




# Anemia and Associated Factors Among Lactating Women in Sierra Leone: An Analysis of the Sierra Leone Demographic and Health Survey 2019

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## ABSTRACT

**BACKGROUND:** Anemia is a condition in which hemoglobin (Hb) concentration and/or red blood cell (RBC) numbers are lower than normal and insufficient to meet an individual's physiological needs. The prevalence of anemia among women of reproductive age is high in Sub-Saharan Africa (SSA), including Sierra Leone. However, data on anemia among lactating women in Sierra Leone are scarce. Therefore, this study was conducted to estimate the prevalence of anemia and determine its associated factors among lactating women in Sierra Leone.

**METHODS:** The 2019 Sierra Leone Demographic and Health Survey (SLDH) data were used of which 1543 lactating women aged 15 to 49 years old had hemoglobin measurements. Multistage stratified sampling was used to select study participants and data were collected using validated questionnaires. Multivariate binary logistic regression was used to determine factors associated with anemia among lactating women in Sierra Leone.

**RESULTS:** The general prevalence of anemia among lactating women in Sierra Leone was 52.9% (95% CI = 50.9–55.8). Almost a quarter, 23.8% (95% CI = 22.1–26.3) of the lactating women had mild anemia, 27.4% (95% CI = 25.3–29.7) had moderate anemia and 1.7% (95% CI = 1.1–2.5) had severe anemia. The use of modern contraceptives (aOR = 1.64, 95% CI = 1.09–2.47), not being visited by a field worker in the past year (aOR = 1.51, 95% CI = 1.12–2.03) and being Muslim (aOR = 1.46, 95% CI = 1.11–1.91), were associated with higher odds of being anemic. Being given and having bought iron supplements during pregnancy (aOR = 0.46, 95% CI = 0.25–0.87) was associated with less odds of being anemic.

**CONCLUSION:** More than half of the lactating mothers in our study were anemic. The risk factors for anemia in our study included: use of modern contraceptives, not being visited by a field worker in the past year and being Muslim. Receiving iron supplements during pregnancy was protective against anemia. According to the results from this study, the recommendation for lactating women was to maintain routine interface with the healthcare system which includes being visited by a field worker who should prescribe and issue iron supplements to them. Lactating women especially Muslims should receive routine nutrition education by the health workers at the health facilities during antenatal care visits or postnatal care in regard to anemia and means of prevention and treatment. Community stakeholders should also work in collaboration to establish scalable methods to correctly identify pregnant women with risk factors, inform them about anemia with caution, and apply appropriate measures as trained or instructed.

**KEYWORDS:** Anemia, lactating women and Sierra Leone

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## Introduction

Anemia is a condition in which hemoglobin (Hb) concentration and/or red blood cell (RBC) numbers are lower than normal and insufficient to meet an individual's physiological needs.<sup>1</sup> Anemia is the world's second leading cause of disability and thus one of the most serious global public health problems affecting 1.62 billion people with major consequences on health, social and economic development.<sup>1</sup>

Anemia is also the most common nutritional deficiency disorder in the world affecting about one-third of the global population with iron deficiency causing almost half of all anemia cases worldwide.<sup>2,3</sup> Africa and Asia account for more than 85% of the absolute anemia burden in high-risk groups.<sup>4</sup> West and Central Africa (48%) have the highest prevalence rates of anemia in the world. Sierra Leone, a country in West Africa, also has a high prevalence of anemia among women of



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reproductive age (45%) which is classified as a severe public health problem.<sup>5-7</sup>

The most at-risk population groups are children and women of reproductive age.<sup>8</sup> The lactation period is an essential transitional phase for both the mother and the newborn, anemia during this period is a public health problem in Africa with focus on Sierra Leone.<sup>4,7,9</sup> Women of reproductive age in Sierra Leone mainly depend on a cereal-based dietary pattern with poor nutritious value, which can lead to deficiency of iron and increased susceptibility to anemia.<sup>10</sup>

Studies have shown that anemia during pregnancy, postpartum hemorrhage (PPH) and poor feeding practices are the greatest risk factors for anemia during the lactation period.<sup>2,11</sup> Blood loss during and after delivery (PPH) as well as depletion of maternal iron stores during lactation are the major causes of anemia among lactating mothers.<sup>11</sup>

