Anaemia and its determinants among reproductive age women (15–49 years) in the Gambia: a multi-level analysis of 2019–20 Gambian Demographic and Health Survey Data

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Abstract

Background: Anaemia is among the top list of the contemporarily public health burden in both developed and developing countries, by affecting mainly women's and children's health.

Objective: This study aimed to identify the burden of anaemia and its individual and community level factors among women in The Gambia.

Method: This study was based on an extensive national survey, Gambian Demographic and Health Survey. A total weighted sample of 5,858 reproductive-age women was included. Because of the hierarchical nature of the DHS data, a multi-level logistic regression model was applied to study individual and community-level factors that may influence anaemia. A 95% confidence interval and a p-value of less than 0.05 were used to declare statistical significance.

Result: The overall prevalence of anemia was found 44.28% (95% CI 0.43, 0.46). Current users of contraceptives were (AOR = 0.66, 95% CI: (0.55–0.79)) and currently pregnant (AOR = 1.44, 95% CI: (1.16, 1.81)) less likely and more likely to develop anaemia compared to their counterparts respectively. In addition to this, living in the region of Brikama (AOR = 0.69, 95% CI: (0.50–0.97)) less likely to be exposed to anemia. From community level factor, high distance to the health facilities (AOR = 1.23,95% CI 1.02–1.48) were associated with anemia.

Conclusion: The study revealed that the burden of anaemia among reproductive age Gambian women was very high. Anaemia was affected by both individual and community levels of factors. Thus, the burden of anaemia could be significantly reduced if pregnant and contraceptive users' women were monitored and encouraged. Increasing the accessibility of health facilities, community mobilization, and awareness enhancement are also advisable.

Keywords: Anemia, Determinants, Gambia, Multi-level Analysis, Reproductive age women

Introduction

Anaemia could hold the definition of reducing the number of red blood cells, haemoglobin and hematocrit below the acceptable range of any healthy person keeping constant other variables such as age, sex and race, however, under similar environmental situations [1]. Although anaemia affects all ages, it mainly affects children (42%) and pregnant and non-pregnant females particularly in low and middle-income countries than the
general population (40%) [2, 3]. Age, sex and physiological status of individuals will assist clinicians to classify those individuals, whether not anaemic, middle, moderate or severe, according to their level of haemoglobin concentration in their blood [4]. Various studies indicate that anaemia increases people’s risk of other illnesses (heart failure and tuberculosis), disturbing sleep quality, financial and other social and psychological stress [5–7]. The physiological and physical alternations with higher nutritional requirements make adolescents among the higher risk group of anaemia [8]; this also make them the most risky and vulnerable group during their motherhood experience [9]. however, they are the most ignored groups of people and not sufficiently addressed by researchers and accessing of healthcare services, mainly in Africa [10]. According to the WHO in 2019 and 204 countries and territories, anaemia affects about 29.9% of mothers of childbearing age and 39.9% of children under the age of five, affecting a total of about half billion reproductive-age women [11, 12].

Africa is the most severely attacked continent of the rest world. The world health organization 2015 report indicated that about 10.8 and 9.7 million women are exposed to anaemia in Africa and the Pacific regions, respectively [13]. The prevalence of anaemia is increasing at an alarming rate in Africa among non-pregnant from 37.7% to 41.5% and from 38.9% to 48.7% for pregnant women with an overall all prevalence of 62.3% [14]. As anaemia affects billions of people worldwide and exposes them to various social, psychological and economic crises, governmental and non-governmental organizations worldwide are paying close attention as a public health concern [15–18]. According to the Gambian micronutrient survey of 2018 report, Gambia is experiencing double or tripled burdens of malnutrition exaggerated by multiple problems of poverty [19]. Several studies were conducted to identify the possible risk or associated factors of anaemia and other related malnutrition. Studies conducted in sub-Saharan Africa, Ethiopia, Lao, Nigeria and Yemen identified that place of residence, family size, poor sanitation, educational status, age, pregnancy complications, meal frequencies and diversity scores were associated with anaemia [20–25]. Regarding to prevalence of anaemia number of studies depicted different results across countries, 39%, 19.7% Ethiopia [21, 22], 39.2% Japan [24], 42% Ghana [26], 25% Yemen [25], 7.6% South Africa [27], 68% Gambia [28]. Another study in the Gambia among non-pregnant women also showed that the prevalence is about 41.4% for iron deficiency and 28.0% for iron deficiency anaemia, respectively [29].

Reports showed that the prevalence of anaemia among reproductive Gambia women is about 57.5%, and its ever lowest prevalence of anaemia was 56.5% in 2011 [30]. However, the Gambia Demographic Health Survey (GDHS) 2019–20 shows the lower prevalence of anaemia among pregnant women was 44% [31]. Despite growing international attention to anaemia, the Gambian government has shown a weak policy implementation and attitude in this regard. Evidence for this, the 2018 report of joint assessment of national strategies concluded that nearly half of stakeholders are not satisfied with the implementation of Gambian government strategies [32] so that health policy and health systems of this country’s needs tremendous implementation efforts and evidence from researchers to avert it [33]. Though the Government of The Gambia has put several measures to address undernutrition, the prevalence of micronutrient deficiencies is still alarmingly high [34, 35]. Therefore, this study aimed to identify potential determinants of anaemia in Gambian women to help stakeholders and program implementers by providing accurate and timely findings.

