ORIGINAL ARTICLE

The prevalence of anaemia in rural primary school children in Ekwusigo Local Government Area, Anambra State, Nigeria

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ABSTRACT

Background: Anaemia is a public health problem affecting children with potential consequences on physical and mental development. Children living in resource poor countries where micro-nutrient deficiency and infections are prevalent are mostly affected.

Objective: To determine the prevalence of anaemia in a rural primary school population of Ekwusigo Local Government Area of Anambra State, Nigeria.

Methodology: One hundred and fifty-six primary school children aged 5-17years (75males, 81females) were recruited into the study using multi-stage sampling technique. Information on sex, age and parents' educational attainment were obtained by the use of a self-administered questionnaire. Haemoglobin concentration of each child was determined, and each child was classified as anaemic if the value is less than the World Health Organization cut-off for age. Ninety-one children had stool microscopy for hook worm ova.

Result: The prevalence of anaemia was 66.7% (104 subjects), 69.3% and 64.2% for males and females respectively. Anaemia was significantly observed more in children of mothers with only primary school education (82%) than children of mothers with tertiary education (30%); $p<0.001$. Of the 91 children whose stool samples were examined, 30 (33.3%) had hookworm infection. Anaemia occurred in 70% of children with hookworm infection compared to 60% of children without hookworm infection ($X^2 = 0.33$, $p>0.5$).

Conclusion: Anaemia is a severe public health concern in the rural primary school population of Ekwusigo Local Government Area. Improved maternal education and mass de-worming provided through a school-based program would be of benefit in improving the haemoglobin concentration of these rural school children.

Keywords: ***H****aemoglobin concentration, hookworm infection, iron deficiency, maternal education*

INTRODUCTION

Anaemia is defined as haemglobin concentration below established cut-off level for the age and sex.[1] Anaemia results from disorders that cause impaired production of red blood cells and haemoglobin, accelerated destruction of red blood cells and blood loss. The most common causes of these disorders are nutritional deficiencies (i.e. iron, folic acid, vitamin A, and vitamin B12), infections and blood disorders (haemoglobinopathies).

Of these, iron deficiency is by far the most common, accounting for 50% of anaemia.[2] It may arise from inadequate nutritional intake and/or poor absorption of iron from the gut, or from chronic blood loss from the intestines secondary to intestinal helminths such as hookworm and *Trichuris trichiura*. Infections like malaria, tuberculosis and human immune deficiency syndrome (HIV/ AIDS) are also important factors which contribute to anaemia in this environment.[3,4] Anaemia, therefore, is an indicator of poor health and poor nutrition.

Anaemia has been associated with fatigue, sleeplessness, impaired memory and poor concentration. These effects are more pronounced in children where learning and cognitive function impartments had been attributed to iron deficiency anaemia.[2,4] In school children these may result in poor physical and academic performance.

Globally, the World Health Organization (WHO) estimates that two billon people are anaemic.[5] In Ibadan, Nigeria, anaemia ranks among the top ten causes of childhood mortality in a hospital based study and a high prevalence (62%) has been reported among rural primary school children.[6,7] Population based data on the burden of anaemia amongst school children in rural communities of Abia State indicated a higher prevalence (82.5%).[8] In the neighbouring Anambra State, there is paucity of literature on the burden of anaemia in school children.

This report presents the prevalence of anaemia based on the determination of haemoglobin (Hb) concentration levels in primary school children in Ekwusigo, a rural local government area of Anambra State, South-East Nigeria.

METHODOLOGY

Subject and Methods

This is a cross-sectional study, done in Ekwusigo, a rural local government area in Anambra State in South-East Nigeria. There are four towns in the local government, viz. Ozubulu, Oraifite, Ichi and Ihembosi. Two of the towns, Ozubulu and Oraifite, were selected by simple random sampling (balloting) for the survey. A school was randomly selected in each town from the list of schools.