The quality of iron in breast milk is maintained at the expense of the maternal iron stores in the body if the mother does not have adequate energy and iron intake in the diet, hence why lactating women are at a greater risk for anemia.<sup>12,13</sup> Maternal anemia during lactation affects children's hemoglobin levels since children less than 6 months of age entirely depend on their own iron stores and breastmilk which leads to continuity of the intergenerational cycle of anemia.<sup>14</sup> Sierra Leone has been trying to address the issue of anemia by establishing policy guidelines on the prevention and management of anemia among pregnancy and lactating women.<sup>15</sup> However, their progress has been slow in achieving the target of reducing anemia among women of the reproductive age set by the World Health Assembly.<sup>15</sup> Thus, the current prevalence of anemia among women of reproductive age in Sierra Leone currently stands at 48.0%.<sup>16</sup> This is considered a severe public health problem by the World Health Organization (WHO).<sup>17</sup>

Improving lactating women's anemia status is critical for reducing potential health and nutrition deficiency diseases in children<sup>3</sup> because maternal anemia during the lactation period alters the emotion and cognition of the mother leading to decreased milk production and postpartum depression of the mother.<sup>2</sup> It also lowers the immunity of the mother and child, affects cognitive development and learning ability of the child.<sup>2,18</sup> Improving blood levels and iron supplies in lactating women, is also considered a strong foundation in the global efforts of reducing maternal mortality.<sup>19</sup> While Sierra Leone did attempt implementation of measures to address anemia, their commitment in the field is ranked low, according to the Global Nutrition Report. This largely stems from their limited focus on pregnant women and children, which is reflected on their high anemia prevalence among children under 5 years of age (76%) and women of reproductive age (48%).<sup>20</sup> In order to design appropriate interventions that address anemia among lactating women, determining the burden and understanding the potential risk and protective factors is crucial. However, there is limited available research about anemia among

lactating women in Sierra Leone. Therefore, this study was conducted using secondary data from the 2019 Sierra Leone Demographic and Health Survey (SLDHS) to estimate the prevalence of anemia and determine its associated factors among lactating women in Sierra Leone.

## Methods

### *Data source and sampling procedure*

This study used secondary data from the 2019 SLDHS conducted from May, 2016 to August, 2019 to analyze nationally representative key anemia indicators. SLDHS is conducted every 5 years and stratified 2-stage cluster sampling method was employed to select the study participants. A total of 13 872 households were selected from the 578 enumeration areas (214 urban and 364 rural) that were sampled. Blood samples were obtained through finger pricking. The blood was drawn into a microcuvette and hemoglobin analysis was done on site using battery-operated portable HemoCue analyzers. To ensure quality of data and blood samples, pretest training was conducted to ensure that the trainers for the main training are well prepared and have adequate knowledge regarding the SLDHS questionnaires and procedures. In the main training, biomarker training that included drawing of blood and use of rapid test kits to test for anemia was done for nurses and lasted 2 weeks. The field coordinators underwent training on the biomarker checklist. All trainings were conducted by technically experienced ICF (Inner City Fund) staff. Furthermore, random re-measurements were done during data collection to strengthen quality assurance. Results of hemoglobin testing for men, women and children were recorded using the biomarker questionnaire. We only analyzed data for lactating women aged 15 to 49 years old whose hemoglobin results were available in the 2019 SLDHS dataset. These hemoglobin results were then adjusted for altitude and smoking status. Given that prolonged exposure to hypoxia increases erythropoiesis and that the partial pressure of oxygen reduces with altitude, hemoglobin increases with altitude to adapt to the less oxygen saturation of the blood.<sup>21</sup> Furthermore, cigarette smoking has been documented to increase hemoglobin concentration which is mainly attributed to the carbon monoxide exposure hence reducing the oxygen-carrying capacity.<sup>22-24</sup> As a result, smokers tend to have higher hemoglobin concentrations compared to the nonsmokers in order to compensate for decreased oxygen delivery.<sup>24</sup> Due to these adaptive increases in hemoglobin, hemoglobin results were adjusted for such factors to ensure accurate interpretation of the data.

