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# PREVALENCE AND RISK FACTORS OF ANAEMIA AMONG WOMEN OF REPRODUCTIVE AGE AT A GHANAIAN UNIVERSITY

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## ABSTRACT

**Background:** *Anaemia is a clinical condition that results in the reduction of haemoglobin levels in the body and affects 33% of women of reproductive age worldwide (about 613 million women between 15 and 49 years of age). In Ghana, the occurrence of anaemia is reported to be 66% in children between the ages of 6 and 59 months, and 42% among women of reproductive age. This study determined the prevalence and risk factors of anaemia among women of reproductive age at a Ghanaian University.*

**Method:** *Two hundred and six non-pregnant women aged 15–40 years, randomly selected from Kwame Nkrumah University of Science and Technology, Kumasi, Ghana, participated in this cross-sectional study. Data on socio-demographics, anthropometrics, dietary diversity scores and information on monthly blood flow (menstruation) and anaemia awareness were collected. Haemoglobin (Hb) levels, oxygen saturation levels and malaria infection status were also determined. The relationships between the independent variables and anaemic status of the study participants were assessed using bi-variate analysis.*

**Results:** *The overall anaemia prevalence was 67.5%, and the prevalence of mild, moderate and severe anaemia were 35.4%, 26.7% and 5.3%, respectively. About 56.8% of the participants had a high dietary diversity score, and more than half (57.8%) had a normal body mass index (18- 24.9 kg/$m^2$). There was no significant association between body mass index ($p=0.430$), dietary diversity score ($p=0.711$), oxygen saturation level ($p=0.761$) and anaemia. However, monthly blood loss significantly contributed to anaemia ($p=0.047$).*

**Conclusion:** *This study has highlighted the high prevalence of anaemia among reproductive-age women. Body mass index, dietary diversity score and oxygen saturation level were not potential risk factors associated with anaemia. However, monthly blood loss was associated with anaemia. Due to the adverse consequences of anaemia on the health of reproductive women, proper interventions such as regular supplementation of the diet with iron and folate can be included to replenish blood loss.*

**Keywords:** Iron Deficiency Anaemia, Risk Factors, Women of Reproductive Age, Ghana

## INTRODUCTION

Anaemia occurs when the number of red blood cells (and thus their oxygen-carrying capacity) is inadequate to fulfil the body's physiologic requirements (World Health Organization, 2011). According to a report by the Global Burden of Disease (Global Burden of Disease Study, 2016), anaemia affected 2.36 billion people worldwide in 2015. According to the most recent figures for 2016, anaemia affected 33% of women of reproductive age worldwide (about 613 million women between 15 and 49 years of age). The prevalence is highest in Africa and Asia (over 35 %), with the lowest levels reported in Northern America, Europe, and Oceania (below 20 %) (World Health Organization, 2014).

According to the World Health Organization (2011), anaemia is mostly common in pre-schoolers (47.4%), with men having the lowest prevalence (12.7 %). However, non-pregnant women are the demographic group with the largest number of people affected (468.4 million) (De Benoist et al., 2008). Women of reproductive age are described as women aged 15 to 49 (World Health Organization, 2006).

Anaemia has enormous consequences on the health of reproductive women. Due to the reduced capacity of a low Hb in sustaining vital functions, it may result in death from heart failure, shock, or infection (World Health Organization, 2006). Preterm labour, abortion, stillbirth, prematurity, intrauterine growth retardation, low birth weight, and mortality are just a few of the severe effects of anaemia during pregnancy for both the mother and the baby (Georgieff, 2020; Juul, Derman and Auerbach, 2019). Anaemia is linked to exhaustion, dizziness, lower job efficiency, and decreased health and growth in the general population (Pasricha *et al.,* 2014).

In Central and West Africa, anaemia affects a large number of people, with 71% being children under the age of five, 48% being non-pregnant women, and 56% being pregnant women (Stevens et al., 2013). In Ghana, a national survey conducted on anaemia in 2016 showed that the occurrence of anaemia in children at the age of 6 and 59 months was 66%, while that of women of reproductive age was 42% in 2014 (Spring, 2016).

The aetiology of anaemia is complex and involves various factors. Examples of such factors include; nutritional (iron, folic acid, and vitamin B12 deficiency), inherited (thalassemia and sickle cell anaemia), environmental toxins (lead poisoning), and autoimmune (haemolytic anaemia) (Al-Zabedi *et al.,* 2014). Moreover, HIV and some persistent parasitic infections like malaria and Helminths infections also contribute to anaemia. Furthermore, other factors such as *Helicobacter pylori* infection, tuberculosis, and cancer are also associated with anaemia (World Health Organization, 2017). Also, factors such as inadequate personal care, poor sanitation, contaminated drinking water, poverty, obesity, and low education may predispose individuals to anaemia (World Health Organization, 2017). In addition to that, other factors such as age, gender, altitude, smoking behaviour, and pregnancy status can also affect the amount of haemoglobin present in an individual (World Health Organization, 2011).