In each selected school, the study was explained to the headmaster and teachers and their co-operation obtained. Class registers were then used to stratify the pupils in all classes based on gender. In each gender stratum simple random sampling (balloting) was used to select subjects. A pre-tested questionnaire and consent form were given to each subject for completion at home by the parent or guardian.

A total of 200 questionnaires (100 for each school) were distributed. Information sought in the questionnaire included age, sex, maternal and paternal highest educational attainment. The consent form detailed the procedure and sought the consent of the parent or guardian of the selected child.

Subjects that returned both filled questionnaires and signed consent forms were recruited. From these subjects, capillary blood was obtained by sterile lancet finger-tip puncture and its haemoglobin (Hb) concentration assayed directly using a portable haemoglobin spectrophotometer (*Haemocue*®, Sweden).

Each of the subjects was given a container for stool collection at home. They were instructed to collect stool close to the time of coming to school. The samples were retrieved from the subjects immediately on coming to school and transported to the laboratory where a wet preparation was microscopically examined

for hookworm ova. All samples were examined within 3hours of retrieval.

The children were classified anaemic as follows: Hb <11.5g/dl (males and females 5-11years), Hb <12g/dl (males and females 12–14years); Hb <12g/dl (female ≥15years old) and Hb < 13g/dl (male ≥15years).[2]

The result of both Hb concentration and stool hookworm ova microscopy were issued to the children. In addition, children with abnormal results were given letters advising their parents or guardians to take them to hospital for further evaluation.

The qualitative variables obtained were tallied, frequency counts done, proportions calculated and the results tabulated. The median, mean and standard deviations were calculated for the quantitative variables. Chi square test was used for further analysis and level of significance; *p-value <0.05.*

RESULTS

One hundred and fifty-six (75males, 81 females) of the 200 recruited subjects were studied, while forty-four were dropped. These were 16 children that did not return their questionnaires, 7 children for incompletely filled questionnaires, and 21 children that objected to needle prick.

Table 1. Age and sex distribution of primary school children in Ekwusigo LGA

Age (years)	Male		Female	
	No	(%)	No	(%)
5 – 11	67	42.9	66	42.3
12 – 14	6	3.8	14	9
≥ 15	2	1.3	1	0.6
Total	75		81	

Table 1 shows the age and sex distribution of the primary school children. In all, 156 children aged 5-17years were studied. Most of the children (133) were between the ages of 5 and 11 years (median age 9years). Seventy-five where males and 81 were females, giving a male/female ratio of 1:1.1.

Table 2. Age and sex distribution of anaemic school children in Ekwusigo LGA, Anambra State

Age (years)	Males			Females		Total
	Anaemic n (%)	Not anaemic n(%)	*p-value*	Anaemic n (%)	Not anaemic n (%)	*p-value*
5 – 11	48(71.64)	19(28.36)	>0.25	40(60.61)	26(39.39)	>0.1 133
12 – 14	3(50)	3(50)		11(78.57)	3(21.43)	20
≥ 15	1(50)	1(50)		1(100)	0(0)	3
Total	52	23		52		29 156

The age and sex distribution of anaemic children is illustrated in Table 2. One hundred and four (66.7%) of all children were anaemic - 52 males (33.3%) and 52 females (33.3%). The haemoglobin concentration ranged 7.9-16.2g/dl, the mean was 11.15±1.83g/dl. None of the children was severely anaemic (Hb conc <7g/dl for ages 5-11years, or Hb conc <8g/dl for ages >12years). Within the genders, the highest age specific percentage distribution of anaemia were 71.6, 78.6 and 100 for males aged 5-11years, females aged 12-14years, and females ≥15years, respectively.

