

Anaemia during pregnancy in Burkina Faso, West Africa, 1995–96: prevalence and associated factors

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We report the results of a cross-sectional study carried out in 1995–96 on anaemia in pregnant women who were attending two antenatal clinics in Bobo-Dioulasso, Burkina Faso, as part of a research programme including a clinical trial of zidovudine (ZDV) in pregnancy (ANRS 049 Clinical Trial). For women infected with human immunodeficiency virus (HIV) in Africa, anaemia is of particular concern when considering the use of ZDV to decrease mother-to-child transmission of HIV. The objectives were to determine the prevalence of and risk factors for maternal anaemia in the study population, and the effect of HIV infection on the severity of maternal anaemia. HIV counselling and testing were offered to all women, and haemograms were determined for those women who consented to serological testing. Haemoglobin (Hb) levels were available for 2308 of the 2667 women who accepted HIV testing. The prevalence of HIV infection was 9.7% (95% confidence interval (CI): 8.6–10.8%). The overall prevalence of anaemia during pregnancy (Hb level < 11 g/dl) was 66% (95% CI: 64–68%). The prevalence of mild (10 g/dl ≤ Hb < 11 g/dl), moderate (7 g/dl ≤ Hb < 10 g/dl) and severe (Hb < 7 g/dl) anaemia was 30.8%, 33.5% and 1.7%, respectively. The prevalence of anaemia was 78.4% in HIV-infected women versus 64.7% in HIV-seronegative women (P<0.001). Although the relative risk of HIV-seropositivity increased with the severity of anaemia, no significant association was found between degree of anaemia and HIV serostatus among the study women with anaemia. Logistic regression analysis showed that anaemia was significantly and independently related to HIV infection, advanced gestational age, and low socioeconomic status. This study confirms the high prevalence of anaemia during pregnancy in Burkina Faso. Antenatal care in this population must include iron supplementation. Although HIV-infected women had a higher prevalence of anaemia, severe anaemia was infrequent, possibly because few women were in the advanced stage of HIV disease. A short course regimen of ZDV should be well tolerated in this population.

Keywords: anaemia, etiology; anaemia, epidemiology; HIV infections, complications; risk factors; zidovudine, adverse effects; pregnancy.

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Introduction

Anaemia, defined by WHO as a haemoglobin (Hb) level <11 g/dl, occurs in 40–80% of pregnant women in Africa (1–4). Iron and folic acid

deficiencies, malaria, intestinal parasitic infections and haemoglobinopathies are the principal causes of anaemia in pregnancy. In recent years, infection with human immunodeficiency virus (HIV) has become an important cause of maternal anaemia, as well as a major public health problem for mothers and children (5–9).

Interventions to reduce mother-to-child transmission of HIV are urgently needed in Africa, a continent with about 90% of the world's HIV-infected children. In industrialized countries, zidovudine (ZDV) has been shown to be effective in reducing mother-to-child transmission, but its impact on transmission in a breastfed population is still unknown (10, 11). Because ZDV has well-known haematological toxicity, maternal anaemia is of particular concern in this context. The tolerance of ZDV versus placebo among pregnant women and their children is being studied in West Africa in an ongoing randomized double-blind clinical trial (ANRS 049a trial). The protocol was approved by the Institutional Review Board of Bordeaux Uni-

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versity Hospital (France) and by the National Committee for AIDS Control in Burkina Faso and Côte d'Ivoire.

As a background to this study, we performed a cross-sectional survey of anaemia during pregnancy in Burkina Faso. The objectives were to determine the prevalence of maternal anaemia in the study population and the effect of HIV infection on the severity of maternal anaemia, as well as to identify the risk factors for maternal anaemia that could be modified by public health interventions.

Methods

Study design

A cross-sectional study was conducted in Bobo-Dioulasso (ca. 400 000 inhabitants), the second largest city of Burkina Faso. A voluntary, confidential and free-of-charge counselling and testing programme for HIV and syphilis operated from July 1995 to June 1996 in two maternal and child health (MCH) centres, the Caisse Nationale de Sécurité Sociale (CNSS) and Farakan. The first clinic mainly treats the wives of private sector workers affiliated with a company-funded health insurance, while the second is a public clinic attended by a predominantly low-income population.

