

Prevalence of anaemia in preschool children in Karma Albalad area, Northern State, Sudan

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معدّل انتشار فقر الدم لدى الأطفال قبل سن المدرسة في منطقة كرمة البلد في الولاية الشمالية في السودان.

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الخلاصة: يُعتبر فقر الدم من المشاكل الصحية الأساسية في مرحلة الطفولة في البلدان النامية. ولقد كان الهدف من هذه الدراسة المستعرضة تحديد معدل انتشار فقر الدم، وبعض محدداته لدى الأطفال في سن ما قبل المدرسة في قرية ريفية في الولاية الشمالية بالسودان. وتم إدراج جميع الأطفال ممن كانت تتراوح أعمارهم بين سن الثالثة والسادسة عند إجراء البحث في مدارس رياض الأطفال الأربعة في الدراسة. وتم تجميع البيانات الديموغرافية والاجتماعية والاقتصادية باستخدام الاستبيان الذي قام الآباء باستكمالها، كما تم أخذ عينات الدم بهدف قياس الهيموغلوبين. ووجد أن 131 من بين 163 طفلاً لديهم فقر دم (أي أن مستوى الهيموغلوبين أقل من 11 غرام لكل دسلي لتر) بمعدل انتشار 80.4%. ويمكن مقارنة هذا الرقم بالبيانات المأخوذة من سائر البلدان النامية. ووجد أن معدّل انتشار فقر الدم لا يرتبط ارتباطاً يعنى به إحصائياً بأي من العوامل الديموغرافية والاجتماعية والاقتصادية التي تمت دراستها (الجنس، الحالة الاقتصادية للأسرة، إلمام الأم بالقراءة والكتابة، أو حجم الأسرة) أو صحة الطفل (سوابق تناول الطفل لمواد غريبة أو عدد مرات الإصابة بالمalaria في العام الماضي). ويتجلى أن هنالك حاجة ماسة إلى إجراء حملة للتعاوي مع هذه المشكلة الصحية الخطيرة على وجه السرعة.

ABSTRACT Anaemia is a major childhood health problem in developing countries. The aim of this cross-sectional study was to determine the prevalence of anaemia, and some of its determinants, in preschool children in a rural village in the Northern State of Sudan. All children aged 3-6 years attending the 4 village kindergartens on the day of the study were enrolled. Demographic and socioeconomic data were collected using a questionnaire completed by parents, and blood samples were taken for haemoglobin measurement. Out of 163 children, 131 had anaemia (haemoglobin level < 11 g/dL), a prevalence of 80.4%. This figure is comparable to data from other developing countries. The prevalence of anaemia was not significantly associated with any of the studied demographic and socioeconomic factors (sex, economic status of the family, mother's literacy or family size) or health of the child (history of pica or number of attacks of malaria in the last year). A campaign to tackle this serious health issue is urgently needed.

Prévalence de l'anémie chez des enfants d'âge préscolaire dans la région de Karma Albalad dans l'État du Nord au Soudan

RÉSUMÉ L'anémie chez l'enfant est une préoccupation de santé publique majeure dans les pays en développement. L'objectif de la présente étude transversale était de déterminer la prévalence de l'anémie ainsi que certains de ses déterminants chez des enfants d'âge préscolaire dans un village rural de l'État du Nord du Soudan. Tous les enfants âgés de trois à six ans fréquentant les quatre écoles maternelles du village le jour de l'étude ont participé. Les données démographiques et socioéconomiques ont été recueillies à l'aide d'un questionnaire rempli par les parents, et des échantillons de sang ont été prélevés pour le dosage du taux d'hémoglobine. Sur 163 enfants, 131 souffraient d'anémie (taux d'hémoglobine < 11 g/dl), une prévalence de 80,4 %. Ce chiffre est comparable aux données d'autres pays en développement. La prévalence de l'anémie n'était significativement associée à aucun des facteurs démographiques et socioéconomiques étudiés (sexe, statut socioéconomique de la famille, degré d'alphabétisme de la mère ou taille de la famille) ni à la santé de l'enfant (antécédents de syndrome de pica ou nombre d'épisodes de paludisme au cours de l'année précédente). Une campagne pour s'attaquer à ce problème de santé sérieux est nécessaire de toute urgence.

