

# Postpartum moderate to severe anemia in a low-income country, Burkina Faso

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## Research article

**Keywords:** Anemia, Postpartum, Women, Prevalence, Associated factor, Burkina Faso

**Posted Date:** October 23rd, 2019

**DOI:** <https://doi.org/10.21203/rs.2.16342/v1>

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## Abstract

**Background** In Burkina Faso, Sahelian country with limited resources, the maternal mortality ratio is still high and anemia is one of the major contributing factors. To identify epidemiological aspects of postpartum anemia in order to better guide public policy in its prevention and management.

**Methods** This was a secondary analysis of data from the 2010 Demographic and Health Survey in Burkina Faso. The classification of anemia in women according to the World Health Organization was considered. For the research of associated factors, moderate or severe anemia was considered.

**Results** A total of 1616 women were included. Hemoglobin levels were less than 12 g/dl in 839 women (51.9%). It was less than 10 g/dl in 251 cases (15.5%). There has been a significant increase in the risk of postpartum anemia for women in the Sahel region (OR=2.9; IC [1.2-7.4];  $p=0.024$ ). The adjusted effect of the woman's status about postpartum amenorrhea also showed an increased risk in women still having no return from menstruation.

**Conclusion** Anemia is common during postpartum. It is of multifactorial origin. Further studies are needed to better adapt its current prevention strategies and investigate the relationship between Sahel region and anemia.

## Background

Maternal mortality remains a scourge, particularly in West African countries including Burkina Faso [1]. It is a silent burden described as a neglected public health problem [2]. It depends on multiple factors. Among the indirect obstetric causes of maternal death, anemia plays an important role [3]. Although anemia has been recognized as a public health problem for many years, little progress has been reported in this area and its high global prevalence remains a problem [4]. The World Health Organization and the United Nations Children's Fund also reiterate the urgency of combating anemia in general and stress the importance of recognizing its multifactorial etiology, a prerequisite for effective control programs [5]. Postpartum anemia is therefore a common complication with prevalence ranging from 10–80% depending on the geographic area [6,7]. It can be a result of pregnancy anemia that can be aggravated by blood loss during childbirth [8]. In addition, in the postpartum period, iron deficiency anemia can occur in breastfeeding mothers who are sensitive to iron depletion if energy and nutrient intake in their diet is inadequate [9]. In Burkina Faso, Sahelian country with limited resources [10], the maternal mortality ratio is still high and anemia is one of the major contributing factors [11]. There are no national data on prevalence or associated factors of postpartum anemia. The objective of this study was to identify these epidemiological aspects of postpartum anemia in order to better guide public policy in its prevention and management with the aim of contributing to the reduction of maternal mortality.

## 1. Methods

This was a secondary analysis of data from the 2010 Demographic and Health Survey (DHS) in Burkina Faso. A database request was made on the DHS website (<https://dhsprogram.com/What-We-Do/Survey-Types/DHS.cfm>). The various databases were obtained electronically in SPSS and Stata format. The collection of DHS data was carried out according to a rigorous methodology and complied with the ethical procedures of research on human subjects as well as the legislation in force in Burkina Faso. This was a cross-sectional study with mixed sampling (stratified on the place of residence and in clusters). It concerned the population of individuals who were living in ordinary households throughout the country. The sample was stratified to provide adequate representation of urban and rural residence in the thirteen regions of the country. The survey was conducted in 14424 households. The data were collected by direct interview with individuals and by measuring biological parameters including hemoglobin (Hb) levels and anthropometric parameters such as weight and height. The blood samples were obtained by the "Dried Blood Spots" (DBS) technique using blotting paper and centralized in the laboratory of the Regional Blood Transfusion Centre in Ouagadougou where tests were conducted to determine hemoglobin levels. Hemoglobin levels were measured in g/dl. The classification of anemia in women according to the World Health Organization was considered: no anemia for hemoglobin levels greater than or equal to 12 g/dl; mild anemia for hemoglobin levels less than 12 g/dl but above 10 g/dl; moderate anemia for hemoglobin levels below 10 g/dl but greater than or equal to 8 g/dl; severe anemia for hemoglobin levels below 8 g/dl [12]. From the DHS database obtained, only data on women who were in postpartum at the time of the survey were extracted and analyzed. The period from delivery to one year after birth was considered. On this basis, 1616 women were included (Figure 1). The dependent variable was represented by hemoglobin levels. For the research of associated factors, moderate or severe anemia was considered. A link between a hemoglobin level under 10 g/dl and the socio-demographic characteristics, clinical characteristics of women was explored from pregnancy, childbirth and postpartum data. The STATA 14.2 software was used for analysis. After a description of the sample, multilevel logistic regression was used for univariate and multivariate analysis to identify factors associated with postpartum anemia. The first level was represented by the woman and the second level by the household and the third level was the clusters (enumeration areas of the National Institute of Statistics and Demography). We appreciated the relevance of multilevel analysis by judging the values of the intraclass correlation coefficient from one level to another. We also adjusted the data using the weighting performed on the statistical analysis unit. The odds ratio (OR) was the measure of association used in studying the sense of association, strength, precision and significance. All variables that