Of the 15 574 women in the 2019 SLDHS data set, only 3134 were lactating, of which 1414 were not sampled for the biomarker questionnaire, 14 were sampled but not present, 163 did not provide for hemoglobin testing. This study used the remaining 1543 lactating women who had hemoglobin results as the sample size. A full protocol with a detailed explanation about the data collection process and sampling is available online.<sup>25</sup>

### Study variables

**Dependent variable.** This study was based on the altitude and cigarette smoking adjusted hemoglobin levels which were provided in the SLDHS data. Hemoglobin level was measured in grams per deciliter (g/dl). For this analysis, anemia among lactating women was operationalized as a categorical variable and categorized as anemic and non-anemic from prior classifications in the levels of hemoglobin (normal  $\geq 12.0$  g/dl, mild = 11.0-11.9 g/dl, moderate = 8.0-10.9 g/dl, severe  $\leq 8.0$  g/dl). Lactating women with hemoglobin levels less than 12.0 g/dl were considered as anemic<sup>3,26</sup> and coded as 1 while those who were not anemic were coded as 0.

**Independent variables.** These included determinants of anemia among lactating women based on evidence from available literature and data.<sup>4,26,27</sup> Twenty explanatory variables were used and they included: maternal age, wealth index, place of residence, region, level of education, household size, sex of household head, working status, marital status, religion problems seeking permission and distance to health facility, exposure to mass media, visited by field health worker, maternal parity, contraceptives use, postnatal care, skilled birth attendance, being given or having bought iron supplements during antenatal care (ANC), body mass index (BMI) status and ANC frequency.

### Statistical analysis

In order to account for the multi-stage cluster design, Statistical Package for the Social Sciences (SPSS) version 25.0 statistical software complex samples package was used to analyze the data. The following variables were incorporated in the analysis: individual sample weight, sample strata for sampling errors and cluster number.<sup>28-30</sup> Analysis was carried out based on the weighted count to account for the unequal probability sampling in different strata and to ensure representativeness of the survey results at the national and regional level. Normal distribution of the data was confirmed by normal Q-Q plots.

Each independent variable was assessed separately for its association with anemia using bivariate logistic regression which generated crude odds ratios (cORs), 95% confidence interval (CIs) and *P*-values. All Independent variables with *P*-values  $\leq .25$  at bivariate analysis, and level of education which was shown to be strongly associated with anemia and not strongly collinear with other independent variables were included in the final multivariate logistic regression model to assess the independent effect of each variable. Adjusted odds ratios (aORs), 95% confidence interval (CIs) and *P*-values were obtained using a statistical significance level set at *P*-value  $< .05$ . Before multivariate regression analysis, Hosmer and Lemeshow test was done and multi-collinearity was assessed using variance inflation factor (VIF) and no VIF was above 3.

## Results

### Sociodemographic characteristics of study participants

The majority, 1404 (91.0%) of the women were not using contraceptives, 1313 (85.1%) were married, 1160 (75.2%) were working, 1226 (79.5%) were Muslims, 1084 (70.3%) resided in rural areas, 812 (52.6%) had no formal education, 1001 (64.9%) were aged 20 to 34 years and 1092 (70.8%) had normal BMI (Table 1). Most of the respondents, 845 (54.7%) had no exposure to the 4 mass media channels (internet, television stations, radio stations, and newspapers).

Slightly more than a half, 816 (52.9%, 95% CI: 50.9-55.8) had anemia (Figure 1). Almost a quarter, 367 (24%, 95% CI: 22.1-26.3) had mild anemia, slightly more than a quarter, 423 (27%, 95% CI: 25.3-29.7) had moderate anemia and 26 (2%, 95% CI: 1.1-2.5) had severe anemia (Figure 2).

### Factors associated with anemia

After adjusting for other variables, use of modern contraceptives, not being visited by a field worker in the past year and being a Muslim were significantly associated with more odds of being anemic (Table 2). Not being given and having bought iron supplements during pregnancy was associated with significantly less odds of being anemic compared to being given or having bought iron supplements during pregnancy (Table 2).

