5% of patients were positive for *Plasmodium falciparum* malaria. Peripheral blood film examination suggested iron deficiency as the major cause of anaemia.**
Conclusions: **Further studies to define the underlying causes of anaemia and to develop community strategies to prevent anaemia are required. The association between fever and anaemia and the use of pallor to diagnose anaemia, are discussed.**

INTRODUCTION

Anaemia is an important cause of morbidity in eastern Africa, and affects mainly adult women and children(1-3). Community and outpatient population studies in Kenya have shown the most important causes of anaemia are nutritional deficiency and infections due to *Plasmodium falciparum* malaria and helminths, mainly hookworm and schistosomiasis(4-7). Sickle cell anaemia contributes to anaemia in the coastal and lake zones(5). The major contributors to anaemia in an area therefore depend on the nutritional status of the population and the transmission of malaria and helminths.

This study was performed to assess the prevalence of anaemia in an outpatient population in an area of seasonal malaria transmission, during the low malaria season. The study was carried out in a health centre serving a rural community in Kenya. The purpose of the study was to collect information preparatory to appropriate interventions to address anaemia in the community.

MATERIALS AND METHODS

Entasopia is a village in Kajiado District, situated in the western part of the Rift Valley at an altitude of 2500 feet above sea level. The area is semi-arid with seasonal rains during May-June and November-December each year. The immediate catchment population is approximately 14,000. The area is traditionally populated with nomadic Maasai; however, due to a constant supply of fresh spring water, there is increasing settlement from other parts of Kenya with establishment of an irrigation scheme and a limited commercial agricultural base. Fresh fruit and vegetables are in plentiful supply, and there is farming of livestock and poultry.

Entasopia Health Centre is managed by a committee of community elders and supported by the African Medical and Research Foundation (AMREF), a non-governmental organisation involved in health care development in eastern Africa. The health centre has outpatient, inpatient and maternity facilities, and a small laboratory.

The study was conducted at Entasopia Health Centre between April-May 1996. Consecutive patients of all ages attending the outpatient curative clinic were invited to enter the study. Patients were attended by the resident Clinical Officer or nurse, who performed the usual clinical assessment, recruited patients on the basis of informed oral consent, referred patients for laboratory investigation and prescribed appropriate management. The following data were collected on the study patients: name, age, sex, residence, history of current illness including fever and use of antimalarial drugs in the month prior to attendance, the presence of pallor, and axillary temperature using a standard mercury thermometer.

The study patients had a fingerprick blood sample collected for haemoglobin estimation and thick and thin blood slides in addition to other laboratory investigations requested

by the resident clinical staff. Laboratory investigations were performed by the resident health centre laboratory staff. 20µl of capillary blood was collected without excessive squeezing into a glass pipette and added to 5ml of Drabkin's solution (1:251 dilution). The haemoglobin concentration was measured directly using a Compur^R haemoglobinometer (Bayer, Germany), which was checked daily for accuracy using a commercial haemiglobincyanide standard. Thick and thin blood films were made on the same slide and stained using the Field stain and reverse Field stain techniques(8). Each thick blood film was examined immediately for malaria parasites. According to standard laboratory practice at Entasopia Health Centre, 200 fields were examined before reporting thick blood films as negative; *P falciparum* trophozoites were counted against 100 white blood cells. All laboratory results were reported to the clinician as soon as possible on the same day, for appropriate management.

The presence of anaemia was defined by age, sex and pregnancy status according to World Health Organisation criteria as follows: Hb < 11g/dl (children aged 6 months to< 6 years); < 12 g/dl (children aged 6-14 years); < 13 g/dl (adult males); < 12 g/dl (adult non-pregnant females); Hb < 11g/dl (adult pregnant females)(9). Anaemic patients were divided into three groups: mild anaemia (between Hb 8 g/dl and the lower limits set as above); moderate anaemia (Hb 5-7.9 g/dl) and severe anaemia (Hb < 5 g/dl) . Fever was defined as axillary temperature ≥37.5°C.

Thick blood films were re-examined later at the AMREF Central Laboratory, Nairobi, by two technologists using a blinded technique; discrepant results were confirmed by a third technologist. Parasite density was calculated as the number of parasites per microlitre, assuming a total white blood count of 8 x 10^9/L. Thin blood films were examined for blood cell morphology in patients with Hb < 10 g/dl.

Sample means were compared using Student's t-test.

RESULTS

Data were available from 280 patients. One hundred and five (37.8%) patients were male and 173 (62.2%) patients were female. The sex of two patients was not recorded.

Haemoglobin: Haemoglobin values were available in 258 patients: the mean haemoglobin value was 11.6 g/dl (s.e. = 0.1). Table 1 summarises the haemoglobin values of the patients by age and sex; all three parameters were available in 237 patients.

Sixty eight (26%) patients had mild anaemia, nine (3.5%) had moderate anaemia, and two (0.8%) had severe anaemia. Seven patients with moderate anaemia were less than six years of age; two were adult female (non-pregnant) patients. Of the patients with severe anaemia, one was a child of less than six years and one was a 14 year old male patient.