Methods
Study setting
The Gambia is situated on the western coast of Africa, and it is long and narrow in shape. The country is bound on three sides by Senegal and on the west by the Atlantic Ocean. The Gambia is one of the smallest states in West Africa, with a land area of 10,689.28 km². The population of the Gambia in 2013 is estimated to be 1.85 million with an estimated 50.41% of female population, and more than half of the population live in urban and semi-urban areas [36].

Data source, population, and sampling procedure
The present study was based on the most recent Gambian Demographic and Health Survey (GDHS) data of 2019–20. A stratified two-stage cluster sampling technique was employed. In the first stage, 281 EAs were selected. In the second stage, an average of 25 households was selected per cluster/EA. We accessed the dataset used for the present study after registering and receiving an authentication letter from the Demographic and Health Survey (DHS) program at The DHS Program—Gambia: Standard DHS, 2010–20 Dataset. A total weighted sample of 5,858 reproductive-age women was included for this study [37].

Variables of the study
The outcome variable of this study was anaemia among reproductive-age women. The variable was dichotomized into 0 = “Not anemic” and 1 = “anemic”. The independent variables were classified into individual level (level 1) variables and community level (level 2) variables. Individual-level variables included age, religion, educational status, husband’s/partner’s age and education, family wealth index, current working status, family
planning message exposure, knowledge of family planning methods, ever use of contraceptive, fertility preference, desire to have children, current pregnancy, and several children. Whereas, community variables involved variables directly taken with no aggregation (residence and contextual region), and variables obtained by aggregating individual variables into their respected community (community media exposure, community poverty, community women education, community distance to health facilities, community antenatal care service utilization rate, and community toilet facility). The aggregates were computed using the mean values of the proportions of women in each category of a given variable. Since the aggregate values of each variable do not follow a normal distribution curve, we categorized the aggregate values of a cluster into groups based on median values.

Operational definitions

Community female education
This is the aggregate value of the educational levels of women based on the average of proportions of educational levels in the community. It was defined as low if the ratio of women with secondary education & above in the community was below the median and high if the value is higher than the media. The median value was 0.4286.

Community media exposure
This variable was derived from individual responses to radio or television exposure. It was defined as low if the proportion of women exposed to media in the community was 0–72% and high if the proportion was 73%–100%.

Community ANC utilization rate
This variable is also derived from the individual values for ANC utilization. It was defined as low if the proportion median of women who attended at least one ANC visit in the community was 0 – 50% and high if the proportion was between 51 –100%.

Community poverty
This variable is also derived from an individual household’s wealth index with the same procedure. It was defined as high if the proportion of women from the two lowest wealth quintiles in a given community was 33.4%–100% and low if the proportion was 0–33.3%

Community distance to the health facility
The variable was aggregated from individual perceived distance to a health facility is a big problem. It was categorized as low if the proportion of women who perceived health facility distance as a big problem in the community was 0–21.43% and categorized as high if the proportion was between 21.44% and 100%.

Community toilet facility improvement
This variable was aggregated from individual toilet facilities like that of the above variables. It was classified as low if the value is below the median value of 0–34.78% and high if it is between 34.79%-100%

Data processing, procedure and analysis

Data were extracted from individual records (IR) files, and further coding and transformations were done using statistical software, STATA version 14. The weighted samples were utilized for Analysis to adjust for unequal probability of selection and non-response in the original survey. Since the Gambian demographic and health survey (GDHS) data applied multi-stage stratified cluster sampling techniques, the data have a hierarchical structure. In this manner, single-level logistic regression is not recommended because classical multiple regression techniques treat the units of Analysis as independent observations. One consequence of failing to recognize hierarchical structures is that standard errors of regression coefficients will be underestimated, leading to an overstatement of statistical significance. In this point of view, an advanced statistical model that takes the hierarchy of the data into account is required to draw valid inferences and conclusions. Therefore, a multivariable multi-level binary logistic regression model was used to estimate the fixed and random effects of the factors associated with anaemia. Four models were constructed. The first model, also called an empty or null model, was fitted without including any explanatory variables. This model was specified to decompose the variance that existed between communities.

