Prevalence of anaemia and parasitic infections among underfive children in Simanjiro District, Tanzania

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Abstract: A study was conducted to determine the prevalence of anaemia and parasitic infections among <5 years old children of the pastoral community in Simanjiro District, northern Tanzania. The haemoglobin concentration was determined from a finger-prick capillary blood sample using haemocue meter. The haemoglobin concentration measurements were according to WHO recommended cut-off points for children underfive years of age. Malaria parasites were determined from a finger-prick blood sample stained by Giemsa and examined under oil immersion microscope. Faecal specimens for investigation of intestinal parasites were examined under low power objective microscope. Results indicated that 47.6% of children were anaemic of which 20.8% were mildly anaemic, 21.6% moderately anaemic and 5.2% severely anaemic. Prevalence of malaria was 20% among children screened. The prevalence of intestinal parasites, in children one year and above, was 48.9%. Of these 9.8% had *Ancylostoma duodenale*, 19.6% *Ascaris lumbricoides* 4.9%, *Enterobius vermicularis* and 14.7% had *Trichuris trichiura*. Malaria and the presence of intestinal parasites were significantly associated with anaemia *($P<0.05$)*. The results of this study conclude that anaemia is a problem in the community and some of the contributing factors are malaria and intestinal parasites.

Introduction

Anaemia is a global public health problem but most prevalent in developing regions especially Asia (50%) and Sub-Saharan Africa (49%) (Haas and Brownilie, 2001)). Anaemia is caused by low haemoglobin concentration in the blood (Hurell *et al.*, 2000). This condition is brought about by parasitic infections, inadequate iron intake and high physiological demands in preschool children, adolescent girls, pregnant and lactating women (Stoltzfus *et al.*, 2000). The most common cause of anaemia is a deficiency of iron, although not necessarily a dietary deficiency of total iron intake. Deficiencies of folates, vitamin B_{12} and protein may also lead to anaemia (WHO, 1999).

Low haemoglobin concentration in combination with iron deficiency has deleterious implications in terms of increased morbidity and mortality rates of vulnerable groups (Kolsteren *et al.*, 1999). Other associated complications include impaired growth, cognitive abilities in children and reduced work capacity in adults (Grantham-McGregor and Ani, 2001). Anaemia in Tanzania is estimated to be present in 33% of the population (UNICEF, 1999).

Parasitic infection has been identified as one of the main cause of poor nutritional status. Its impact on iron status particularly haemoglobin depends largely on the type, intensity and duration of infestation. Iron status is reported to be influenced by malaria (Tatala *et al.*, 1998; Stoltzfus *et al.*, 2000). Malaria destroys red blood cells and suppresses bone marrow function, while hookworm and schistosomiasis infections leads to loss of blood thereby leading to anaemia (Stephenson *et al.*, 1985). The impact of parasites is sometimes increased due to multiple infestations in the individual child's iron status, and may worsen further when these parasitic infestations interact with nutrient deficiencies (Osman, 1997).

The present study was conducted in a pastoral community who subsist mostly on meat and dairy products. The objective of the study was to investigate on the prevalence of anaemia in children under five years of age in a pastoral community and possible causative factors.

Materials and Methods

Study area

The study was conducted in Simanjiro district in Manyara region, northern Tanzania. The district lies between latitude 3° 50' and 5° 20'S 36° 45' and 38° 0'E. Annual rainfall is below 800 mm, usually with short and long rains. The short rains contribute to about 25 percent of total production while long rains is the main production season. The dominant vegetation is savannah woodland and bush. The district is mainly semi-arid, occupied by pastoralists with large herds of cattle. Crop production in this area is insignificant (URT, 1998).

The district occupies an area of about 20,991 square kilometres with an arable land of about 420,000 hectares and land under cultivation about 30,000 hectares with the remaining area being for grazing land, national parks, forest and wasteland/woodland. The district is divided into six divisions namely Naberera, Ruvu Remit, Terrati, Msitu wa Tembo, Moipo and Emboret. Simanjiro district has a population of 150,000 according to 2002 census (URT, 2002). The dominant ethnic group is the Maasai, and their main activity is livestock keeping.

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The district has no hospital, but has 2 health centres, 20 dispensaries and 35 mobile clinics. The most common causes of morbidity and mortality are malaria, diarrhoea, upper respiratory tract infections, tuberculosis, skin diseases, malnutrition, anaemia, eye and ear diseases, pregnancy complications, and surgical complications (URT, 1998). People from the rural areas of the district have to walk a distance of more than 5 kilometres to reach the health services.

Research design

Cross-sectional design was used in data collection. According to Babbie (1990) cross-sectional design allows data to be collected at a single point in time without repetitions from sample selected to represent some large population.