Parasitaemia and temperature: Only 12 patients reported taking antimalarial drugs prior to attending the clinic. Eight patients had taken amodiaquine; two patients had taken chloroquine; one patient had taken Fansidar^R (sulfadoxine/ pyrimethamine); and one patient had taken a combination of Fansidar^R and quinine.

The results of the thick blood slide examination were available in 261 patients: 13 (5%) were positive with trophozoites of *Plasmodium falciparum.* The geometric mean parasite density was 0.46µl (range 0-240,000/µl). The mean haemoglobin values in malaria positive and negative patients were 11.7 (0.1) and 11.6 (0.6) respectively (p=0.78).

One hundred and fifty three patients had an axillary temperature recorded; 68 (44%) had an elevated temperature (≥37.5°C). One hundred and forty nine patients had both haemoglobin and temperature levels recorded. The mean haemoglobin level in the afebrile group (n=82) was 12 (0.2) and in the febrile group (n=67) was 10.7 (0.3); p= <0.05. Temperature and blood slide results were available in 150 patients. Of the 142 patients with negative blood slides, 65 (46%) had a raised temperature; and of eight patients with positive blood slides, 3 (38%) had a raised temperature.

Pallor and haemoglobin: A decision on pallor was available in 237 patients; 36 (15.2%) patients had pallor. Two hundred and twenty one patients had both pallor and haemoglobin values recorded. The mean

Table 1

Haemoglobin values by age and sex

		Number of patients	Mean Hb g/dl (s.e.)	p-value	Anaemia prevalence	p-value
Age≥0.5-<6 years		86				
Sex	M	34	10.6 (0.4)	0.74	21 (62%)	0.23
	F	52	10.7 (0.3)		28 (54%)	
Age≥6- < 14 years		34				
Sex	M	10	12.1 (0.4)	0.99	5 (50%)	0.42
	F	24	12.1 (0.3)		13 (54%)	
Age > 14 years		109				
Sex	M	40	13.6 (0.4)	<0.05	11 (28%)	<0.05
	F (non-pregnant)	69	11.8 (0.2)		36 (52%)	
	F (pregnant)*	8	10.6 (0.6)		3 (38%)	

*suspected or confirmed

haemoglobin values of patients with and without pallor were significantly different 8.9 (0.4) versus 12.1 (0.1) respectively; p = <0.05. Table 2 shows the relationship between pallor and haemoglobin values.

Table 2

Relationship between pallor and haemoglobin values

	Pallor		
Haemoglobin (g/dl)	Yes	No	Total
≥11	7	140	147
8-10.9	17	45	62
5-7.9	8	2	10
<5	2	0	2
Total	34	187	221

Pallor had a sensitivity of 36% and a specificity of 95% in detecting haemoglobin levels < 11 g/dl. The sensitivity of pallor in detecting mild anaemia was 27% and moderate anaemia was 80%.

Peripheral blood picture: The red blood cell morphology of 26 thin blood films from patients with Hb < 10 g/dl was examined. The predominant abnormality was hypochromia, microcytosis and targeted red cells. No other significant abnormality was noted.

DISCUSSION

There was no difference in haemoglobin values between the sexes in patients aged less than 14 years of age. In patients above 14 years of age haemoglobin values were significantly lower in females than in males; this is a normal physiological finding. However, in all groups except adult males, more than half the patients tested had haemoglobin values below the lower reference limits, suggesting that anaemia is widely present in this population even during the low malaria season. The number of pregnant women was too small for separate analysis. There was no difference in haemoglobin levels in patients with and without malaria infection; however our sample size was too small for further analysis.

Fever was a common finding, second to pallor, in a group of hospital-based anaemic patients studied in western Kenya (10). Fever was also a common sign in children admitted to hospital with severe anaemia in Kilifi, on the Kenyan coast (5). These facility-based studies, including our own, indicate that most patients present for medical care with a febrile disease; although some of these diseases, notably malaria, may cause anaemia, the association in other cases may be coincidental.

Pallor is an important sign of anaemia, especially for health workers with no access to laboratory facilities. Studies evaluating the diagnosis of anaemia on the basis of signs and symptoms alone have shown a high specificity approaching 100%; however the sensitivity varies from 27% to 89% (11-14). In these studies, the sensitivity of detecting anaemia increased with increasing severity of anaemia. In our study the sensitivity of pallor for detecting mild anaemia was only 27 %, emphasising the need to perform routine haemoglobin checks, especially in groups at high risk for anaemia.

The peripheral blood film examination suggests that iron deficiency is the major cause of anaemia, possibly from a combination of poor iron intake and intestinal parasite infestation. Although all types of food including meat, eggs and green vegetables are in plentiful supply in Entasopia, economic pressures result in much of the food that would avoid iron deficiency being sold to generate cash income. The moist warm conditions at Entasopia favour the presence of intestinal parasites; both these contributors to anaemia require further study. The available data suggest that an intensive community education programme addressing diet and sanitation could assist in preventing anaemia in this population.