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Introduction

Anaemia is a major child health problem worldwide [1–3]. One-third of the world's population suffers from anaemia, notably over half of the children in developing countries [1]. Iron deficiency is the main cause of childhood anaemia; other causes include micronutrient deficiencies, haemoglobinopathies and infections such as malaria [4–9]. Children are more vulnerable to developing anaemia because they are rapidly growing and liable to infection. Moreover, micronutrients such as iron and folic acid are likely to be inadequate in children's diets if parents are not well informed [2,9,10,11]. Anaemia is not only one of the leading causes of childhood mortality and morbidity [12], it may also affect cognitive development and school performance [13,14].

According to the World Health Organization (WHO), the prevalence of anaemia, defined as haemoglobin (Hb) level < 11 g/dL, among children aged under 5 years in Africa varies from 49% to 89% [1]. To our knowledge, few studies have investigated the prevalence of anaemia in Sudanese children [1,15–17] and there are no recent epidemiological studies. Nevertheless it is likely that it continues to be a significant burden on health facilities in the country, as documented in a survey conducted in 2006, which estimated the prevalence of anaemia in Sudanese children under 5 years old as 84.9% [12,15]. There have been changes in recent decades in the demography and socioeconomic status of the Sudanese community, both negative due to civil wars and natural disasters (flooding and desertification), as well as positive due to Sudan becoming an oil-producing country. We therefore undertook this epidemiological study to determine the prevalence of anaemia, and some of its determinants, in an area in the

north of Sudan. This would help local health decision-makers to plan for prevention and comprehensive management of this important health problem [2,3,11].

Methods

Study area and population

The current study was conducted in Karma Albalad, which is a village in the Northern State of Sudan. It is located on the east bank of the River Nile, 60 km north of Dongola (the capital of the region). The population of the Northern State of Sudan is 750 000 according to the recent census, with the vast majority living in rural areas. About 10 000 people live in Karma Albalad, 800 of them in the age group 1–5 years according to Ministry of Health data from the expanded programme on immunization in Northern State [12]. Most of the residents of the village are farmers, while a few are labourers, employees or working abroad [18]. The educational facilities include 4 kindergartens, 5 mixed primary schools and 1 secondary school for girls. There is a health centre run by a medical assistant and a hospital with paediatric facilities in the nearby village of Alborgeig. We selected Karma Albalad as the study area because it is the biggest and most populous village in the Northern State. Furthermore, there are 4 kindergarten schools in this village while the other villages have only 1 or 2.

Although preschool education is not mandatory in Sudan, it is strongly recommended by the Ministry of Education. All kindergartens in Karma Albalad are public, with admission free of charge for all children. The great majority of parents admit their children to these kindergartens as it is widely believed among the local community that kindergarten improves the academic and social performance in later school years. There are no available data on

the number of preschool age children in the village. However, children attending kindergartens are fairly representative of the preschool age group as they account for about nearly 20% of the children aged < 5 years in the village [12].

Study design and sample

This was a cross-sectional study. All children aged 3–6 years who attended the 4 kindergartens in Karma Albalad on the day of the study (8 January 2010) were included in the study group. Written consent was taken from the local authority as well as from the parents of children participating in the study. Illiterate parents gave verbal consent to the research team members in the presence of a witness.

Data collection

The study team included the first author, 2 medical officers, 2 nurses and 2 laboratory technicians. The team members received training by the first author on the study technique. The first author also trained the kindergarten teachers on how to fill the questionnaire. The research team trained parents on how to fill the questionnaire. The research team and the teachers assisted parents, especially illiterate ones, who had difficulty in completing the questionnaire. Some of the parents who were comfortable with filling the questionnaire after the training session did so at home and returned it later. Children whose parents refused to participate in the study or failed to fill the questionnaire were excluded.