had a p-value of less than 0.2 during the univariate analysis were progressively included in the multivariate model with evaluation of the Akaike information criterion (AIC). The significance level used in multivariate was  $p < 0.05$ .

## 2. Results

### 2.1 Prevalence of postpartum anemia

Hemoglobin level was less than 12g/dl in 839 women (51.9%). It was less than 10g/dl in 251 women (15.5%). The distribution of women by hemoglobin level is summarized in Table 1.

### 2.2. Factors associated with moderate or severe anemia in postpartum

#### Univariate analysis

the odds of being admitted for males is 5.44 times that of females.

The odds of being anemic (moderate or severe) among postpartum women in the Sahel region were 3.7 times that of postpartum women in the Central Region (OR = 3.7, CI [1.5–8.9];  $p = 0.004$ ).

The odds of being anemic (moderate or severe) among women of the second quintile were significantly high compared to odds of women of the fourth quintile (OR = 1.9, CI [1.0–3.5]) with a lightly degree of significance ( $p = 0.041$ ). Table 2 summarizes the relationship between the sociodemographic characteristics of patients and the presence of moderate to severe postpartum anemia in univariate analysis.

There was no significant association between moderate or severe postpartum anemia and clinical characteristics (pregnancy's characteristics) in univariate analysis (Tables 3 and 4).

Finally, we found a significant association between severe to moderate anemia and being in lactational amenorrhea or being in the first trimester of the postpartum. In fact, compared with those who were not in lactational amenorrhea, those in amenorrhea were 1.9 times more likely to have postpartum anemia than the others (OR = 1.9, CI: [1.2 –2.9],  $p = 0.005$ ). Women in the first trimester of the postpartum compared to women in the fourth trimester of the postpartum were 2.1 times more likely to be anemic ( $p = 0.001$ ). The associations between moderate to severe anemia and childbirth and postpartum characteristics in univariate analysis are shown in Table 5.

#### Multivariate analysis

Following the multivariate analysis, the administrative region of woman, the woman's status about postpartum amenorrhea, and woman's marital status were lightly significantly associated with moderate to severe postpartum anemia. There was a significant increase in risk of nearly 200% to present postpartum anemia for women in the Sahel region combined with a decrease of 70% of risk of postpartum anemia for women in the Hauts-Bassins region in comparison with the women of the Central region. The adjusted effect of the woman's status about postpartum amenorrhea also showed an increased risk in women still having no return from menstruation. The same effect was found for marital status where women who are in union have been found to be less at risk of developing postpartum anemia than non-union women.

Table 6 presents the factors associated with postpartum anemia in multivariate analysis.

## 3. Discussion

### Strengths and limitations of this study

This study is one of the few population studies which are investigate postpartum anemia. Indeed, most of the data in the literature on the subject concern samples in a hospital environment. As a result, we filled a major gap that was the lack of postpartum anemia prevalence data in the similar countries.