All women aged ≥ 18 years who lived within the urban limits of Bobo-Dioulasso, were of gestational age < 7 months, and who were attending these two MCH centres, were offered individual pre-test HIV counselling in their vernacular language by a specially trained social worker. Demographic, socio-economic and obstetric data were collected. Women who entered the HIV and syphilis testing programme after written informed consent were also offered a haemogram. Iron supplementation was systematically given free of charge.

Laboratory methods

Laboratory tests were performed at the Centre MURAZ, Organisation de Coordination et de Coopération pour la lutte contre les Grandes Endémies (OCCGE) in Bobo-Dioulasso.

Syphilis screening was performed with the rapid plasma reagin slide test (RPR, BioMérieux, France), and all positive sera were then analysed using *Treponema pallidum* haemagglutination assay (TPHA, BioMérieux, France). Patients positive for both RPR and TPHA were considered to have recent syphilis. Screening for HIV infection was performed with a commercial ELISA test (Genelavia Mixt, Sanofi Diagnostics Pasteur, France). All reactive sera were tested further with Pepti-LAV 1-2 (Sanofi Diagnostics Pasteur, Paris, France). To exclude handling errors, we collected second blood samples from women who tested positive and carried out a rapid test on them (Multispot HIV-1/HIV-2; Sanofi Diagnostics Pasteur, France). Haemograms were performed using a Coulter Counter T540 (Coultronics, Paris, France).

Statistical analysis

Anaemia during pregnancy was defined as an Hb level < 11 g/dl, in accordance with WHO guidelines (1), and classified in three stages: mild (10 g/dl \leq Hb < 11 g/dl), moderate (7 g/dl \leq Hb < 10 g/dl), or severe (Hb < 7 g/dl). Socioeconomic status was classified by a scoring system taking into account: the type of construction materials used in the house; commodities (running water, electricity, telephone, toilet); and consumer goods (radio, television, refrigerator, bicycle, moped, motorcycle, car). Estimates are presented with their 95% confidence interval (CI). The level of statistical significance was fixed at $P \leq 0.05$. Variables found to be associated with anaemia by univariate analysis (χ^2 test, Fisher's exact test or variance analysis, as appropriate) were entered into a logistic regression model to identify risk factors for anaemia.

Results

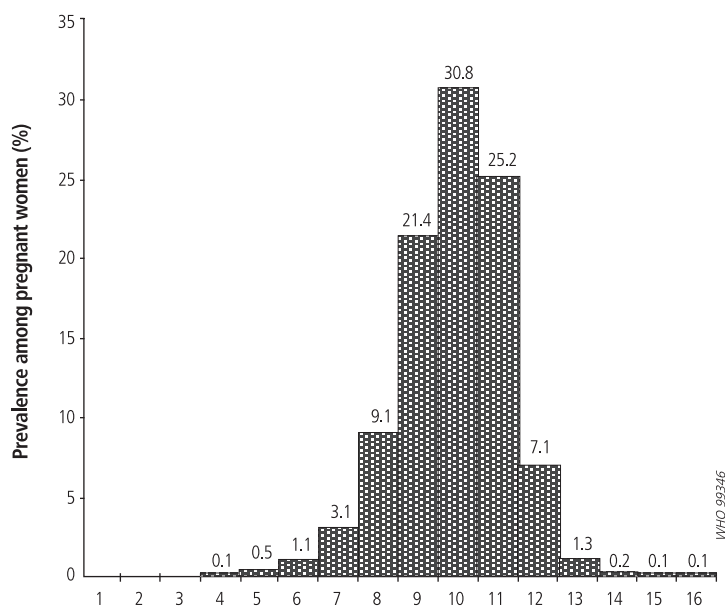
During the study period, 2870 pregnant women attending the MCH centres were offered HIV counselling and testing services. Of these, 2667 consented to be tested and haemograms were obtained for 2308 of them. The mean age of the women with all tests available was 25.9 ± 6.1 years (range, 18–50 years). The mean number of previous pregnancies was 3.7 ± 1.3 per woman (range, 1–16). Only 13% of the women knew how to read and to write, 5% were of foreign origin, and 10% were single. Overall, 57% of the women were housewives, and 40% were involved in some form of retail. A total of 60% of the women had their first antenatal visit during the second trimester of pregnancy and 24% in the third trimester.