The null model is essential for understanding the community variations. We used it as a reference to estimate how much community factors could explain the observed variations in the intention to use contraceptives. Moreover, this model was used to justify using a multi-level statistical framework as it is a litmus paper on whether multi-level or traditional logistic regression should be used. It was assessed using the Log-Likelihood Ratio test (LLR), Median Odds Ratio (MOR), Intra-class Correlation Coefficient (ICC), and Proportional Change of Variance (PCV). The second model contained only individual-level factors. The third had only community-level characteristics. In comparison, the final (fourth) model included both individual and community-level factors. Moreover, the model comparison was made using model deviance, a model with the lowest deviance selected for reporting and interpretation results.
Results

Study population characteristics

The data on 5,636 reproductive age (15–49) women were included in this Analysis, including 281 clusters nested in the eight regions. The detailed descriptive statistics of the study participants are presented in Table 1. The respondents’ mean (± SD) age was 28.3 years (± 9.4 years), and around 40.1% of women were found under the range of 15–24 years. Nearly two-thirds (64.36%) of participants were married or living with a partner. About (42.72%) of the women had a secondary level of educational status, and most of them (96.92%) were followers of the Islamic religion. Regarding occupational status, wealth index, anaemia status, and ethicality group, 40.28% had no work, nearly a quarter of them (25.1%) are the richest class, 32.90% were from Mandinka/Jahanka ethnicity, and about 44.28% of participants had experienced anaemia. Only 45.12% of them had taken iron folate during their pregnancies, and more than half (58.06) had never tested for HIV status. Regarding the source of drinking water supply, around 93.95% of them had drunk unimproved water, and nearly half of them (49.24%) had scored an average body mass index (Table 1).

Community level factors characteristics

The majority of participants lived in an urban area (72.95%), and (43.72%) of participants belonged to the region of Brikama. In similar way participants in low community media exposure (41.5%), low community women education (34.47%), low community poverty (63.59%), low community antenatal care utilization rate (63.04%), low community distance to health facilities (50.47%), and low community toilet facility 60.07% of the participants were observed respectively (Table 2).

Factors associated with anemia

In the multi-level multivariable Analysis, current use of contraceptives, currently pregnant women, region and community distance to health facilities were significant factors associated with participant’s anaemia status. Current users of contraceptives of participants were 0.34 times less likely to be experienced anaemia compared to current nonusers of contraceptives (AOR = 0.66, 95% CI: (0.55– 0.79)). Currently, pregnant participants have 1.44 times more likelihood of exposure to anaemia (AOR = 1.44, 95% CI: (1.16, 1.81)) than women who are not currently pregnant. In addition to this, women living in the region of Brikama have (AOR = 0.69, 95% CI: (0.50–0.97)) less likely to be exposed to anemia. Regarding community-level variables, Women from a community having a high distance to the health facilities were (AOR = 1.23,95% CI 1.02–1.48)) times more likely to be

Table 1  Sociodemographic and other health-related characteristics of study participants included in the analysis: Gambian demographic and health survey, 2019–20 (n = 5,858)

| Variables                        | Anaemia status | Total, n (%) |
|----------------------------------|----------------|--------------|
| Age                               |                |              |
| 15–24                            | 1,352.60       | 2,373.37(40.51) |
| 25–35                            | 1,176.58       | 2,092.27(35.72) |
| 36–49                            | 734.91         | 1,392.51(23.77) |
| Religion                         |                |              |
| Muslim                           | 3,156.23       | 5,677.58(96.92) |
| Christian                        | 104.61         | 177.28(3.03) |
| Others                           | 3.27           | 3.27(0.06) |
| The highest educational level of mothers |            |              |
| No-formal education              | 988.48         | 2,022.56(34.53) |
| Primary                          | 507.84         | 943.81(16.11) |
| Secondary                        | 1,527.81       | 2,504.48(42.75) |
| Higher                           | 239.97         | 387.29(6.61) |
| Marital status of mothers        |                |              |
| Single                           | 1,272.38       | 2,087.69(35.64) |
| Married                          | 1,991.72       | 3,770.45(64.36) |
| Ethnicity                        |                |              |
| Mandinka/jahanka                 | 1,054.51       | 1,927.15(32.90) |
| Wolof                            | 415.23         | 743.03(12.68) |
| Jola/karoninka                   | 443.86         | 654.80(11.18) |
| Fula/tukul/lorobo                | 550.03         | 1,075.65(18.36) |
| Serere                           | 145.07         | 225.93(3.86) |
| Sarahule                         | 229.41         | 463.53(7.91) |
| creole/aku/marabout              | 18.13          | 27.77(0.47) |
| Ninjago                          | 35.86          | 66.28(1.13) |
| Bambara                          | 38.51          | 74.88(1.28) |
| Non-Gambian                      | 303.84         | 555.76(9.49) |
| Other                            | 29.65          | 43.36(0.74) |
| Occupation status of participants|                |              |
| No working                       | 1,338.38       | 2,359.58(40.28) |
| Farmer                           | 418.99         | 969.47(16.55) |
| Salaried worker                  | 213.63         | 329.63(5.63) |
| Sales and trades                 | 1,128.09       | 1,944.51(33.19) |
| Others                           | 164.99         | 254.94(4.35) |
| Wealth Index                     |                |              |
| Poorest                          | 428.09         | 976.05(16.66) |
| Poorer                           | 507.22         | 1,010.81(17.25) |
| Middle                           | 656.89         | 1,171.63(20.00) |
| Richer                           | 698.32         | 1,229.25(20.98) |
| Richest                          | 973.56         | 1,470.41(25.10) |
| Body mass indexa                 |                |              |
| <18.5                            | 299.85         | 562.36(14.22) |
| 18.5–24.9                        | 1,085.91       | 1,946.93(49.24) |
| 25–29.9                          | 516.90         | 876.61(22.17) |
| ≥ 30                             | 369.85         | 568.17(14.37) |
Prevalence of anemia
Estimated participants of 2,594 (44.28%, 95% CI 0.43, 0.46) of reproductive age women have experienced anaemia.