## Discussion

Anemia in lactating women is an overlooked public health issue that affects both the mother and the newborn.<sup>31</sup> Thus, this study determined the magnitude and determinant factors of anemia among lactating women in Sierra Leone. According to this study, it was discovered that more than a half of lactating women in Sierra Leone were anemic. The prevalence of anemia in lactating women is slightly higher than that of women in reproductive age (48%) as a whole in Sierra Leone.<sup>16</sup> However, this prevalence is far lower than the prevalence of anemia among lactating women in India (63%)<sup>32</sup> and higher than that in East Africa (36.15%).<sup>27</sup> The increased prevalence of anemia among lactating women in this study as compared to the prevalence of anemia among the entire population of women in the reproductive age group could be due to the additional nutrition requirements (including iron requirements) needed for the production of adequate quantity of milk, whereas the difference between the prevalence of anemia in this study and that among lactating women in India could be attributed to the study population, time gap and study setting among others.

This study found a statistically significant association between anemia and the use of modern contraceptive methods among lactating women in Sierra Leone. According to this study, use of modern contraceptive methods increased the likelihood of a lactating woman becoming anemic, this could be due the fact that majority of the women were Muslims and

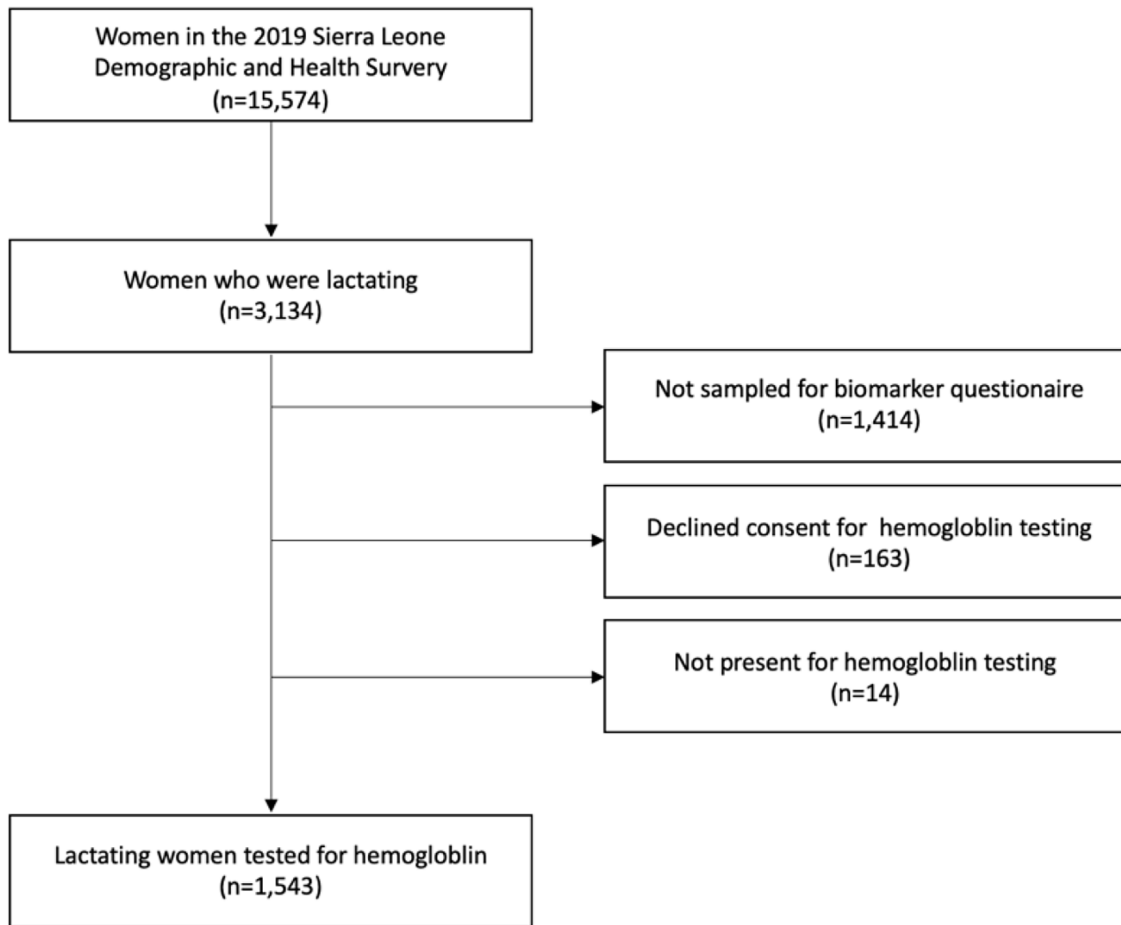
**Table 1.** Socio-demographic characteristics of lactating women with hemoglobin measurements in Sierra Leone as per the 2019 SLDHS.