Fig. 1 shows the distribution of Hb levels in the study sample. The mean Hb level was 10.3 ± 1.4 g/dl (range, 4.1–17.3 g/dl). The overall prevalence of anaemia was 66% (CI: 64–68%). The prevalence of mild, moderate, and severe anaemia was, respectively, 30.8%, 33.5% and 1.7%. Most (74%) of these anaemias were not accompanied by any morphological changes in circulating erythrocytes, and 22% were hypochromic (mean cell haemoglobin concentration < 32 g/dl) with microcytosis (50 fl \leq mean cell volume ≤ 80 fl).

The seroprevalence of syphilis and HIV infection in pregnant women was 0.4% (CI: 0.2–0.7%) and 9.7% (CI: 8.6–10.8%), respectively. Of the 258 HIV-infected pregnant women, 84.5% were infected by HIV type 1, 12% by HIV type 2, and 3.5% had dually reactive sera.

There was a relation between HIV infection and anaemia: the prevalence of anaemia was 78.4% in HIV-infected women versus 64.7% in HIV-negative women ($P < 0.001$; prevalence ratio = 1.21; 95% CI: 1.12–1.31). Although the relative risk of HIV seropositivity increased somewhat with the severity of anaemia, no significant association was found

Fig. 1. Distribution of haemoglobin levels among 2308 pregnant women, Bobo-Dioulasso, Burkina Faso, 1995–96



between degree of anaemia and HIV serostatus among women with anaemia in the study (Table 1).

The prevalence of anaemia in relation to demographic, socioeconomic and obstetrical characteristics is shown in Table 2. The prevalence did not differ with age, obstetric history, immigrant status or marital status; however, the prevalence increased with the duration of pregnancy and was associated with a low level of education and low socioeconomic status. In the multivariate analysis, anaemia was significantly and independently related to HIV infection, advanced gestational age, and low socioeconomic status (Table 3).

Discussion

Our study shows that two-thirds of the pregnant women living in Bobo-Dioulasso, Burkina Faso, and attending MCH centres were anaemic, confirming preliminary results from the same community (12). This level is compatible with data from other

developing countries, and is four times higher than usual estimates from industrialized countries (1–4). Although the majority of pregnant women in our study had no obvious changes in erythrocyte morphology, one out of four had hypochromia and microcytosis, reflecting severe iron deficiency. Anaemia in pregnancy reflects the precarious nutritional status of most African women. In a study conducted in 1993 in Burkina Faso, we showed a mean Hb level of 12.2 ± 1.4 g/dl among non-pregnant and non-breastfeeding women, in contrast to the normal value of 13.3 g/dl (12, 13). Physiological haemodilution and transfer of 300–500 mg of iron per day to the fetus leads to a mean decrease in Hb concentration of 2.3 g/dl (13, 14). In the present study, the prevalence of anaemia increased with gestation time, reflecting the progressive collapse of weak reserves of iron and folic acid during pregnancy due to increased demand by the fetus and haemodilution.

The three types of factor responsible for the high prevalence of maternal anaemia in such a setting are shown below in order of importance.

- Iron and folic acid deficiencies, due to under-feeding, consumption of cereals with low iron content, food taboos during pregnancy, short intervals between pregnancies, and intestinal parasitic infections (15–17); poverty impairs all these factors and limited access to health care prevents them being corrected. Our study showed a statistically significant relationship between low socioeconomic status and maternal anaemia. Although iron and folic acid supplementation are generally recommended, there are numerous economic, cultural and social obstacles to this simple prevention measure (18).
- Haemolysis due to haemoglobinopathies and malaria, which are endemic in Africa (15, 19).
- Spread of HIV infection among women of reproductive age. Prevalence of HIV infection in our population was high (9.7%) and a relationship with anaemia was demonstrated. Because HIV testing was voluntary, selection biases cannot be excluded. However, since the acceptance rate for testing was high (93%), our estimate is likely to be close to the true seroprevalence in this population.