Study population, sampling and sample size

The subjects of study consisted of all mother-child pair who attended Maternal and Child Health (MCH) clinics in eight villages in Simanjiro district. The sampling procedure was done through multistage, random sampling technique. Sampling started at district level. Three divisions of Simanjiro district out of six were randomly selected. Then from these divisions, four wards and eight villages were respectively randomly selected. All villages in the district are served with mobile MCH clinics. From each village sampling of children was done according to age groups based on MCH register as recommended by (WHO, 1995). The sample was estimated according to Moser and Kalton (1979), basing on the prevalence of anaemia 20% of the population in the District. Absolute sampling error of 5% and confidence interval of 95% were used to obtain the sample size of 250 children.

Data collection

The study used both primary and secondary data. Primary data were obtained from the laboratory investigations and structured questionnaire. Pre-testing the questionnaire was done on thirty mothers to ascertain validity of the questions. Thereafter, necessary modifications and corrections were incorporated. The questionnaire was used to collect information such as health status of child (i.e. morbidity rate and frequency of common diseases affecting children), water and sanitation and mothers education. Secondary data was obtained from MCH records, district dispensaries, Sokoine National Agricultural Library (SNAL), and other publications.

Haemoglobin determination and stool examination of children

Blood and stool specimens were obtained from children after verbal consent of their mothers. The haemoglobin concentration was determined from a finger prick capillary blood sample. This was carried out using haemocue meter. In this attempt, a battery-operated HemoCue photometer (HemoCue AB, ƒngelholm, Sweden) with disposable cuvettes was used. The middle finger was used to collect blood sample. The finger was cleaned with spirit and pricked with a sterile disposable lancet. A drop of blood was filled in the cuvette by capillarity in one continuous process until the cuvette was completely full. Immediately the filled cuvette was inserted into the Hemocue meter and reading obtained. Haemoglobin values were expressed as g/dL as recommended by the World Health Organization (WHO, 1997) as shown in Table 1. Similarly, capillary blood samples were collected for making thick blood smears to screen for malaria parasites. The dried thick blood films were stained by Giemsa stain and examined under oil immersion microscope.

Faecal specimens were examined for the presence of helminthic larvae or eggs. The specimens were collected and examined on the same day. Plastic cups were used for the collection of these specimens. As soon as the specimen was received a saline wet mount was prepared and then examined under low power objective microscope. For all the laboratory investigations above, a trained and qualified laboratory technician performed the examinations.

Data analysis

Descriptive and inferential statistics that covered measurements of central tendency, frequency, cross tabulation was done using Microsoft Excel 2000 and SPSS for windows version 11.5 computer programme.

Results

Table 2 shows percentage distribution of anaemia among children studied by age group. The results indicate that 52.4% of children had normal Hb, 20.8% were mildly anaemic, 21.6% were moderately anaemic and 5.2% had severe anaemia.

Table 1: Anaemia classification

Nutritional variable	Classification	Remarks
Hb concentration	Above or equal to 11g/dL	Normal
	10.0-10.9 g/dL	Mild anaemia
	7.0-9.9 g/dL	Moderate anaemia
	4.0-6.9 g/dL	Severe anaemia
	Less than 4.0 g/dL	Very severe anaemia

Source: WHO (1997)

Table 2: Prevalence of anaemia among children by age group

Age group (months)	Normal Hb		Mild Anaemia		Moderate anaemia		Severe anaemia		Total
	N	%	N	%	N	%	N	%	N
0-11	40	16.0	17	6.8	9	3.6	0	0.0	66
12–17	13	5.2	10	4.0	16	6.4	2	0.8	41
18–23	14	5.6	6	2.4	2	0.8	3	1.2	25
24–35	26	10.4	12	4.8	14	5.6	3	1.2	55
36–47	24	9.6	3	1.2	7	2.8	4	1.6	38
48-59	14	5.6	4	1.6	6	2.4	1	0.4	25
Total	131	52.4	52	20.8	54	21.6	13	5.2	250

Table 3: Frequency of malaria and helminthes among children < 5 years of age

Species	Positive		Negative		Total
	No.	%	No.	%	No.
Plasmodium falciparum	50	20.0	200	80.0	250
Ancylostoma duodenale	18	9.8	166	90.2	184
Ascaris lumbricoides	36	19.6	148	80.4	184
Enterobius vermicularis	*9*	*4.9*	*175*	*95.5*	*184*
Trichuris trichiura	27	14.7	157	85.3	184

The results in Table 3 indicate that the prevalence of malaria parasites (*Plasmodium falciparum*) among children studied was 20%. Worm infestation was found in 48.3% children of whom 9.6% had *Ancylostoma duodenale*. Others were *Ascaris lumbricoides* (19.5%), *Trichuris trichiura* (14.7%) and *Enterobius vermicularis* (4.8%).