However, important limitations are to be taken into account when analyzing the DHS data: first, the data are from 2010, so the current situation may have changed. Next, we did not have any variables that indicated the clinical status of women during pregnancy, particularly in terms of general illnesses or health events that could explain the subsequent occurrence of anemia in the postpartum (placenta previa, bleeding during pregnancy, anemia during pregnancy, etc.). In addition, the DHS database does not collect a certain number of very important variables in the occurrence of anemia in the postpartum, including the quantification of blood loss during childbirth, the actions performed during the birth delivery as an administration of oxytocic, the realization of an episiotomy, etc. Finally, the biological characteristics of anemia (mean cell volume,

mean corpuscular concentration of hemoglobin) were not collected. This characterization could have focused more on the factors most likely to justify anemia in the postpartum in women. These limitations may have contributed to reducing the quality of the statistical analysis of associated factors. But by opting for a multilevel analysis, we have also improved the quality of the results by controlling a possible correlation that might exist between women in the same cluster. Moreover, the exploratory results showed the relevance of such an analysis because the intraclass correlation coefficient (ICC) was 0.24 taking into account 3 levels: woman, household and clusters.

## Prevalence of postpartum anemia

Hemoglobin levels were less than 12 g/dl in 51.9% of women. Moderate to severe anemia (Hb levels below 10 g/dl) were found in 15.5% of cases. Heterogeneity of thresholds for defining postpartum anemia has been noted in the literature, making comparisons difficult. Indeed, while some studies have considered mild or severe anemia, others have just chosen to address the issue in women whose anemia was moderate or severe (case of our study). Also, most of these studies were conducted in hospitals. The prevalence of moderate to severe anemia found in our series testifies to the problem of anemia in our country. This is all the more so since this high prevalence could contribute to maintaining already significant maternal mortality in our context. Lakew et al reported an anemia prevalence of 22.1% in 2015, considering a threshold of 12g/dl in a population of 7332 lactating women in Ethiopia. [9]. Bergman et al noted a higher prevalence (22%) of moderate or severe anemia (Hb level below 10 g/dl) in a large retrospective study of 43,807 women who gave birth between 1993 and 2008 [13]. However, this latest study only involved women in the immediate postpartum (48 hours of postpartum). Our study concerned the expanded postpartum to twelve months after delivery. This longer period would help reduce this prevalence of moderate or severe anemia in our study. Indeed, physiologically, blood losses are compensated in a few weeks or even months, following their occurrence if all physiological mechanisms are not altered and also if these losses are not severe. In 2009, Somdatta et al in a cross-sectional study in a village in northern India reported a 70% prevalence of postpartum anemia by setting a threshold for hemoglobin levels below 11g/dl [14]. In 2014, Rakesh et al in India found a prevalence of 47.3% by the sixth week of postpartum with a threshold value of 12g/dl [15]. Other proportions, still high, were found as 60.3% in 2014, by Zhao et al among lactating women in Myanmar [4] and 62% by Trinh et al in Vietnam in 2007 [16] and finally 29% by Garrido et al in Spain among women in postpartum [17].

A constant emerges from the various studies: this is the high proportion of anemic women in the postpartum regardless of the period thresholds set (from a few weeks to a few months), regardless also of the threshold value used for the hemoglobin level. However, Bhagwan et al reported a very low prevalence of moderate anemia in India in 2016 (0.6%) without any cases of severe anemia [18].

## Factors associated with moderate to severe postpartum anemia

In multivariate analysis, the region, postpartum amenorrhea status and marital status were the main factors associated with postpartum anemia with lightly degree of significance. No association was noted with a number of factors found in the literature. These included breastfeeding [8,9], professional activity [19], wealth quintile [4], age [15, 19], ethnicity [16], educational attainment [4, 16, 18] and race [8, 17, 18, 20, 21]. The same was true for variables such as multiple pregnancies [13], caesarean delivery [17] and postnatal consultation within two months of delivery [22], obesity [8], and parity [22]. The administrative region was associated with moderate or severe postpartum anemia, with two regions acting in the opposite way. Indeed, while belonging to the Sahel region was a risk factor for postpartum anemia, belonging to the Hauts-Bassins region was a protective factor (reducing the risk of postpartum anemia) when comparing these two regions to Central Region. Geographical factors combined with other factors such as cultural practices coupled with religious practices and eating habits may explain these differences. However, in our series, some key variables were not included in the analysis model because of their sensitivity: religion and ethnicity.