Our study showed that HIV infection is closely correlated with anaemia in pregnant women. It is well known that HIV infection causes pancytopenia (4). However, most of these haematological changes are associated with advanced HIV disease. In our population, most of the HIV-infected pregnant women were asymptomatic with no overt immune deficiency (data not shown). This may explain why the prevalence of severe anaemia was not significantly higher among HIV-infected compared with HIV-negative pregnant women. The low proportion of women with advanced HIV disease in pregnancy may be due to several factors, some of which may change over time: African women with clinical AIDS

Table 1. Severity of anaemia (haemoglobin <11 g/dl) during pregnancy, according to HIV serostatus, Bobo-Dioulasso, Burkina Faso, 1995–96

Severity of anaemia	Anaemic pregnant women (%) ^a	
	HIV-positive (n = 171)	HIV-negative (n = 1353)
Mild (10 g/dl ≤ haemoglobin < 11 g/dl)	41.5	47.3
Moderate (7 g/dl ≤ haemoglobin < 10 g/dl)	54.4	50.3
Severe (haemoglobin < 7 g/dl)	4.1	2.4

^a $P = 0.19$; χ^2 test with 2 df.

Table 2. Demographic, socioeconomic and obstetric characteristics associated with anaemia during pregnancy in Bobo-Dioulasso, Burkina Faso, 1995–96, by univariate analysis

Characteristic	No. of pregnant women (<i>n</i> = 2308)	Anaemia		
		%	PR ^a	<i>P</i> -value
Age (years)				
< 25	1074	67.1	1.04 (0.98–1.11) ^b	0.25
25–34	961	64.6	1.00	
≥ 35	273	66.7	1.03 (0.94–1.14)	0.58
No. of pregnancies				
1	460	68.3	1.08 (0.97–1.19)	0.18
2–4	1098	66.0	1.04 (0.95–1.14)	0.42
5–6	405	65.7	1.03 (0.93–1.15)	0.58
≥ 7	345	63.5	1.00	
History of miscarriages				
Yes	340	66.8	0.92 (0.84–1.01)	0.06
No	1968	61.5	1.00	
History of stillbirth				
Yes	85	60.0	0.91 (0.76–1.08)	0.24
No	2223	66.3	1.00	
No. of live births				
0	460	68.3	1.03 (0.94–1.13)	0.51
1	1098	66.0	1.06 (0.97–1.16)	0.23
2–4	405	65.7	1.01 (0.92–1.09)	0.96
≥ 5	345	63.5	1.00	
History of infant death				
Yes	688	68.2	1.05 (0.98–1.11)	0.17
No	1620	65.1	1.00	
Marital status				
Single	229	69.0	1.05 (0.96–1.15)	0.35
Married	2079	65.7	1.00	
Occupation				
Housewife	1299	66.9	1.32 (1.08–1.63)	<0.01
Informal business	918	66.3	1.31 (1.07–1.62)	<0.01
Employee/Students	91	50.5	1.92 (1.01–3.64)	
Education				
None	1519	67.9	1.15 (1.04–1.27)	<0.01
1–6 years	495	64.4	1.09 (0.97–1.22)	0.16
≥ 7 years	294	59.2	1.00	
Socioeconomic status				
Low	918	71.0	1.22 (1.09–1.38)	<0.001
Middle	1168	63.6	1.09 (0.97–1.23)	0.14
High	222	58.1	1.00	
Gestational age				
1st trimester	392	52.8	1.00	
2nd trimester	1374	67.8	1.28 (1.16–1.42)	<0.001
3rd trimester	542	71.2	1.92 (1.21–1.50)	<0.001

^a Prevalence ratio.

^b Figures in parentheses are the 95% confidence interval.

have shown decreased fertility and a higher miscarriage rate (20, 21); women with immune deficiency have high mortality rates (8, 22); and the HIV epidemic in Burkina Faso is still in a phase of expansion and a large proportion of HIV-positive women have been contaminated relatively recently. In this context, most pregnant women are therefore asymptomatic and have mild or moderate anaemia. Under such conditions, ZDV should be well tolerated, especially if given over a short period (10).