Discussion
Since anaemia among women is a significant public health concern in low and middle-income countries [38], this study aimed to assess the burden of anaemia and its associated factors among reproductive age Gambian women. The proportion of participants exposed to anaemia was 44.28 (0.43–0.46). This prevalence is less observed than studies conducted in Gambia [28, 29]. It is almost in agreement with a study conducted in Tanzania and Ghana [39]; nevertheless, this figure is higher than studies investigated in Ethiopia 22.7% 22.1% [40, 41], Rwanda [42]. The possible justification for why this study’s empirical findings are higher than the one mentioned above might be due to...
Table 3  Individual and community-level factors associated with anaemia among reproductive-age women in Gambia (n = 5,858)

| Independent variables                                | Null model | Model I          | Model III         | Model IV          |
|-------------------------------------------------------|------------|------------------|-------------------|------------------|
|                                                       |            | AOR [95% CI]     | AOR [95% CI]      | AOR [95% CI]     |
| Age of the respondent                                 |            |                  |                   |                  |
| 15–24                                                 | -          | 1                | -                 | 1                |
| 25–35                                                 | -          | 1.02(0.86, 1.21) | -                 | 1.03(0.87–1.22)  |
| 36–49                                                 | -          | 1.11(0.86, 1.42) | -                 | 1.13(0.87–1.46)  |
| Education                                             |            |                  |                   |                  |
| No formal education                                   | -          | 1                | -                 | 1                |
| Primary                                               | -          | 0.86(0.73–1.02)  | -                 | 0.87(0.74–1.04)  |
| Secondary                                             | -          | 0.85(0.73–0.99)  | -                 | 0.89(0.76–1.05)  |
| Higher                                                | -          | 1.07(0.76–1.49)  | -                 | 1.09(0.78–1.53)  |
| Marital status                                        |            |                  |                   |                  |
| Single                                                | -          | 1                | -                 | 1                |
| Married                                               | -          | 1.06(0.89–1.25)  | -                 | 1.04(0.87–1.23)  |
| Occupational status                                   |            |                  |                   |                  |
| No working                                            | -          | 1                | -                 | 1                |
| Farmer                                                | -          | 1.12(1.01–1.41)  | 1.14(0.96–1.35)   |                  |
| Salaried worker                                       | -          | 0.79(0.56–1.10)  | 0.79(0.57–1.11)   |                  |
| Sales and trades                                       | -          | 0.92(0.79–1.06)  | 0.94(0.81–1.09)   |                  |
| Others                                                | -          | 0.71(0.51–0.98)  | -                 | 0.74(0.54–1.04)  |
| Wealth index                                          |            |                  |                   |                  |
| Poorest                                               | -          | 1                | -                 | 1                |
| Poorer                                                | -          | 0.89(0.74–1.06)  | 0.98(0.81–1.18)   |                  |
| Middle                                                | -          | 0.77(0.63–0.94)  | 0.93(0.74–1.17)   |                  |
| Richer                                                | -          | 0.72(0.57–0.90)  | 0.91(0.69–1.20)   |                  |
| Richest                                               | -          | 0.60(0.47–0.77)  | -                 | 0.79(0.59–1.08)  |
| Current use of contraceptive                          |            |                  |                   |                  |
| Yes                                                   | -          | 0.65(0.55–0.78)  | -                 | 0.66(0.55–0.79)  |
| No                                                    | -          | 1                | -                 | 1                |
| Iron folate intake during pregnancy                   |            |                  |                   |                  |
| Yes                                                   | -          | 1.23(0.78–1.94)  | -                 | 1.21(0.77–1.91)  |
| No                                                    | -          | 1                | -                 | 1                |
| Total children ever born Conti*                       | -          | 1.03(0.99–1.07)  | 1.03(0.99–1.08)   |                  |
| Births in the last three years Conti*                 | -          | 1.14(0.97–1.35)  | 1.15(0.98–1.36)   |                  |
| Currently breastfeeding                               |            |                  |                   |                  |
| Yes                                                   | -          | 0.96(0.78–1.17)  | -                 | 0.96(0.79–1.16)  |
| No                                                    | -          | 1                | -                 | 1                |
| Currently pregnant                                    |            |                  |                   |                  |
| Yes                                                   | -          | 1.45(1.16–1.81)  | -                 | 1.44(1.16–1.81)  |
| No                                                    | -          | 1                | -                 | 1                |
| Ever tested for HIV                                   |            |                  |                   |                  |
| Yes                                                   | -          | 0.96(0.81–1.09)  | -                 | 0.95(0.83–1.08)  |
| No                                                    | -          | 1                | -                 | 1                |
| Source of drinking water                              |            |                  |                   |                  |
| Unimproved                                            | -          | 1                | -                 | 1                |
| Improved                                              | -          | 1.12(0.85–1.48)  | -                 | 1.10(0.83–1.46)  |
| Type of toilet facility                               |            |                  |                   |                  |
| Unimproved                                            | -          | 1                | -                 | 1                |
| Improved                                              | -          | 0.94(0.81–1.06)  | -                 | 0.94(0.81–1.09)  |
countries profiles of anaemia and other communicable diseases, participants’ attitudes, knowledge, and educational backgrounds towards anaemia. On the other hand, this study found a significantly lower prevalence of anaemia, which might minimize confounding factors both on the individuals and community-level factors that could have positive or negative implications on anaemia status. The majority of those listed studies concluded the prevalence of anaemia based upon individual factors with minimal sample size, study settings and without consideration of community level factors that might have effect on anaemia.