CHARACTERISTICS	FREQUENCY (N) = 1543	PERCENTAGE (%)
Age		
15-19	193	12.5
20-34	1001	64.9
35-49	349	22.6
Visited by field worker		
No	1055	68.3
Yes	489	31.7
Residence		
Urban	459	29.7
Rural	1084	70.3
Region		
Western	220	14.2
Eastern	367	23.8
Northwestern	252	16.3
Northern	349	22.6
Southern	355	23.1
Religion		
Islam	1226	79.5
Christianity	317	20.5
Sex of household head		
Male	1197	77.6
Female	346	22.4
Household size		
Equal to or more than 7	703	45.6
Less than 7	840	54.4
Working status		
Not working	383	24.8
Working	1160	75.2
Marital status		
Not married	230	14.9
Married	1313	85.1
Education level		
No formal education	812	52.6
Primary education	264	17.1
Post-primary education	467	30.3

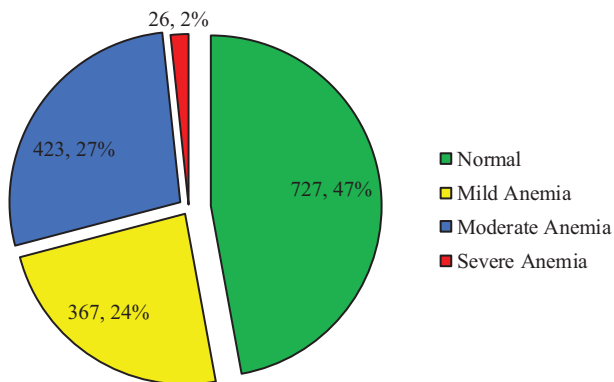
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**Table 1.** (Continued)

CHARACTERISTICS	FREQUENCY (N) = 1543	PERCENTAGE (%)
Wealth Index		
Poorest	397	25.7
Poorer	370	24.0
Middle	323	21.0
Richer	250	16.2
Richest	203	13.2
Parity		
1-3	928	60.2
Equal to or more than 4	615	39.8
Exposure to mass media		
No	845	54.7
Yes	698	45.3
Skilled birth attendance		
No	170	11.0
Yes	1373	89.0
Use of modern contraceptives		
No	1404	91.0
Yes	139	9.0
Internet use		
No	1428	92.5
Yes	115	7.5
Permission to access healthcare		
Big problem	427	27.7
Not big problem	1116	72.3
Distance to health facility		
Big problem	784	50.8
Not big problem	759	49.2
Given Iron during ANC		
No	63	4.1
Yes	1480	95.9
ANC attendance		
Equal to or more than 8 contacts	327	21.2
Less than 8 contacts	1216	78.8
Body mass index status (kg/m <sup>2</sup> )		
25.00 and above	359	23.3
18.50-24.99	1092	70.7
Less than 18.50	92	6.0



**Figure 1** Anemia among lactating women in Sierra Leone as per the 2019 SLDHS.



**Figure 2.** Sampling procedure to select lactating mothers.

most of them did not use the modern contraceptive methods. This finding is contrary to what is scientifically known that modern contraceptive methods (mostly the hormonal contraceptives) reduce menstrual bleeding and hence decrease susceptibility of women to anemia as confirmed by findings from the different studies conducted in Rwanda, East Africa, Ethiopia, and Nepal.<sup>4,33-35</sup>

In the current study, lactating women who were not visited by a field (health) worker in the past year were more likely to be

anemic compared to their counterparts. This is in-line with a study carried out in East Africa.<sup>27</sup> This is not surprising as these women never got the opportunity to receive services offered by the field (health) workers. The field (health) workers offer health education, referral and follow-up of the lactating women within their communities as part the routine out-reaches, they carry out. These field (health) workers additionally provide healthcare services including the provision of iron supplements. A further argument could be that interface with the health care system in the form of health workers creates a conducive environment for continuous counseling on the benefits of iron supplementation and the provision of iron supplementation drugs.