In conclusion, our study found a high prevalence of anaemia during pregnancy in Burkina Faso, and an increased prevalence of maternal anaemia, generally mild or moderate, among HIV-infected women. Prevention and control of anaemia must be offered to all pregnant women in Africa, regardless of their HIV serostatus. Antenatal care must include systematic supplementation with iron and folic acid, chemoprophylaxis of malaria and screening and treatment of intestinal parasitic infections. In order to improve compliance, adapted

Table 3. Risk factors for anaemia during pregnancy in a logistic regression analysis, Bobo-Dioulasso, Burkina Faso, 1995–96

Characteristic	Adjusted odds ratio ^a	95% confidence interval	P-value
HIV infection			
Yes	2.03	1.45–2.84	<0.001
No	1.00		
Gestational age			
First trimester	1.00		
Second trimester	1.72	1.41–2.09	<0.001
Third trimester	1.99	1.55–2.55	<0.001
Socioeconomic status			
Low	1.49	1.20–1.84	<0.001
Middle	1.09	0.90–1.33	0.35
High	1.00		

^a Adjusted for maternal age, number of pregnancies, history of miscarriages, stillbirth, infant death, occupation, and educational level.

strategies should be developed, such as distributing drugs once a week in conjunction with a counselling programme (18). A broader approach to correcting iron deficiency in African women should also include campaigns on food diversification, individual and domestic hygiene, and family planning. ■

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Résumé

L'anémie de la femme enceinte au Burkina Faso (Afrique de l'Ouest), 1995–1996 : prévalence et facteurs associés

La prévalence de l'anémie chez la femme enceinte est élevée en Afrique. L'anémie de la femme enceinte infectée par le virus de l'immunodéficience humaine (VIH) est particulièrement préoccupante dès lors qu'on envisage d'utiliser la zidovudine (ZDV) pour réduire le risque de transmission du VIH de la mère à l'enfant. L'hématotoxicité de la ZDV est en effet bien connue et l'on peut se demander, dans le contexte de l'Afrique, si la pancytopenie provoquée par l'infection à VIH ne risque pas d'aggraver la prévalence et la sévérité de l'anémie chez les femmes enceintes, et d'entraîner une intolérance à la ZDV dans cette population. Un essai clinique a été réalisé à Bobo-Dioulasso (Burkina Faso) et à Abidjan (Côte d'Ivoire) pour évaluer la tolérance par les femmes enceintes d'une thérapie courte par la ZDV. Une enquête transversale a d'abord été faite pour mesurer la prévalence de l'anémie pendant la grossesse, identifier les facteurs de risque associés à cette anémie, et déterminer l'effet de l'infection à VIH sur la sévérité de l'anémie maternelle, afin de formuler des hypothèses sur la tolérance par les femmes enceintes dans la population générale aux antirétroviraux à potentiel hématotoxique.

Dans le cadre de l'essai clinique, des services de conseil et de dépistage du VIH ont été mis en place dans deux dispensaires prénatals de Bobo-Dioulasso, le Centre de santé maternelle et infantile (SMI) de la Caisse nationale de sécurité sociale (CNSS) et le Centre de SMI de Farakan. Des assistantes sociales ont proposé à toutes les femmes enceintes de 18 ans ou plus, enceintes de 7 mois ou moins et résidant dans l'agglomération de Bobo-Dioulasso, un conseil individuel de pré-dépistage à l'occasion duquel ont été recueillies des informations démographiques, socio-économiques et obstétricales. Un hémogramme a aussi été proposé à toutes les femmes ayant accepté de se soumettre au programme de dépistage du VIH et de la syphilis après avoir donné leur consentement éclairé par écrit.

L'enquête transversale a porté sur la période de juillet 1995 à juin 1996. Des services de conseil et de dépistage du VIH ont été proposés à 2870 femmes enceintes venues à la consultation des centres de SMI. Sur ce nombre, 2667, soit 93% des femmes enceintes, ont accepté le dépistage du VIH et 2308 hémogrammes ont été réalisés. La prévalence de l'infection à VIH était de 9,7% (intervalle de confiance (IC) à 95%: 8,6–10,8%). La prévalence globale de l'anémie (Hb<11g/dl) pendant la grossesse était de 66% (IC à 95%: 64–68%). La prévalence de l'anémie légère (10g/dl ≤ Hb<11g/dl), modérée (7g/dl ≤ Hb<10g/dl) et sévère (Hb<7g/dl) était de 30,8%, 33,5% et 1,7% respectivement. Une relation statistiquement significative (p<0,001) a été observée entre l'infection à VIH et l'anémie maternelle. La prévalence de l'anémie était de 78,4% chez les femmes infectées par le VIH contre 64,7% chez les femmes séronégatives pour le VIH. Malgré l'augmentation du risque relatif de séropositivité pour le VIH en fonction de la gravité de l'anémie, aucune association significative n'a été observée dans le cadre de l'étude entre la sévérité de l'anémie et la séropositivité pour le VIH parmi les femmes anémiées. L'analyse de régression logistique a montré que l'infection à VIH, le stade avancé de la grossesse et le faible niveau socio-économique étaient fortement et indépendamment associés à l'anémie maternelle (p<0,001).