| Independent variables | Null model | Model I | Model III | Model IV |
|-----------------------|------------|---------|-----------|----------|
| Ever use of ANC       |            |         |           |          |
| Yes                   | -          | 0.74(0.47–1.18) | - | 0.76(0.47–1.21) |
| Never                 | -          | 1       | -         | 1        |
| Type of residence     |            |         |           |          |
| Urban                 | -          | -       | 1         | 1        |
| Rural                 | -          | -       | 1.96(1.65–2.33) | 1.17(0.83–1.64) |
| Region                |            |         |           |          |
| Banjul                | -          | -       | 1         | 1        |
| Kanifing              | -          | -       | 0.92(0.66–1.28) | 0.87(0.62–1.20) |
| Brikama               | -          | -       | 0.85(0.62–1.18) | 0.69(0.50–0.97) |
| Mansakonko            | -          | -       | 1.58(1.09–2.31) | 0.87(0.56–1.35) |
| Korean                | -          | -       | 1.65(1.15–2.35) | 1.04(0.69–1.57) |
| Kuntaur               | -          | -       | 2.30(1.59–3.33) | 1.11(0.69–1.77) |
| Janjanbureh           | -          | -       | 1.57(1.09–2.26) | 0.81(0.51–1.29) |
| Basse                 | -          | -       | 1.59(1.13–2.26) | 0.88(0.58–1.35) |
| Community media exposure |        |         |           |          |
| Low                   | -          | -       | 1         | 1        |
| High                  | -          | -       | 0.69(0.58–0.84) | 1.01(0.83–1.23) |
| Community-women education |    |         |           |          |
| Low                   | -          | -       | 1         | 1        |
| High                  | -          | -       | 0.55(0.46–0.65) | 0.91(0.71–1.16) |
| Community-level poverty |        |         |           |          |
| Low                   | -          | -       | 1         | 1        |
| High                  | -          | -       | 1.80(1.51–2.15) | 0.97(0.70–1.34) |
| Community ANC utilization rate | |         |           |          |
| Low                   | -          | -       | 1         | 1        |
| High                  | -          | -       | 1.53(1.28–1.84) | 1.07(0.88–1.30) |
| Community to Health Facility distance problem | |         |           |          |
| High                  | -          | -       | 1.27(1.07–1.52) | 1.23(1.02–1.48) |
| Low                   | -          | -       | 1         | 1        |
| Community-level toilet facility | |         |           |          |
| Low                   | -          | -       | 1         | 1        |
| High                  | -          | -       | 1.57(1.31–1.88) | 1.02(0.81–1.29) |

Random parameters and model comparison

|                      | Null model | Model I | Model III | Model IV |
|----------------------|------------|---------|-----------|----------|
| Community-level variance | 0.42(0.060) | 0.278(0.049) | 0.24(0.043) | 0.24(0.449) |
| ICC (%)              | 11.2       | 7.8     | 6.7       | 6.8      |
| MOR (95% CI)         | 1.84 (1.70, 202) | 1.62(150, 1.80) | 1.60(1.46, 1.74) | 1.58(1.46, 1.73) |
| PCV (%)              | Reference  | 36.60   | 41.46     | 43.90    |
| LR                   | -3985.76   | -3774.81 | -3945.98  | -3762.66 |
| DIC (-2LLR)          | 7,971.52   | 7,549.62 | 7,891.96  | 7,525.32 |

Conti* Continuous variable
The multi-level logistic regression analysis depicted those women who have current contraceptives have less likely to be anaemic patients than current contraceptive nonusers. This finding is supported by literature investigated in Ethiopia [41], Rwanda [42], 24 Sub-Saharan Africa study [43]. The DHS data of 12 developing countries was conducted to determine the existence and degree of contraceptive benefits other than prevention of unintended pregnancy found a reduction rate of 32% to 44% odds of anaemia exposure among contraceptive users [44]. This could be explained by modern contraceptives having a positive protective effect on menstrual bleeding, pregnancy, birth-related haemorrhages, and iron supplementation to prevent anaemia other than prevention of pregnancy [45]. The observed gain in haemoglobin could be due to the considerable reduction in cyclic blood loss frequently documented among contraceptive uses [46]. Further, the placebo iron pills provided with many contraceptive brands can also reduce anaemia.