## Conclusion

Anemia in postpartum is common in our country despite the policy of pre- and post-natal supplementation in iron and folic acid. Given its importance and also its variability according to the geographical regions, it is necessary to investigate the quality of the conduct of the anti-anemic prophylaxis at the pregnant woman and the postpartum and to carry out additional research to better understand the supposed link between postpartum anemia and geographical areas. This could guide the fight against this maternal mortality factor in order to be more effective

## Declarations

## Acknowledgements

The authors are very grateful to the administrator of the DHS database hosting site for making this database available to us.

## Authors' contribution:

HZ, GCD, AC and BBT designed the study. The manuscript has been written mainly by HZ and AC. AC and HZ contributed to data management and analysis.

All authors contributed toward data analysis, drafting, and revising the paper and agreed to be accountable for all aspects of the work.

## Declarations of interest:

We declare no competing interests.

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## Tables

**Table 1.** Distribution of women in postpartum period by hemoglobin level, Burkina Faso, 2010.

Hemoglobin level (g/dl)	Number	Percentage
< 8 (severe anemia)	18	1.1
8 ≤ Hb < 10 (moderate anemia)	233	14.4
10 ≤ Hb < 12 (mild anemia)	588	36.4
≥ 12 (normal)	777	48.1

**Table 2.** Sociodemographic factors associated with moderate or severe postpartum anemia in univariate analysis

Sociodemographic factors	Total (N)	Anemia n (%)	OR	95% CI	P
<b>Administrative region</b>					
Boucle de Mouhoun	140	21(15.0)	0.9	[0.3-2.4]	0.785
Cascades	105	19(18.1)	1.2	[0.5-3.1]	0.657
Centre	84	13(15.5)	Ref		
Centre-Est	138	21(15.2)	1.0	[0.4-2.7]	0.991
Centre-Nord	132	21(18.7)	0.9	[0.3-2.5]	0.864
Centre-Ouest	155	29(15.9)	1.3	[0.5-3.3]	0.607
Centre-Sud	93	7(7.5)	0.5	[0.1-1.4]	0.182
Est	165	25(15.2)	1.1	[0.4-2.6]	0.907
Hauts Basins	124	8(6.5)	0.3	[0.1-1.1]	0.078
Nord	146	22(15.1)	0.9	[0.3-2.4]	0.818
Plateau Central	109	14(12.8)	0.8	[0.3-2.1]	0.611
Sahel	124	41(33.1)	3.7	[1.5-8.9]	0.004
Sud-Ouest	101	10(9.9)	0.6	[0.2-1.7]	0.348
<b>Place of residence</b>					
Urban	340	50(14.7)	Ref		
Rural	1276	201(15.8)	1.2	[0.8-2.0]	0.373
<b>Age (years)</b>					
< 18	86	17(19.8)	Ref		
18-24	489	69(14.1)	0.5	[0.3-1.0]	0.058
25-34	740	122(16.5)	0.6	[0.3-1.2]	0.142
35-49	301	43(14.3)	0.5	[0.3-1.1]	0.087
<b>Women's level of schooling</b>					
No	1342	216(16.1)	1.3	[0.7-2.3]	0.405
Primary	171	23(13.5)	Ref		
Secondary/Superior	103	12(11.7)	1.2	[0.5-3.0]	0.731
<b>Household wealth quintiles</b>					
Poorer	338	53(15.7)	1.6	[0.9-3.0]	0.142
Poor	330	61(18.5)	1.9	[1.0-3.5]	0.041
Medium	355	60(16.9)	1.6	[0.9-3.0]	0.143
Rich	350	49(14.0)	1.2	[0.6-2.2]	0.657
Richer	243	28(11.5)	Ref		
<b>Woman marital status</b>					
Single	51	13(25.5)	Ref		
In couple	1565	238(15.2)	0.5	[0.2-1.1]	0.080