According to this study, not being given or having bought iron supplements during pregnancy was associated with less odds of being anemic compared to being given or having bought iron supplements during pregnancy. This could be because lactating women that received prescribed iron, were not able to take it as was instructed and most likely this Iron was given after finding them anemic. Studies carried out in India and Ethiopia<sup>3,32</sup> discovered that iron supplementation during pregnancy was associated with less odds of being anemic for lactating women thus contradicting our study findings.

**Table 2.** Factors associated with anemia among lactating women in Sierra Leone as per the 2019 SLDHS.

CHARACTERISTICS	CRUDE COR (95% CI)	P-VALUE	ADJUSTED AOR (95% CI)	P-VALUE
<b>Age</b>				
35-49	1		1	
20-34	1.16 (0.88-1.53)	.279	1.09 (0.78-1.51)	.618
15-19	1.31 (0.92-1.86)	.136	1.11 (0.69-1.77)	.676
<b>Residence</b>				
Rural	1		1	
Urban	<b>0.67 (0.51-0.88) **</b>	.004	0.72 (0.45-1.17)	.185
<b>Region</b>				
Western	1		1	
Southern	1.24 (0.82-1.88)	.316	0.81 (0.47-1.38)	.433
Northwestern	1.51 (0.98-2.33)	.062	0.85 (0.49-1.49)	.568
Northern	1.29 (0.81-2.06)	.290	0.87 (0.51-1.51)	.623
Eastern	1.35 (0.88-2.10)	.173	0.98 (0.57-1.68)	.930
<b>Religion</b>				
Christianity and other religions	1		1	
Islam	<b>1.45 (1.11-1.90) **</b>	.006	<b>1.46 (1.11-1.91) *</b>	.007
<b>Sex household head</b>				
Male	1			
Female	0.97 (0.74-1.27)	.822		
<b>Household size</b>				
Equal to or more than 7	1		1	
Less than 7	<b>0.79 (0.64-0.98) *</b>	.032	0.83 (0.66-1.05)	.112
<b>Working status</b>				
Not working	1			
Working	0.97 (0.75-1.27)	.843		
<b>Marital status</b>				
Not married	1		1	
Married	0.84 (0.62-1.13)	.240	0.82 (0.58-1.15)	.244
<b>Education level</b>				
No formal education	1		1	
Primary education	1.17 (0.80-1.73)	.421	1.15 (0.78-1.71)	.481
Post-primary Education	0.89 (0.68-1.17)	.401	0.94 (0.68-1.31)	.707
<b>Wealth Index</b>				
Poorest	1		1	
Poorer	<b>1.41 (1.03-1.93) *</b>	.032	1.32 (0.97-1.80)	.079
Middle	1.01 (0.73-1.40)	.670	1.00 (0.71-1.42)	.990
Richer	0.89 (0.63-1.26)	.501	1.11 (0.68-1.81)	.685
Richest	0.72 (0.49-1.06)	.096	0.92 (0.49-1.74)	.805

(Continued)

Table 2. (Continued)

CHARACTERISTICS	CRUDE COR (95% CI)	P-VALUE	ADJUSTED AOR (95% CI)	P-VALUE
Parity				
1-3	1		1	
Equal to or more than 4	0.89 (0.70-1.09)	.242	0.90 (0.66-1.21)	.464
Postnatal care				
Yes	1		1	
No	1.30 (0.88-1.94)	.189	1.25 (0.83-1.87)	.286
ANC frequency				
Equal to or more than 8 contacts	1			
Less than 8 contacts	1.11 (0.85-1.46)	.449		
Skilled birth attendance				
Yes	1		1	
No	1.23 (0.89-1.71)	.207	1.05 (0.73-1.51)	.786
Modern contraceptive use				
Yes	1		1	
No	<b>1.77 (1.17-2.69) **</b>	.007	<b>1.64 (1.09-2.47) *</b>	.018
Permission to access healthcare				
Big problem	1			
Not big problem	0.90 (0.68-1.20)	.471		
Distance to health facility				
Big problem	1		1	
Not big problem	0.86 (0.69-1.07)	.182	1.00 (0.79-1.28)	.974
Exposure to media				
Yes	1		1	
No	1.21 (0.95-1.55)	.122	0.99 (0.75-1.29)	.928
Visited by fieldworker				
Yes	1		1	
No	<b>1.59 (1.22-2.07) **</b>	.001	<b>1.51 (1.12-2.03) **</b>	.007
Given/bought iron during ANC				
Yes	1			
No	<b>0.50 (0.28-0.91) *</b>	.022	<b>0.46 (0.25-0.87) *</b>	.017
Body mass index (kg/m <sup>2</sup> )				
25.00 and above	1			
18.50-24.99	<b>1.37 (1.04-1.82) *</b>	.019	1.22 (0.90-1.66)	.194
Less than 18.50	<b>1.92 (1.12-3.32) *</b>	.027	1.65 (0.92-2.95)	.091