The study also found that participants who are currently pregnant have a more advanced probability of developing anaemia than those who did not have a current pregnancy status. Indeed, this is a physiological fact supported by the international researchers and similar to the study done in Ethiopia [47, 48]. During pregnancy, some physiological systems begin to work unusually because of the growth of the fetus, the placenta, a more considerable amount of blood circulation in the pregnant mother and depletion of haemoglobin; these situations might expose her to higher demand of iron-folic acid nutrients. However, due to many factors, most pregnant mothers in developing countries could not start their iron nutrients. However, due to many factors, most pregnant mothers in developing countries could not start their iron nutrients. The DHS data of 12 developing countries was conducted to determine the existence and degree of contraceptive benefits other than prevention of unintended pregnancy found a reduction rate of 32% to 44% odds of anaemia exposure among contraceptive users [44]. This could be explained by modern contraceptives having a positive protective effect on menstrual bleeding, pregnancy, birth-related haemorrhages, and iron supplementation to prevent anaemia other than prevention of pregnancy [45]. The observed gain in haemoglobin could be due to the considerable reduction in cyclic blood loss frequently documented among contraceptive uses [46]. Further, the placebo iron pills provided with many contraceptive brands can also reduce anaemia.

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Study participants residing in the region of Brikama have a less likely chance of developing anaemia than their counterparts of the Banjul region. Although differences across regions did not well investigated in the Gambia, studies from similar developing countries found a regional variation of anaemia [41, 42]. This could be demonstrated by differences in anaemia risk in the spread of communicable diseases associated to regional geographic conditions, food supply, availability of a variety of foods, accessibility, and use of healthcare facilities. [20]. Household dietary diversity scores among regions were assessed in 2020, and Brikama had showed only 2% of food groups of 0–2; however, this figure was about 12% in Banjul. Furthermore, food consumption by region was also assessed, and Brikama has shown 9.9% poorer and 86.5% acceptable food consumption, whereas Banjul region scored 11.8% poor and 76.5% acceptable food consumption, respectively [52]. This might have its contribution by increasing the risk of anaemia.

Those participants living with a high range of distance to the health facilities have a higher tendency to be exposed to anaemia than those living with a limited or low distance from the health facilities. This result agrees with a qualitative study conducted in the Gambia that prolonged transportation decreases their health-seeking behavior [53]. For instance, a study conducted in five east African countries showed that distance perceived as a big problem was one factor for the burden of anemia [54].

Conclusions
This study revealed that the overall burden of anaemia among reproductive age Gambian women is very high. Anemia was statistically significantly correlated with current contraceptive use, current pregnancy, state, area, and community distance to health facilities. Therefore, the risk of anaemia could be significantly reduced if pregnant women are monitored by health professionals, community health workers, others governmental and non-governmental stakeholders and given iron supplementation; it will also be better if women use contraceptives. A policy on the use of contraceptives has been developed by the Gambian government. It will be preferable if the government puts the policy into effect in accordance with the current and other fresh initiatives while taking into account contextual elements. In light of the community-level factors, the health sector could extend access to health facilities in all parts of the country to save mothers who become ill and suffer from malnutrition due to distance from health facilities. Community mobilization is also crucial to increase community awareness.

Study implications for policy and practice
The implication of this study was providing a nationwide preliminary information for those who are engaging in the women and children health intervention by identifying both individual and community level potential factors of anaemia in Gambian women to help stakeholders and program implementers by providing accurate and timely findings.

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Authors’ contributions
KS conceptualization, data curation, formal analysis, investigation, resources, software, validation, visualization, review & editing. BT data curation, formal analysis, investigation, methodology, resources, software, validation, visualization, writing – original draft. All the authors read and approved the final manuscript.

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Availability of data and materials
Data for this study were obtained from the DHS Program through https://www.dhsprogram.com/

Declarations

Ethics approval and consent to participate
We declare that this study represents our work, which has been done after registration and receipt for accessing data at www.dhsprogram.com and confirm that all methods were carried out following relevant guidelines and regulations. We have attempted to identify all the risks related to this research that may arise in conducting this research, obtained the relevant data access and acknowledged my obligations and the rights of the participants by the demography and health survey program authorities. The research is conducted in accordance with the declaration of Helsinki. There was no patient or public involvement in this study.

Consents for publication
Not applicable.

Competing interests
The authors declared no conflict of interest.