Questionnaire

The questionnaire was designed by the 2 authors and was pilot-tested on a group of school-age children not attending kindergarten to anticipate any problems in phrasing or understanding of the questions by parents. It was in Arabic language, which is the

language spoken by the local community. The questionnaire covered the demographic and socioeconomic status of the families. The first part of the questionnaire consisted of demographic information about the child (age, sex). The second part contained information about the parents (education, occupation, income). The third and main part of the questionnaire was on the health status of the child and the risk factors for anaemia including history of chronic diseases (asthma, diabetes, renal disease, tuberculosis), number of attacks of malaria in the last year and history of pica in the last 2 years. Frequent malaria attacks refers to having 4 or more malaria attacks in the last year. Education of parents was categorized as follows: illiterate, primary school, secondary school and post-secondary education. For income we adopted the Northern State local authority classification of families: poor (receiving government allowances) or not poor (not receiving government assistance).

Laboratory methods

A 2 mL blood sample was taken from all participating children. The Hb level was measured within 6 hours after collection using the HemoCue® system and Drapkins reagents. In this study, anaemia was defined as Hb < 11 g/dL. Mild anaemia was Hb < 11 > 9.9 g/dL, moderate anaemia was Hb 7–9 g/dL, while severe anaemia was Hb < 7 g/dL [1,2,9].

Statistical analysis

The data were entered and analysed using SPSS, version 17. The difference between 2 proportions test was used to test statistical significance. It was considered significant when *P*-value < 0.05.

Binary logistic regression test was used to determine risk factors associated with anaemia in the study population.

Results

Of the 189 children eligible for the study, 4 were excluded as the parents refused to participate and 13 failed to attend for testing. Questionnaires were distributed to the parents of 172 children, of whom 9 failed to fill and return the questionnaire. Questionnaire data and blood samples were therefore analysed for 163 children (94.8% response rate).

Table 1 shows the characteristics of the study group. There were 82 girls and 81 boys. A majority of the children (43.0%) were from large families (≥ 4 children), while the rest were from small families (< 4 children). Pica behaviour was reported in 17 children (10.4% of the study group). Fathers of 13.5% of the study children were illiterate while 7.4% had illiterate mothers. Fathers of 77.3% of children were farmers. A quarter of the studied children (24.5%) were from poor families (receiving regular allowances from the social authority).

Out of 163 studied children, 131 had Hb levels below the cut-off for anaemia, a prevalence of 80.4%. Anaemia was graded as mild in 81 (49.7%),

moderate in 47 (28.8%) and severe in 3 (1.8%).

Table 2 shows that the prevalence of anaemia was not statistically significantly related to any of the studied demographic and socioeconomic factors (sex, economic status of the family, mother's literacy or family size) or health of the child (history of pica or number of attacks of malaria in the last year).

Discussion

Anaemia is a global health problem and is one of the major causes of childhood mortality and morbidity [1]. As the epidemiological data on anaemia in Sudanese children are scarce [12], we decided to study the prevalence of anaemia in children as an important determinant of well-being.

In the present study the prevalence of anaemia among preschool children in Karma Albalad village was 80.4%. This is consistent with the results of the household survey conducted in Sudan in 1994, which reported a prevalence of anaemia in preschool children in Sudan as 84.9% [13]. This

Table 1 Characteristics of the study group of preschool children in Karma Albalad, Northern State, Sudan (n = 163)

Characteristic	No.	%
Sex		
Male	81	49.7
Female	82	50.3
Family characteristics		
Large family	70	43.0
Poor family	40	24.5
Illiterate mother	12	7.4
Health history		
Frequent malaria attacks	55	33.7
History of pica	17	10.4
Asthma	13	8.0
Type 1 diabetes	1	0.6
Recurrent urinary tract infection	1	0.6
Tuberculosis	0	0.0

Table 2 Risk factors associated with anaemia in preschool children in Karma Albalad, Northern State, Sudan (n = 163)