Cette étude confirme la prévalence élevée de l'anémie chez les femmes enceintes au Burkina Faso, comme dans beaucoup de pays d'Afrique, et une prévalence accrue de l'anémie maternelle chez les femmes infectées par le VIH; l'anémie sévère est cependant rare, probablement en raison du stade peu avancé de l'infection. Une thérapie courte par la ZDV pourrait de ce fait être bien tolérée dans cette population. Pour remédier durablement à la carence en fer chez les femmes en Afrique, il conviendrait d'organiser des

campagnes pour promouvoir la diversification alimentaire, l'hygiène et la planification familiale. Les soins prénatals devraient inclure une supplémentation systé-

matique en fer et en acide folique, une chimioprophylaxie du paludisme et le dépistage et le traitement des parasitoses intestinales.

Resumen

Anemia durante el embarazo en Burkina Faso, África occidental, 1995-1996: prevalencia y factores asociados

En África la prevalencia de la anemia es elevada en las embarazadas. Entre las mujeres gestantes infectadas por el virus de la inmunodeficiencia humana (VIH), esa alta prevalencia de anemia debe suscitar preocupación cuando haya serios motivos para emplear la zidovudina (ZDV) a fin de reducir el riesgo de transmisión materno-infantil del VIH. El principal efecto nocivo que se conoce de la ZDV es su toxicidad para las células sanguíneas. Así pues, la cuestión principal que podría plantearse en el contexto de África es la siguiente: dados sus efectos igualmente citopénicos, ¿agrava el VIH la importancia y severidad de la anemia en las embarazadas, hasta el punto de poder provocar una muy mala tolerancia a la ZDV en esa población? A fin de resolver ese interrogante, se llevó a cabo un ensayo clínico en Bobo-Dioulasso (Burkina Faso) y en Abidján (Côte d'Ivoire) con el objeto de evaluar la tolerancia a un tratamiento breve con ZDV en las mujeres embarazadas. Realizamos una encuesta transversal para medir la prevalencia de la anemia durante el embarazo, identificar los factores a ella asociados y determinar la repercusión de la infección por el VIH en la gravedad de la anemia, con el propósito de formular hipótesis sobre la tolerancia de la población general de mujeres embarazadas a los antirretrovíricos potencialmente hemotóxicos.

En el marco del ensayo clínico, se pusieron en funcionamiento servicios de asesoramiento y cribado del VIH en dos dispensarios de atención prenatal de Bobo-Dioulasso, a saber, el Centro de Salud Materno-infantil (SMI) de la CNSS (Caisse Nationale de Sécurité Sociale) y el centro de SMI de Farakan. En esos centros, asistentes sociales proponían la prueba del VIH a toda mujer de 18 años o más que estuviera embarazada de siete meses como máximo y residiera dentro del perímetro urbano de Bobo-Dioulasso. Antes de someterse al análisis de cribado del VIH, todas las mujeres debían dar su consentimiento escrito y firmado al término de una sesión de asesoramiento individual. Se propuso también un hemograma gratuito a todas las mujeres sometidas a cribado. Con ocasión del asesoramiento individual previo al análisis, los asistentes sociales rellenaban para cada mujer un cuestionario normalizado con los datos demográficos, económicos y obstétricos que permitirían luego examinar los factores asociados a la anemia.