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References
1. Keohane E, Otto CN, Walenga J. Rodak’s Hematology-E-Book: Clinical Principles and Applications. Elsevier Health Sciences, 2019. https://www.elsevier.com/books/rodak’s-hematology/978-0-323-53045-3.
2. De Benoist B, Cogswell M, Egli I, McLean E. Worldwide prevalence of anemia 1993–2005, WHO global database of anemia. 2008.
3. Kassebaum NJ, Jasrasaria R, Naghavi M, Wulf SK, Johns N, Lozano R, et al. A systematic analysis of global anemia burden from 1990 to 2010. Blood. 2014;123(5):615–24.
4. Organization WH. Vitamin and mineral nutrition information system. WHO global database on vitamin a deficiency. 2011.
5. Gelaw Y, Getaneh Z, Melku M. Anemia as a risk factor for tuberculo-sis: a systematic review and meta-analysis. Environ Health Prev Med. 2021;26(1):1–15.
6. Groenveld HF, Januzzi JL, Dammann K, van Wijngaarden J, Hillege HL, van Veldhuisen DJ, et al. Anemia and mortality in heart failure patients: a systematic review and meta-analysis. J Am Coll Cardiol. 2008;52(10):818–27.
7. Blank PR, Tomonaga Y, Szucs TD, Schwenkglenks M. Economic burden of symptomatic iron deficiency–a survey among Swiss women. BMC Women’s Health. 2019;19(1):1–9.
8. Tesfaye M, Yemane T, Adisu W, Asres Y, Gedefaw LJAh. Anemia and iron deficiency among school adolescents: burden, severity, and determinant factors in southwest Ethiopia. Adolesc Health Med Ther. 2015;6:189.
9. Tesfaye M, Yemane T, Adisu W, Asres Y, Gedefaw LJAh. Anemia and iron deficiency among school adolescents: burden, severity, and determinant factors in southwest Ethiopia. Med Ther. 2015;6:189.
10. Kinney M, Kerber K, Black R, Cohen B, Krimhold P, Coovadia H, et al. Science in Action: Saving the lives of Africa’s Mothers. 2010.
11. Organization WH. The GLOBAL HEALTH OBSERVATORY: Anemia in women and children: https://www.who.int/data/gho/data/themes/topics/anaemia_in_women_and_children_2021.
12. Safiri S, Kolahi A-A, Noori M, Nejadghaderi SA, Karamzad N, Bragazzi NL, et al. Burden of anemia and its underlying causes in 204 countries and territories, 1990–2019: results from the Global Burden of Disease Study 2019. J Hematol Oncol. 2021;14(1):1–16.
13. Nagata JM, Gatti LR, Barg FK. Social determinants of iron supplementation among women of reproductive age: a systematic review of qualitative data. Matern Child Nutr. 2012;8(1):1–18.
14. Organization; WGWH. The global prevalence of anemia in 2011. 2015.
15. Assembly G. Resolution adopted by the General Assembly on 31 October 2002.
16. Annan KA. We the children: meeting the promises of the World Summit for Children: Unicef, 2001.
17. Kinyoki D, Osgood Zimmerman AE, Bhattacharjee NV, Kassebaum NJ, Hay SI. Anemia prevalence in women of reproductive age in low- and middle-income countries between 2000 and 2018. Nat Med. 2021;27(10):1761–82.
18. Haas JD, Brownlie TIV. Iron deficiency and reduced work capacity: a critical review of the research to determine a causal relationship. J Nutr. 2001;131(2):676S–90S.
19. National Nutrition Agency (NaNA)—Gambia U, Gambia Bureau of Statistics (GBOS). GroundWork. Gambia National Micronutrient Survey Banjul, Gambia, 2019, 2018.
20. Correa-Aguledo E, Kim HY, Musuka GN, Mukandavire Z, Miller FD, Tanser F, et al. The epidemiological landscape of anemia in women of reproductive age in sub-Saharan Africa. Sci Rep. 2021;11(1):1–10.
21. Tura MR, Egata G, Fage SG, Roba KT. Prevalence of anemia and its associated factors among female adolescents in Ambo Town, West Shewa Ethiopia. J Blood Med. 2020;11:279.
22. Aboh A, Yusuf ME, Wasse MM. Prevalence and associated factors of anemia among pregnant women of Mekelle town: a cross sectional study. BMC Res Notes. 2014;7(1):1–6.
23. Olutunbosun OA, Abasiala AM, Bassey EA, James RS, Ibanga G, Morgan A. Prevalence of anemia among pregnant women at booking in the University of Uyo Teaching Hospital, Uyo, Nigeria. BioMed Res Int. 2014;2014:849060.
24. Keokerschanh S, Kounnavong S, Tobinou K, Aidonkwa K, Imeda W. Morita A, et al. Prevalence of Anemia and Its Associate Factors among Women of Reproductive Age in Lao PDR. Evidence from a Nationally Representative Survey. Anemia. 2021;2021:8823030.
25. Al-Aini S, Senani CP, Azzani M. Prevalence and associated factors of anemia among pregnant women in Sana’a Yemen. Indian J Med Sci. 2020;72(3):185–90.
26. Abdikya MN, Areyetey R, Yost M, Jones AD, Wilson ML. Determinants of anemia among pregnant women in northern Ghana. bioRxiv. 2019:708784. https://www.biorxiv.org/content/10.1101/708784v1.abstract
27. Plessis T, Movley K, Lachman A. Prevalence of iron deficiency in a South African adolescent inpatient psychiatric population: Rates, risk factors and recommendations. S Afr J Psychiatry. 2019;25(1):1–6.
28. Sey-Sawo J, Tunkara-Bah H. Iron deficiency anemia in Pregnancy: the fate of the mother and the unborn child in the Gambia. Int J Innov Res Adv Stud. 2016;3(12):1–6.
29. Petty N, Jallow B, Sawo Y, Darboe MK, Barrow S, San A, et al. Micronutri-ent deficiencies, nutritional status and the determinants of anemia in children 0–59 months of age and non-pregnant women of reproductive age in the Gambia. Nutrients. 2019;11(10):2275.
30. Index Mundi The Gambia - Prevalence of anemia: https://www.indexmundi.com/facts/the-gambia/prevalence-of-anemia.
31. Gambia Bureau of Statistics - GBoS, ICF. The Gambia Demographic and Health Survey 2019–20 Banjul: The Gambia: GBoS/ICF, 2021.
32. Organization WH. The Gambia Country Cooperation Strategy at Glance. 2018.
33. African development bank ADF. The Gambia ADF/World Bank Joint Assistance Strategy 2012–2015 Cover Note Regional Department West II. 2012.