Results in Table 4 show that out of 50 children who were positive for malaria, 8% had normal haemoglobin while 12.4 % were anaemic, which shows that malaria infection had significant effect *(P<0.05)* on haemoglobin concentration. Similarly, out of 90 children who were infected with various intestinal parasites 18% of the children had normal haemoglobin while 31% were anaemic, which shows that worm infestation had significant effect *(P<0.05)* on haemoglobin concentration.

In this study (Table 4) chi-square test showed that there was significant association *(P<0.05)* between anaemia and presence of malaria parasite.

Discussion

It was observed in the present study that there was high prevalence of anaemia among children underfive years of age. However other studies observed even higher prevalence rates. The study conducted by TFNC (1999), observed a prevalence of 50.0% of anaemia in underfive children among Maasai and Batemi communities of Ngorongoro district. In Tanzania, it has been observed that more than 45% of all underfive children are anaemic (TFNC, 1996). Therefore anaemia is still a serious public health problem.

Table 4: Effects of malaria and helminthes infection on haemoglobin concentration

Variable	Normal Hb (%)	Anaemic (%)	Total (%)
Malaria parasite			
Positive	7.6 (19)	12.4 (31)	20.0 (50)
Negative	48.4 (121)	31.6 (79)	80.0 (200)
Total	56.0 (140)	44.0 (110)	100.0 (250)
Helminthes species			
Ancylostoma duodenale	1.5 (3)	8.1 (15)	9.6 (18)
Ascaris lumbricoides	7.1 (15)	10.4 (21)	19.5 (36)
Enterobius vermicularis	1.5 (3)	3.0 (6)	4.8 (9)
Trichuris trichiura	6.6 (12)	8.1 (15)	14.7 (27)
Total	17.7 (33)	30.6 (57)	48.3 (90)

Figures inside brackets indicate number of children

Severe anaemia was not found among age group 0-11 months but the group had higher percentage of mild and moderate anaemia. This could be due to universal breast-feeding habit at this age. Although iron from breast milk is not enough to meet child's iron requirement beyond the age of 6 months (WHO, 1999), it is relatively highly absorbed (50-70%) than that from other supplementary foods (Latham, 1997). High prevalence of anaemia observed in this study is unlikely to have been attributed to inadequate dietary sources of iron during complementation period, because in this study community diets are mostly from animal products. The study also indicated that the majority of children (data not shown) are fed with maize porridge with milk and others are fed with milk only as their main diet. Studies show that animal milk provides adequate nutritional supplementation for young children. However, its excessive use can cause anaemia because it is low in iron and high in calcium. The latter can inhibit absorption of iron from other dietary sources (Grinder-Pedersen *et al.*, 2004). Similarly, it has been observed that before 9 months of age fresh cow's milk can cause occult intestinal blood loss and therefore ideally animal milk should be given between meals (Fredman, 2002)

Prevalence of malaria was 20% of the children screened for malaria. This could be due to the fact that most of the households do not use mosquito nets. The prevalence of intestinal parasite which was assessed only in children from one year and above, was 48.9%. The most prevalent intestinal worms was *Ascaris lumbricoides* and least infestation is of *Enterobius vermicularis*. However, the available epidemiological evidence indicates that intense infestation with worms is much less common in children less than five years than in children five years and above (Warren, 1993). The high prevalence of intestinal worms could also be attributed to poor hygiene and especially with regard to minimal use of toilet facilities. With these conditions the worm parasites are able to complete their life cycles either between animals and man or the environment and man. Although health service are carried by mobile maternal and child health clinic that provides antihelmith tablets to this group of underfive children it might seem inadequate. It was observed that during mobile clinics medical staff provides anti-helminthes tablets, after presenting medical history and clinical investigation of the patients. The intestinal worms might also be contributing significantly to anaemia as evidenced in this study.

In this study anaemia was associated with malaria parasites. Malaria causes destruction of red blood cells that are parasitized, which can lead to haemolytic anaemia (Latham, 1997). Other studies conducted by Tatala *et al.* (1998) in Lindi and Stoltzfus *et al.* (1997) in Zanzibar both in Tanzania also found significant association *($P<0.001$)* between anaemia and malaria. Likewise, intestinal worms in this study were associated with anaemia. The worms suck blood and also damage the intestinal wall, causing blood leakage. However, a significant effect depends on the intensity and duration of infestation. Intestinal parasite like that of hookworm has been associated with anaemia in several studies (Tatala *et al.*, 1998; Stoltzfus *et al.*, 2000).

In conclusion, the prevalence of anaemia in Simanjiro district is high. Some of the causative factors include malaria and intestinal worm infestations. It is thus important to have programmes to prevent diseases such as malaria and environmental sanitation to prevent worm infestations.

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