La encuesta transversal se centró en el periodo de julio de 1995 a junio de 1996. Durante ese periodo se

propuso la prueba del VIH a 2870 embarazadas que acudieron a los dispensarios prenatales elegidos. En total 2667 (esto es, un 93% de las mujeres encintas) aceptaron someterse a la prueba del VIH. Se obtuvo el hemograma de 2308 de ellas. La prevalencia de la infección por el VIH fue del 9,7% (IC95%: 8,6%-10,8%). La prevalencia global de anemia durante el embarazo (nivel de Hb < 11 g/dl) fue del 66% (IC95%: 64%-68%). La prevalencia de anemia leve ($10 \leq Hb < 11$), moderada ($7 \leq Hb < 10$) y grave (concentración de Hb < 7 g/dl) fue respectivamente de 30,8%, 33,5% y 1,7%. Se observó una relación estadísticamente significativa ($p < 0,001$) entre la infección por el VIH y la anemia materna. La prevalencia de anemia fue del 78,4% entre las infectadas por el VIH, frente al 64,7% entre las mujeres seronegativas. Pese al aumento del riesgo de seropositividad con el grado de anemia, no se halló ninguna relación significativa entre la gravedad de la anemia y la infección por el VIH entre las mujeres anémicas incluidas en nuestro estudio. El análisis de regresión logística mostró que la infección por el VIH, el estado avanzado de gestación y un nivel socioeconómico bajo eran factores relacionados de forma independiente y muy significativa ($p < 0,001$) con la anemia materna.

El presente estudio confirma la elevada prevalencia de la anemia durante el embarazo en Burkina Faso, al igual que ocurre en muchos otros países de África. En esas circunstancias la atención prenatal debe incluir sistemáticamente la administración de suplementos de hierro. Aunque la prevalencia de anemia materna es elevada entre las embarazadas infectadas por el VIH, fueron raros los casos de anemia grave, probablemente porque había pocas mujeres que estuvieran en una fase avanzada de la infección. Así pues, un régimen breve de ZDV podría ser bien tolerado por esa población. Sin embargo, la solución duradera para limitar la anemia durante el embarazo estriba en la diversificación alimentaria necesaria para consumir hierro, folatos y vitaminas en abundancia, el fomento de la higiene para evitar parasitosis intestinales, el refuerzo de la planificación familiar para limitar el número y proximidad de los embarazos y, sobre todo, la lucha contra el paludismo y el SIDA.

References

1. *The prevalence of anaemia in women: a tabulation of available information*, 2nd ed. Geneva, World Health Organization, 1992 (unpublished document WHO/MCH/MSM/92.2; available upon request from Reproductive Health and Research, World Health Organization, 1211 Geneva 27, Switzerland).
2. **Hercberg S et al.** Nutritional anaemia in pregnant Beninese women: consequences on the haematological profile of the newborn. *British journal of nutrition*, 1987, **57**: 185-193.