34. Stelle I, McDonagh LK, Hessain I, Kalea AZ, Pereira DJN. The IHAT-GUT iron supplementation trial in rural Gambia: barriers, facilitators, and benefits. Nutrients. 2021;13(4):1140.

35. Brief WA. Women Suffering from Anemia a Major Challenge: http://www.west-africa-brief.org/content/en/women-suffering-anaemia-%E2%80%93-major-challenge. 2019.

36. Statistics TGBo. The Gambia 2013 Population and Housing Census Preliminary Results Banjul GBOS. http://www.gbos.gov.gm/uploads/census/The%20Gambia%20Population%20and%20Housing%20Census%202013%20Provisional%20Report.pdf. 2014.

37. Statistics GB, ICF. The Gambia demographic and health survey 2019–20. USA: GBOS and ICF Maryland; 2021.

38. Yasutake S, He H, Decker MR, Sonenstein FL, Astone NM. Anemia among young (15–24 years) women in Ethiopia: a multilevel analysis of the 2016 Ethiopian demographic and health survey data. PLoS ONE. 2020;15(10):e0241342.

39. Nti J, Afagbedzi S, da Costa Vroom FB, Ibrahim NA, Guure C. Variations and Determinants of Anemia among Reproductive Age Women in Five Sub-Saharan Africa Countries. BioMed Res Int. 2021;2021:9957160.

40. Lakew Y, Biadgilign S, Haile D. Anaemia prevalence and associated factors among lactating mothers in Ethiopia: evidence from the 2006s and 2011 demographic and health surveys. BMJ Open. 2015;5(4):e006001.

41. Worku MG, Tesema GA, Teshale AB. Prevalence and determinants of anaemia among young (15–24 years) women in Ethiopia: a multilevel analysis of the 2016 Ethiopian demographic and health survey data. PLoS ONE. 2015;10(10):e0238957.

42. Hakizimana D, Nisingizwe MP, Logan J, Wong R. Identifying risk factors of anemia among women of reproductive age in Rwanda–a cross-sectional study using secondary data from the Rwanda demographic and health survey 2014/2015. BMC Public Health. 2019;19(1):1–11.

43. Gebremedhin S, Asefa A. Association between type of contraceptive use and haemoglobin status among women of reproductive age in 24 sub-Saharan Africa countries. BMJ Sex Reprod Health. 2019;45(1):54–60.

44. Bellizzi S, Ali MM. Effect of oral contraception on anemia in 12 low-and middle-income countries. Contraception. 2018;97(3):236–42.

45. Haile ZT, Teweldeberhan AK, Chertok IR. Association between oral contraceptive use and markers of iron deficiency in a cross-sectional study of Tanzanian women. Int J Gynecol Obstet. 2016;132(1):50–4.

46. Bahamondes L, Valeria Bahamondes M, Shulman LP. Non-contraceptive benefits of hormonal and intrauterine reversible contraceptive methods. Hum Reprod Update. 2015;21(5):640–51.

47. Kidbet KT, Chojenta C, D’Arcy E, Loxton D. Spatial distribution and determinant factors of anaemia among women of reproductive age in Ethiopia: a multilevel and spatial analysis. BMJ Open. 2019;9(4):e027276.

48. Haile ZT, Teweldeberhan AK, Chertok IR. Association between oral contraceptive use and markers of iron deficiency in a cross-sectional study of Tanzanian women. Int J Gynecol Obstet. 2016;132(1):50–4.

49. Ahmed MO, Kalsoom U, Sughra U, Hadi U, Imran M. Effect of maternal anaemia on birth weight. J Ayub Med Coll Abbottabad. 2011;23(1):77–9.

50. Organization WH. Nutrition. http://www.who.int/nutrition/topics/ida/en/ Accessed 2016.

51. WFP. The Gambia mVAM Food Security and Market Bulletin #1, August 2020. https://reliefweb.int/report/gambia/gambia-mvam-food-security-and-market-bulletin-august-2020. 2020.

52. Cham M, Sundby J, Vangen S. Maternal mortality in the rural Gambia, a qualitative study on access to emergency obstetric care. Reprod Health. 2005;2(1):1–8.

53. Teshale AB, Tesema GA, Worku MG, Yeshaw Y, Tessema ZT. Anemia and its associated factors among women of reproductive age in eastern Africa: a multilevel mixed-effects generalized linear model. PLoS ONE. 2020;15(9):e0238957.