

Anaemia in Nigerian mothers and their children: relative importance of infections and iron deficiency

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Summary

The study assessed the relative contribution of infections and iron deficiency to anaemia in Nigerian mothers and their children. Sixty-one mother-child pairs were recruited. The mean ages of mothers and children were 31.05 ± 9.35 years and 30.85 ± 16.70 months, respectively. Dietary iron intake was used as proxy for iron status while anaemia was diagnosed by whole blood haemoglobin concentration < 120 g/L in mothers and < 110 g/l in the children. A structured questionnaire was used to collect information on the exposure of the mothers and their children to infections. Approximately 53% of mothers and 56% of children had abnormal haemoglobin concentrations indicative of anaemia. Also, 41% of the mothers and 37% of the children had dietary iron intakes below the recommended dietary allowance. In the preceding 6 months of the study, about 50% of the mothers, and 65% of the children in the preceding month, were ill. Febrile illness accounted for 70% and 30% of the illness in mothers and children, respectively. There was significant correlation between mothers' and children's dietary iron intake and blood haemoglobin concentration. In conclusion, iron deficiency and infections were equally important aetiological factors in the anaemia recorded in the subjects of this study.

Keywords: Anaemia, infections, iron deficiency, mother-child, dietary iron intake and haemoglobin.

Résumé

L'étude a évalué la contribution relative des infections et déficience en fer dans l'anémie chez les mères Nigériennes et leurs enfants. Soixante une paires mere-enfants ont été recrutées. Les moyennes d'âges des mères et des enfants vaient été de $31,05 \pm 9,35$ ans et $30,85 \pm 16,70$ mois respectivement. La diététique de la prise de fer avait été utilisé comme mandataire pour le status du fer, alors que l'anémie a été diagnostiquer par la concentration totale d'haémoglobine dans le sang (120 g/L chez la maman, et 110 g/L chez les enfants). Un questionnaire structuré avait été utilisé afin d'utilisé les informations sur le degré d'exposition des mères et 56% des enfants ont eu une réponse anormale des concentrations d'haémoglobines indicative d'anaémie. Deplus, 41% des mères et 37% d'enfants ont eu une alimentation indiquant une prise de fer en dessous le niveaux normal recommandé. Dans les 6 mois précédent l'étude, pres de 50% des mères et 65% des enfants dans le mois précédent avaient été malade. Les maladies engendiant la fievre, ont contribué pour 70% et 30% des maladies chez les ères et les enfants respectivement.

Il ya en une correlation significative entre la prise de fer dans l'alimentation des meres et des enfants et la concentration d'haemoglobin dans le sang. En conclusion, la defience en fer, et les infections ont une importance egale sur le les facteurs qui au l'anemie enregistré chez les sujets de cet etude.

Introduction

Anaemia is a major public health problem in both developed and developing countries although the prevalence is much higher in developing than developed countries [1]. Worldwide, it is estimated that over 2 thousand million people are anaemic by WHO criteria [2]. The most affected are pregnant women, preschool age children, low birth weight infants, adolescent girls, the elderly, school age children and adult men, roughly in that order.

Anaemia is caused by a variety of factors, but iron deficiency is recognised as the leading cause of nutritional anaemia in most people [3-5]. Besides nutritional deficiency, anaemia is also caused by infections and worm infestations [6,7].

In Nigeria, recent data show that prevalence of anaemia in preschool age children ranges from 11% to 50% and 11% to 81% in adult non-pregnant women [8]. The aim of the present study was to assess the relative contributions of infections and iron deficiency to anaemia in Nigeria mothers and their children.

Subjects and methods

Subjects

Sixty-one mother-child pairs were recruited for the study. Both mother and child were apparently well at the time of the study and neither had received blood transfusion in the 6 months preceding the study nor was any of the subjects on prophylactic or therapeutic iron or folate regimen at the time of the study. Ten (16.4%) of the mother-child pairs were urban dwellers while the remaining 51 pairs (83.6%) were rural dwellers.

Methods

- (i) *Assessment of dietary iron intake:* iron intake of the mother and her child was assessed from 3 consecutive 24 hour recalls including one weekend day given by the mother. All food items consumed for breakfast, lunch and supper were weighed by trained assistants. The amount of iron consumed in the diet was calculated from published food composition tables [9]. Dietary iron intake was expressed in milligrams per day. Adequacy of iron intake was determined by comparison with the recommended dietary allowances, RDA [10] for different ages.
- (ii) *Exposure to infections:* A structured questionnaire was used to collect information on the exposure of a mother and her child to

infections. In the case of mothers, information was obtained on her exposure to infections in the 6 months preceding the study while in the children it was in the one month preceding the study. The type of infections and the frequency of exposure were recorded.

- (iii) *Assessment of anaemia:* Whole blood (2-5 ml) from each mother and child pair was drawn into heparinised tubes and mixed gently on a roller mixer. Whole blood haemoglobin concentration in the blood samples was determined by the cyanmethemoglobin method [11]. Anaemia was diagnosed on the basis of whole blood haemoglobin concentration < 110 g/L in children and < 120 g/L in the mothers [2].