Risk factors	Anaemic Hb < 11g/dL (n = 131)		Not anaemic Hb ≥ 11g/dL (n = 32)		OR	95% CI	P-value
	No.	%	No.	%			
Sex							
Male	63	48.1	18	56.3	1.19	0.54–2.60	0.54
Female	68	51.9	14	43.8	1.19	0.54–2.66	0.54
Family characteristics							
Large family	58	44.3	12	37.5	0.78	0.30–1.76	0.55
Poor family	33	25.2	7	21.9	1.06	0.49–2.80	0.90
Illiterate mother	11	8.4	1	3.1	2.63	0.30–22.7	0.38
Health history^a							
Frequent malaria attacks	45	34.4	10	31.3	0.88	0.37–2.06	0.37
Pica	16	12.2	1	3.1	0.23	0.03–1.80	0.16

^aOf the 13 children with asthma 6 had Hb ≥ 11 g/dL and 7 had Hb < 11 g/dL. The 1 child with type 1 diabetes had normal Hb and the 1 child with recurrent urinary tract infection had low Hb < 11 g/dL.

Hb = haemoglobin; OR = odds ratio; CI = confidence interval.

alarmingly high prevalence of anaemia is comparable with results from studies conducted in other developing countries such as India and Nigeria [19–22]. The situation, however, is very different from that in developed countries [1,23]. For instance, the prevalence of anaemia in children in the United States of America has been reported as only 16% [1]. It is well known that the prevalence of anaemia rises with increasing poverty [24–26]. The high prevalence of anaemia in this study is therefore not surprising as Sudan is one of the poorest countries in the world. The recent Sudan poverty assessment prepared by the World Bank and the Sudan government stated that overall 46.5% of the population was below the poverty line with a higher rate (57.6%) among the rural population [27]. Other profiles present a detailed analysis of poverty, demographic, livelihood, education and employment in the country [28–30]. Our study was conducted in a rural area where the great majority of the parents were farmers with limited income and education.

People living in rural areas of Sudan constitute 86% of the population according to the 2008 census [29]. The rural community in Sudan is homogenous and the majority of people are from the same tribe, which explains the similarities in their social characteristics. When we analysed the possible risk factors associated with anaemia, such as parent's education, family size, family income and other socioeconomic indicators of poverty, none of these risks factors were statistically significantly associated with anaemia. This study was conducted in a rural village community where families are extended and share a similar culture; therefore the lifestyles of the people, especially eating habits, are expected to be relatively similar, despite differences in socioeconomic status. So, socioeconomic factors would not have as great an impact on children's nutrition as compared with urban communities. In contrast to our findings, Alawady et al. reported a high prevalence of anaemia among children with uneducated mothers in Kuwait [31]. In the USA too, parent's education was reported as a risk

factor for the development of childhood anaemia [1].

Most of the children in this study were exposed to multiple attacks of malaria in the year prior to the date of the study. This is understandable as malaria is endemic in Sudan. However, recurrent attacks of malaria (≥ 4 times per year) were not shown to be a risk factor for anaemia in this study. Malaria causes anaemia by subjecting red blood cells to haemolysis [6]. Severe malaria as well as the presence of glucose-6-phosphate dehydrogenase deficiency (G6PDD) are known risk factors for development of haemolysis associated anaemia [32]. Mild malaria, however, is not usually a cause of anaemia, and most of the children in the current study had mild anaemia. While G6PDD is common in the west of Sudan, it is not in the north. All these factors may possibly explain the finding that malaria was not associated with anaemia in this study.

Relatively small numbers of anaemic children in the current study were reported to have pica, which was not statistically different from the numbers of non-anaemic children. Pica is a social stigma; therefore a

questionnaire-based study may not be the best way to obtain objective data on the prevalence of pica. This may be one of the limitations of the study. Other limitations include the relatively small study sample and the lack of a control group. Further investigations to determine the etiology of anaemia in these children were beyond the scope of this study. However, having more data as to the type and cause of

anaemia would be informative. We recommend that a more comprehensive study on a wider scale would be helpful to validate our findings and to stimulate the authorities to address this important childhood health problem. Daily iron supplementation, for example, is a viable intervention to increase Hb levels [33]. A campaign to tackle this detrimental health issue is urgently needed.

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