**Table 3.** Clinical factors associated with moderate to severe postpartum anemia in univariate analysis

	Total (N)	Anemia n (%)	OR	95% CI	P
<b>Tobacco use</b>					
No	1570	243(15.5)	Ref		
Yes	46	8(17.4)	1.4	[0.6-3.6]	0.436
<b>Body mass index</b>					
Thin	577	95(16.5)	1.3	[0.9-1.8]	0.151
Normal	922	142(15.4)	Ref		
Overweight	117	14(12.0)	0.8	[0.4-1.8]	0.623
<b>Parity</b>					
Prim parous	272	44(16.2)	Ref		
Paucipare	560	87(15.5)	0.9	[0.6-1.5]	0.725
Multiparous	394	67(17.0)	1.0	[0.6-1.6]	0.961
Large multiparous	390	53(13.6)	0.8	[0.5-1.3]	0.345
<b>Abortion history</b>					
No	1446	219(15.1)	0.7	[0.4-1.2]	0.267
Yes	170	32(18.8)	Ref		
<b>Caesarean delivery</b>					
No	1581	245(15.5)	Ref		
Yes	35	6(17.1)	0.9	[0.3-3.0]	0.899

**Table 4.** Association between moderate or severe postpartum anemia and pregnancy characteristics in univariate analysis

Pregnancy characteristics	Total (N)	Anemia* n (%)	OR	IC à 95%	p
<b>Iron and folic acid prophylaxis</b>					
No	103	15(14.6)	Ref		
Yes	1513	236(15.6)	1.2	[0.6-2.5]	0.568
<b>Anti-malarial prophylaxis by pyrimethamine sulfadoxine</b>					
No	349	56(16.0)	1.1	[0.7-1.8]	0.525
Yes	1267	195(15.4)	Ref		
<b>Anti-malarial prophylaxis by chloroquine</b>					
No	1471	226(15.4)	0.8	[0.4-1.6]	0.556
Yes	145	25(17.2)	Ref		
<b>Deworming</b>					
No	1194	180(15.1)	Ref		
Yes	422	71(16.8)	1.2	[0.8-1.7]	0.389
<b>Antenatal cure (ANC)</b>					
No	59	11(18.6)	1.4	[0.6-3.6]	0.443
1-3	1011	161(15.9)	1.1	[0.8-1.6]	0.431
At least 4	546	79(14.5)	Ref		

**Table 5.** Characteristics of childbirth/postpartum and risk of moderate or severe anemia in postpartum

Caractéristiques de l'accouchement et du postpartum	Total (N)	Anemia* n (%)	OR	IC à 95%	P
<b>Place of delivery</b>					
At home	395	66(16.7)	1.1	[0.7-1.7]	0.599
In a health center	1221	185(15.2)	Ref		
<b>Lactating woman</b>					
No	89	12(13.5)	0.9	[0.4-1.8]	0.713
Yes	1527	239(15.7)	Ref		
<b>Woman still in amenorrhea</b>					
No	398	42(10.6)	Ref		
Yes	1218	209(17.2)	1.9	[1.2-2.9]	0.005
<b>Sex of birth</b>					
Male	834	126(15.1)	Ref		
Female	782	125(16.0)	1.2	[0.8-1.6]	0.358
<b>Last child alive</b>					
No	71	10(14.1)	Ref		
Yes	1545	241(15.6)	1.0	[0.5-2.4]	0.929
<b>Postpartum period</b>					
1 <sup>st</sup> trimester	480	103(21.5)	2.1	[1.3-3.3]	0.001
2 <sup>nd</sup> trimester	407	50(12.3)	0.9	[0.6-1.5]	0.773
3 <sup>rd</sup> trimester	373	50(13.4)	1.2	[0.7-2.1]	0.416
4 <sup>th</sup> trimester	356	48(13.5)	Ref		
<b>Use of contraceptive methods</b>					
No	1513	243(16.1)	Ref		
Yes	103	8(7.8)	0.5	[0.2-1.2]	0.133