Statistical Analysis

Data were analysed using the EPI-INFO and SPSS statistical packages. The differences between mean values were tested using the student's t-test with level of significance set at 5%. Pearson's correlation coefficient was calculated to establish a relationship between mother and child dietary iron intake and haemoglobin concentrations.

Results

Table 1 summarizes the data on dietary iron intake and whole blood haemoglobin concentrations in mothers and children. The mean age of the mothers was 31.05 ± 9.35 years while the mean age of the children was 30.85 ± 16.70 months. The mean haemoglobin concentration of mothers was 112.8 ± 17.4 g/L while that of the children was 104.2 ± 18.1 g/L. These values were slightly below the threshold of anaemia in both mothers and children; further analysis however revealed that 32 of the 61 mothers had haemoglobin values below 120.0 g/L giving a prevalence of 52.5% anaemia in the mothers. Similarly, in the children, 34 out of 61 had haemoglobin values < 110 g/L, giving anaemia prevalence of 55.7% (Table 2).

Table 1: Age, dietary iron intake and whole blood haemoglobin concentration of study subjects

Parameters	Mother	Child	R ⁺	P
Age*	31.05±9.35	30.85±16.70		
Dietary iron intake mg/day	17.20±12.81	11.34±8.17	0.75	0.001
Haemoglobin conc. g/L	112.8±17.4	104.2±18.1	0.27	0.034

* - in years for mother; in months for child

+ - Pearson correlation coefficient

The mean dietary iron intake of mother and child is shown in Table 1. The mean dietary iron intake of mothers, 17.20 ± 12.81 mg/day was significantly greater than that of the children, 11.34 ± 8.17 mg/day (t-test; $P < 0.01$). Although, these mean intake values were above the 15 mg and 10 mg which are the RDA for mothers and children, respectively, 11% (25/61) of mothers and 37% (22/61) of children had daily iron intakes below the RDA (Table 2).

Table 2: Proportion of subjects with anaemia and iron deficiency

Parameter	Mother		Child	
	N	%	n	%
Anaemia	32	52.5	34	55.7
Iron deficiency	25	41.0	22	37.3

Table 3 shows the pattern of recent illness in mothers and children. The table shows that infection was highly prevalent in the mothers and their children. Fifty-one percent of the mothers were ill at least once in the 6 months preceding the study, while 65% of the children were reported by their mothers to be ill at least once in one month preceding the study. Febrile illness accounted for over 70% and 30% of the illness in the mothers and children, respectively. Diarrhoea was the second most important cause of illness in the children with 13% of the children reported to have had diarrhoea in the one month preceding the study. Non-infectious conditions accounted for the other illnesses.

Table 3: History of previous illness in study subjects

Subjects	Proportion Ill		Type of illness		
	N	%	Febrile illness	Diarrhoea	Others
Mother	31	51.4	73.9	-	26.1
Child	40	65.2	32.8	12.8	54.4

There was a strong positive correlation between dietary iron intakes of mothers and those of their children ($r = 0.75$; $P < 0.001$); similarly, there was a significant positive correlation between haemoglobin concentration in mother and child ($r = 0.27$; $P = 0.034$). - Table 1.

Discussion

In a recent publication [12], we reported that there was a significant positive correlation in dietary iron intakes of Nigerian mothers and their children. The present data also show a significant positive correlation between whole blood haemoglobin concentration of mothers and children and similar prevalence of anaemia.

Anaemia has multifactorial causes, but iron deficiency and infections are recognised as the leading causes [13-15]. Contrary to the general observation that iron deficiency is the leading cause of anaemia in human population [16,17], the results of the present study indicate that the role of infection was equally important, particularly in the children. The low dietary iron intake in the subjects could most probably be the result of consumption of diets low in iron content as the traditional diet is mainly vegetable based with animal proteins contributing very little to the total energy intake [12].

High prevalence rates of anaemia have been reported in the tropics, being as high as 70% in hospitalised patients and 40% or higher in community based studies [14]. The 55% prevalence of anaemia in children in the present study was the same as that reported in rural school age children from the middle belt of Nigeria and which was said to represent a deterioration by comparison with earlier studies [18].

0% of the children in the present study were rural. The rise in prevalence of anaemia in children in this and other studies in Nigeria is in contrast to the situation in developed countries where the prevalence of anaemia in the population has witnessed a gradual decrease over the years [19] as a result of concerted efforts including food fortification with iron, supplementation and improved nutrition and health care, among others.

Exposure to infections was also high in the mothers and children who formed the subjects of the study. Although none was ill at the time of the study, nonetheless, it is reasonable to conclude that the exposure to infection would adversely affect their haemoglobin concentration. Febrile illness was the illness reported by mothers and their children in the study and in our environment malaria is known to be a common cause. This tends to confirm the prevalence of malaria in the aetiology of anaemia in the population reported by other workers [20-22]. The appearance of chloroquine resistant strains of *P. falciparum* no doubt is a contributory factor to the high prevalence of anaemia in malaria endemic areas like

In conclusion, anaemia is highly prevalent in the mothers and their children. Iron deficiency as well as inadequate dietary iron intake and exposure to infections appeared to be equally important in the aetiology of the anaemia reported in the subjects of this study.

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