Abbreviations: aOR, adjusted odds ratio; cOR, crude odds ratio.

Values in bold were statistically significant.

<sup>a</sup>Missing 113 (1.5%) respondents.

\*Significant at  $P$ -value < .05. \*\*Significant at  $P$ -value < .01. \*\*\*Significant at  $P$ -value < .001.

This study also found an association between being Muslim and having anemia among lactating women in Sierra Leone. This could be attributed to the difference in the dietary patterns of the Muslims and the other religious populations. Muslims in Sierra Leone have a cereal based dietary pattern.<sup>36</sup> According to the Sierra Leone Nutrition National survey, women of reproductive age mostly depend on cereal diets with inclusion of dark green leafy vegetable plus nuts and seeds. These women do not frequently consume meat, poultry, organ meat, eggs, vitamin A rich fruits, root and stem tubers.<sup>36</sup> Therefore, since Islam is the dominant religion among the lactating women in Sierra Leone as confirmed by this study, most of them could become anemic based on their dietary pattern. Contrary to the findings of this study, Mohrotra et al<sup>37</sup> found that Christian women were more likely to be anemic compared to Muslim women in a study he carried out in Port Blair, Andaman and the Nicobar Islands.

### Limitations

The presence of underlying factors like severe dehydration, cancer of the liver or kidneys and other chronic diseases could have affected the results. The etiology of anemia cannot be deduced from the results. The HemoCue analyzer used mainly shows concentration of serum iron which can also be affected by other factors like infections thus affecting the results. The data set used lacked some predictors like dietary intake.

The Strength of this study is that it used nationally representative data.

### Conclusion

Slightly more than half of the lactating mothers were anemic. The risk factors for anemia in our study included: use of modern contraceptives, not being visited by a field worker in the past year and being Muslim. Receiving iron supplements by being given or having bought them was protective against anemia. Thus, this study recommends that lactating women in Sierra Leone maintain routine interface with the healthcare system which includes being visited by a field worker who should prescribe and issue iron supplements to them. Lactating women, especially, Muslims should receive routine nutrition education at the health facilities during antenatal care visits or postnatal care in regard to anemia and means of prevention and treatment. Community stakeholders should work to establish scalable methods to correctly identify pregnant and lactating women with risk factors, inform them about anemia with caution, and apply appropriate measures as trained or instructed.

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### Author Contributions

Conceptualization: Ivan Kato Arinda and Quraish Sserwanja. Formal Analysis: Quraish Sserwanja. Methodology: Quraish Sserwanja, Ivan Kato Arinda, Kassim Kamara, Napyo Agnes,

David Mukunya, Nsubuga Edirisa Juniour, Nuwahereza Christinah, Seungwon Lee, Anitah Kagali. Writing—Original Draft Preparation: Ivan Kato Arinda and Quraish Sserwanja. Writing—Review & Editing: Quraish Sserwanja, Ivan Kato Arinda, Kassim Kamara, Napyo Agnes, David Mukunya, Nsubuga Edirisa Juniour, Nuwahereza Christinah, Seungwon Lee, Anitah Kagali. All authors have read and approved the final manuscript version of the manuscript.

### Ethics and Consent

Acquired permission from the MEASURE DHS program to use the particular data set.

### Paper Context

Iron deficiency anemia is known to contribute to half of all anemia cases globally. Different factors, in relation to lactating women in Sierra Leone, have been associated with anemia and these are still inconsistent. In order to improve the various specific interventions or responses to anemia, understanding these factors in relation to lactating women in Sierra Leone is of importance to the public health sector.

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