**Table 6.** Factors associated with postpartum anemia in multivariate analysis

	OR	IC à 95%	p
<b>Administrative region</b>			
Boucle de Mouhoun	0.6	[0.2-1.8]	0.383
Cascades	0.9	[0.4-2.4]	0.909
Centre	Ref		
Centre-Est	0.8	[0.3-2.2]	0.706
Centre-Nord	0.7	[0.2-1.9]	0.440
Centre-Ouest	1.0	[0.4-2.6]	0.964
Centre-Sud	0.3	[0.1-1.0]	0.046
Est	0.8	[0.3-2.1]	0.693
Hauts Basins	0.3	[0.1-0.9]	0.039
Nord	0.7	[0.2-1.8]	0.423
Plateau Central	0.5	[0.2-1.5]	0.244
Sahel	2.9	[1.2-7.4]	0.024
Sud-Ouest	0.5	[0.2-1.4]	0.158
<b>Wealth quintile</b>			
Lowest	1.2	[0.6-2.2]	0.613
Second	1.6	[0.9-2.8]	0.113
Middle	1.5	[0.8-2.8]	0.160
Fourth	1.1	[0.6-2.0]	0.804
Highest	Ref		
<b>Woman marital status</b>			
Single	Ref		
In couple	0.4	[0.2-1.0]	0.041
<b>Woman still in amenorrhea</b>			
No	Ref		
Yes	1.7	[1.0-2.7]	0.040
<b>Postpartum period</b>			
1 <sup>st</sup> trimester	1.6	[1.0-2.5]	0.054
2 <sup>nd</sup> trimester	0.8	[0.5-1.3]	0.381
3 <sup>rd</sup> trimester	1.1	[0.7-1.9]	0.654
4 <sup>th</sup> trimester	Ref		

## Figures

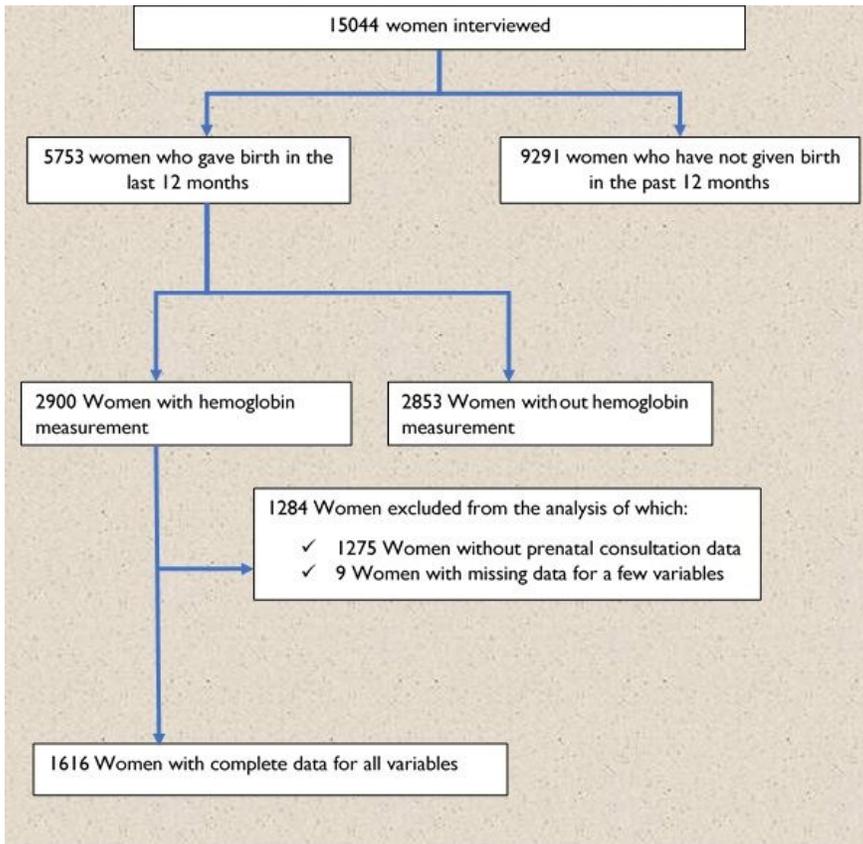


Figure 1

flowchart of selected women