Table 3. Influence of parental educational attainment on the prevalence of anaemia among primary school children in Ekwusigo LGA, Anambra State

Parental education	Maternal				Paternal			
	Anaemic n (%)	Not anaemic n (%)	x^2	*p-value*	Anaemic n (%)	Not anaemic n (%)	x^2	*p-value*
Primary	41 (82)	9 (18)	26.93	0.001	60 (74.07)	21 (25.93)	5.36	0.20
Secondary	54 (73.97)	19 (26.03)			33 (68.75)	15 (31.25)		
Tertiary	8 (30.77)	18 (69.23)			8 (42.11)	11 (57.89)		
Unspecified	2 (28.57)	5 (71.43)			4 (50)	4 (50)		
Total	105	51			105	51		

Table 3 depicts a reduction in anaemia amongst children of mothers with higher educational qualification (82% of children of mothers with only primary school education compared to 30% of children of mothers with tertiary education were anaemic ($X^2=26.93$, $p<0.001$). Children of fathers with higher educational qualification were equally less anaemic ($X2 =5.36$, $p>0.2$).

Table 4. Relationship between hookworm infection and anaemia

Hookworm Infection	Anaemic n (%)	Not anaemic n (%)	Total	x^2	p-value
Infected	21 (70)	9 (30)	30	0.33	>0.5
Uninfected	39 (60)	22 (61)	61		
Total	60	31	91		

Table 4 shows, the prevalence of anaemia in hookworm infected and non-infected children. Thirty of the ninety-one children (33%) whose stools were examined had hookworm infestation. The percentage distribution of anaemia was 70 and 60 in hookworm infested and non-hookworm infested children, respectively ($p>0.5$).

DISCUSSION

At 66.7% prevalence, anaemia is a severe public health problem amongst primary school children in the studied local population. This finding is similar to the 62% reported earlier in Ibadan.[7] Both studies were on a similar population – rural primary school children - and used the same haemoglobin concentration cut-offs to diagnose anaemia. It is, however, lower than the 82.5% observed in Umuahia North and Ikwuano Local Government Areas of Abia State, Nigeria by Onimawo, *et al*.[8] In the studies in Abia State and Ibadan, iron deficiency was attributed to nutritional insufficiency. This study did not explore the serum ferritin of the subjects as did the above-mentioned studies, however, all three studies were done in southern Nigerian communities which main staple foods are roots (cassava) and tubers (yam), both of which are known to be low in iron content and bioavailability.[8,9] This could have predisposed the children to iron deficiency anaemia. Noteworthy is that no case of severe anaemia was observed; if the Hb concentration threshold for anaemia definition were to be lowered as is advocated for blacks, the prevalence in this study may have been lower.[10]

Chronic blood loss from hookworm infestation is known to contribute to iron loss and possibly, iron deficiency anaemia. In this study, a greater percentage of hookworm infested children (70%) compared to non-infested (60%) were anaemic. This suggests that the infestation may have possibly played a role in the cause of anaemia in the studied communities. However, as this difference is not statistically significant, it is probable that other causes of anaemia, like endemic malaria and deficiency of iron in local staples, could be equally important.

The subjects within 12-14 and >15 years age range were of small number. This age range is expected to have finished primary school.

However, in this group, proportionally more females were anaemic. The observation could be due to earlier female puberty which increases the need of iron for accelerated body growth and to replace the loss during the menstrual period. Meeting this additional iron requirement has been suggested to be difficult with the background of inadequate content in local staple food.[11] Similar findings on gender difference in the prevalence of anaemia in adolescents was also reported by Hettiarachchi, *et al*.[12]

Maternal education seems to have a significant influence on the prevalence of anaemia in these rural children. The probable reason for this could be due to the traditional role of the mother as the major child caregiver. Where these mothers are better educated, their socio-economic status, knowledge base and decision taking ability will improve and empower them to take better care of these children in such aspects as the provision of good nutrition and prompt treatment of illness with reduction in the prevalence of anaemia. The impact of improved maternal education on nutrition and health of children has been reported in other studies.[13,14]

In conclusion, this study highlights the high prevalence of anaemia in rural school children in the studied local government area. As anaemia is the indicator used to screen for iron deficiency and iron deficiency anaemia, these children will be considered iron deficient. Improved maternal education and mass de-worming provided through a school-based program would be of benefit in improving the haemoglobin concentration of these rural school children.

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