3. **Dop MC et al.** [Anaemia during pregnancy in Lomé (Togo): prevalence, risk factors, and repercussions for neonates]. *Revue d'épidémiologie et de santé publique*, 1992, **40**: 259–267 (in French).
4. **Fleming AF.** Haematological diseases in the tropics. In: Cook GC, ed. *Manson's tropical diseases*, 20th ed. London, Saunders, 1996: 101–173.
5. **Braddick M et al.** Impact of maternal HIV infection on obstetrical and early neonatal outcome. *AIDS*, 1990, **4**: 1001–1005.
6. **Lindan PC et al.** Predictors of mortality among HIV-infected women in Kigali, Rwanda. *Annals of internal medicine*, 1992, **116**: 320–328.
7. **Taha TET et al.** The effect of human immunodeficiency virus infection on birthweight, and infant and child mortality in urban Malawi. *International journal of epidemiology*, 1995, **24**: 1022–1029.
8. **De Clercq A, Fox E.** Causes of death in reproductive age in Rwanda: respective parts of AIDS and obstetric causes. Paper presented at: *IX International Conference on AIDS and STD in Africa, 10–14 December 1995, Kampala, Uganda*. Abstract WeB785.
9. **Walraven G et al.** The impact of HIV-1 infection on child health in sub-Saharan Africa: the burden on the health services. *Tropical medicine and international health*, 1996, **1**: 3–14.
10. **Dabis F et al.** Zidovudine to decrease mother-to-child transmission of HIV-1: is it good for developing countries? *AIDS*, 1995, **9**: 204–206.
11. **Van de Perre P et al.** Zidovudine and breast-feeding. *AIDS, patient care and STDs*, 1997, **11**: 4–5.
12. **Meda N, Cousens S, Kanki B.** Anemia among women of reproductive age in Burkina Faso. *World health forum*, 1996, **17**: 369–372.
13. **Steer P et al.** Relation between maternal haemoglobin concentration and birth weight in different ethnic groups. *British medical journal*, 1995, **310**: 489–491.
14. **Zittoun R et al.** *Manuel d'hématologie*. Paris, Doin, 1993: 446.
15. **Fleming AF.** Anemia in pregnancy in tropical Africa. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 1989, **83**: 441–448.
16. **Hercberg S.** [Iron deficiency and folic acid deficiency anaemias]. *L'enfant en Milieu tropical (Centre International de l'Enfance, Paris, France)*, 1990, **186**: 40 (in French).
17. **Galan P et al.** Iron absorption from typical West African meals containing contaminating Fe. *British journal of nutrition*, 1990, **64**: 541–546.
18. **Morrow O.** *Iron supplementation during pregnancy: why aren't women complying?* Geneva, World Health Organization, 1990 (unpublished document WHO/MCH/90.5; available upon request from Reproductive Health and Research, World Health Organization, 1211 Geneva 27, Switzerland).
19. **Hercberg S et al.** Relationship between anemia, iron and folacin deficiency, haemoglobinopathies and parasitic infection. *Human nutrition: clinical nutrition*, 1986, **40C**: 371–379.
20. **Temmerman M, Chomba EN, Piot P.** HIV-1 and reproductive health in Africa. *International journal of gynecology and obstetrics*, 1994, **44**: 107–112.
21. **Gray RH et al.** Population-based study of fertility in women with HIV-1 infection in Uganda. *Lancet*, 1998, **351**: 98–103.
22. **Piot P.** HIV/AIDS — with an emphasis on Africa. In: Cook GC, ed. *Manson's tropical diseases*, 20th ed. London, Saunders, 1996: 305–322.

Annex

The DITRAME Study Group

The DITRAME (DIminution de la TRAnsmisssion MEre-Enfant) Study Group is organized as follows:

Biostatistics:³ L. Dequae-Merchadou, R. Lassalle, V. Leroy, R. Salamon. **Epidemiology:** M. Cartoux,² F. Dabis (Coordinator of the DITRAME ANRS 049 trial),³ N. Meda (Coordinator of Bobo-Dioulasso Centre),² P. Msellati (Coordinator of Abidjan Centre),¹ R. Ramon.¹ **Gynaecology-obstetrics:** A. Bazié,² B. Dao,² R. Likikouet,¹ L. Mandelbrot (Principal Investigator),⁴ C. Welffens-Ekra (Principal Investigator).¹ **Microbiology:** D. Bonard,¹ P. Combe,¹ M. Dosso,¹ L. Gautier-Charpentier,² F.D. Ky,² A. Ouangré,² T. Ouassa,¹ O. Sanou,² F. Sylla-Koko,¹ Y. Traore,² P. Van de Perre.² **Molecular biology:** A.M. Cassel-Beraud,² J.B. Kottan,¹ O. Manigart,² C. Montcho,¹ C. Rouzioux,⁴ A. Simonon,² D. Valea,² B. You.¹

Paediatrics: R. Camara,¹ N. Elenga,¹ B. Nacro,² F. Tall,² M. Timité.¹ **Trial monitoring:** G. Gourvellec,¹ O. Ky-Zerbo,² V. Noba,¹ I. Sombié,² S. Tiendrebeogo,² I. Viho,¹ S. Yaro.²

Abidjan Health Facilities: the Anonkoua-Koute, Ouassakara, Yopougon and Yopougon-Attie Health Centres; the Centre Hospitalier Universitaire de Yopougon. **Bobo-Dioulasso Health Facilities:** the Accart-Ville, Farakan and Social Security Health Centres; the Centre Hospitalier National Sourô Sanou. **Data and Safety Monitoring Board:** J.F. Delfraissy (President, internal medicine specialist), D. Costagliola and C. Chouquet (statisticians), B. Bazin (trialist), P. Lepage (paediatrician), B. Masquelier (virologist) and K. Toure Coulibaly (obstetrician).

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