There are few studies examining the prevalence of anaemia in communities in hypoendemic or mesoendemic malarial areas in Kenya during the low malaria season. A recent survey conducted in children aged two months to three years in an area of seasonal malaria transmission (Makueni District, Kenya), when the prevalence rate of malaria infection was only 17%, found that 69% of children had haemoglobin values below 11 g/dl (H. Verhoef, personal communication). Ours was not a community-based study; however since most patients presented to the outpatient clinic with acute illness the data suggest that anaemia may be commonly found in members of the community. The study findings have emphasised the importance of anaemia unrelated to malaria, a situation which may be common in all age groups in other populations in Kenya. Several studies have reported altered physical and mental development in iron deficient children, which may be reversible with adequate treatment (15, 16); this finding is an important reason to detect mild anaemia and correct iron deficiency in all populations in Kenya. In addition, the complications of severe anaemia due to malaria and the need for blood transfusion may be avoided if anaemia can be corrected early.

AKNOWLEDGEMENTS

The authors would like to thank the Entasopia Health Committee for permission to conduct this study, and the staff at Entasopia Health Centre for their assistance in carrying out the study. WMW is grateful to the Wellcome Trust of Great Britain for project and personal support.

REFERENCES

1. Zucker, J.R., Lackritz, E.M., Ruebush, T.K., Hightower, A.W., Adungosi, J.E., Were, J.B.O. and Campbell, C.C. Anaemia, blood transfusion practices, HIV and mortality among women of reproductive age in Western Kenya. *Trans. R. Soc. Trop. Med. Hyg.* 1994; **88**:173-176.
2. Kasili, E.G. Malnutrition and infections as causes of chilhood anaemia in tropical Africa. *Amer. J. Paediat. Haematol. Oncol.* 1990; **12**:375-377.
3. Demaeyer, E. and Adiels Tegman, M. The prevalence of anaemia in the world. Wld. Hlth. Stat. Quart. 1985; **38**:302-316.
4. Lawless, J.W., Latham, M.C., Stephenson, L.S., Kinoti, S.N. and Pertet, A.M. Iron supplementation improves appetite and growth in anaemic Kenyan primary school children. *J. Nutr.* 1994; **124**:645-654.
5. Newton, C.R.J.C., Warn, P.A., Winstanley, P.A., Peshu, N., Snow R.W., Pasvol, G. and Marsh, K. Severe anaemia in children living in a malaria endemic area of Kenya. *Trop. Med. Int. Hlth.* 1997; **2**:165-178.
6. Stephenson, L.S., Kinoti, S.N, Latham, M.C., Kurtz, K.M. and Kyobe, J. Single dose metrifonate or praziquantel treatment in Kenyan children. 1. Effects on Schistosoma haematobium, hookworm, haemoglobin levels, splenomegaly, hepatomegaly. *Amer. J. trop. Med. Hyg.* 1989; **41**:436-444.
7. Stephenson, L.S., Latham, M.C., Kurz, K.M., Kinoti, S.M., Oduori, M.L. and Crompton, D.W. Relationships of Schistosoma haematobium, hookworm and malarial infections and metrifonate treatment to haemoglobin levels in Kenyan school children. *Amer. J. trop. Med. Hyg.* 1985; **34**:519-528.
8. Carter, J.Y. and Lema, O.E. A Practical Laboratory Manual for Health Centres in Eastern Africa. Nairobi, AMREF. 1984.
9. Geneva: World Health Organisation Scientific Group. Nutritional Anaemias. World Health Organisation Technical Report Series No. 405. 1968.
10. Kasili, E.G. Anaemia in a patient population at a provincial hospital in western Kenya. *E.A. Med. J.* 1980; **57**:373-381.
11. Gjorup, T., Bugge, P.M., Hendriksen, C. and Jensen, A. A critical evaluation of the clinical diagnosis of anaemia. *Amer. J. Epidem.* 1986; **124**:657-665.
12. Strobach, R.S., Anderson, S.K., Doll, D.C. and Ringerberg, S. The value of the physical examination in the diagnosis of anaemia. *Arch. Intern. Med.* 1988; **148**:831-832.
13. Sanchez-Carrillo, C.I. Bias due to conjunctival hue and the clinical assessment of anaemia. *J. Clin. Epidem.* 1989; **42**:751-754.
14. Nardone, D.A., Roth, K.M., Mazur, D.J. and Mcafee, J.H. Usefulness of physical examination in detecting the presence or absence of anaemia. *Arch. Intern. Med.* 1990; **150**:202-204.
15. Idjradinata, P. and Pollitt, E. Reversal of developmental delays in iron deficient anaemic infants treated with iron. *Lancet.* 1993; **341**:1-4.
16. Lozoff, B., Brittenham, G.M. and Wolf, A.B. Iron deficiency anaemia and iron therapy: effects on infant developmental test performance. *J. Paediat.* 1987; **79**:981-995.