The World Health Organization considers anaemia to be a public health problem, and as such has set a target to reduce it by 50%

in women of reproductive age globally by the year 2025 (World Health Organization, 2020). However, the majority of research conducted globally has focused on the prevalence of anaemia among pregnant women and children, with little attention paid to women of reproductive age. If this issue remains unaddressed, the problem of anaemia will persist regardless of the current prevention efforts. As a result, identifying the risk factors associated with anaemia is essential in lowering its prevalence rates. Thus, this study aimed to assess the prevalence and risk factors of anaemia among some randomly selected women of reproductive age at a Ghanaian university.

# MATERIALS AND METHODS

## Study design and subjects

This was a cross-sectional study and a randomized selection method was used to recruit reproductive women aged 15-49 years from the colleges in Kwame Nkrumah University of Science and Technology (KNUST). KNUST is a Ghanaian university located in the Ashanti Region. It was founded in 1952 and is the largest university in the Kumasi Metropolis. It has a long and illustrious history in its development into a world-class university. KNUST has undergone a structural transformation. Instead of faculties, it now operates with six colleges. These colleges encompass various faculties, which are further subdivided into departments. The University is located on a sixteen-square-kilometre campus with undulating ground and beautiful environs, roughly seven kilometres from Kumasi's core business centre (www.educartis.com.gh).

## Questionnaire and sample collection

The sample size for this study was calculated from the Cochran formula for cross-sectional studies ($N = [(Z)^2 \times p\,(1-p)/\,(d)^2]$) by using the prevalence of anaemia among reproductive women (42%) from a previous study in Ghana (Spring, 2016). Considering the prevalence of anaemia of 42% (p) with a confidence of 95%, marginal error of 5% (d), Z- score of 1.96, and attrition rate of 5% (Cochran, 1977), the expected sample size was 374, however, only 265 subjects were willing to participate in this study, which was further reduced to a total of 206, upon sorting out based on the exclusion criteria.

Data obtained from the participants using structured questionnaires were based on their socio-demography (age, educational level, religion, and place of residence), information on their monthly blood flow (menstruation), awareness of anaemia, and dietary diversity score.

The weight and height of the women were measured using a Seca weighing scale (SECA 213, USA) and a stadiometer (SECA 217, SECA, USA). Their weight and height were measured to the nearest 0.1 kilograms and 0.1 centimetres, respectively. The Body mass index (BMI) of the participants were calculated using the formula, weight (kg)/ height ($m^2$). The BMIs of participants were classified as underweight (<18.5), normal weight (18.5-24.9), overweight (25.0-29.9), and Obese (≥ 30) (Jamnok *et al.,* 2020).

Their dietary diversity scores (DDS) were assessed using a 24-hour recall on the day of data collection. The food items included were cereals, root/tubers, pulses/legumes/ nuts, grains, fruits, meat/poultry, eggs, fish/ seafood, sugar/honey, milk/milk products, oil/fats, and others (Swindale and Paula, 2006). The consumption of any of the food items from the various categories was denoted as one (1). However, the absence of the intake of any of these food items in the various categories was assigned zero (0). The dietary diversity score was categorized into two divisions: low (when DDS was less/equal to 5), and high (when DDS was between 5-10) (Ayensu et al., 2020, Gebremedhin and Enquselassie, 2011).

### Laboratory analysis

Blood haemoglobin levels were estimated using a URIT-12 Hb meter from Guangzhou Anbanjia Medical Technology Company Limited, which was calibrated at the Clinical Analysis Laboratory (CanLab) at the Biochemistry Department of KNUST before being used. This involved pricking the fingers of participants and analyzing their blood Hb levels. The pricking was done on the tips of their middle fingers using safety lancets to obtain a drop of blood. The drop of blood was placed onto the URIT-12 test strip from URIT Medical Electronic Company in China for analysis. The level of haemoglobin concentration (Hb) in the blood was measured in grams per deciliter (g/dL), and this was used to classify the category of anaemia in the participants. The anaemia status was graded as severe if the Hb was less than 8.0 g/dL, moderate (between 8.0 and 10.9 g/dL), mild (11-11.9 g/dL), and not anaemic (>12.0 g/dL) (Habyarimana, Zewotir and Ramroop, 2020).

Another drop of blood was placed into the sample hole of a Rapid Diagnostic Test kit for Malaria *Falciparum* (OSCAR) for onset analysis. Positive and negative test results denoted the presence and absence of the malaria parasite (*Falciparum)*, respectively (Medicalexpo, 2014; Petry *et al.,* 2020).

The oxygen saturation levels of study participants were also measured by placing the index finger into a pulse oximeter (a non-invasive method for evaluating arterial oxygen saturation), for reading. Normal oxygen level ranges were from 95% -100% (Fernandez *et al.,* 2007).

Participants were asked to provide information on the number of sanitary pads used per day, menstrual duration, and also the amount of blood loss per day by comparing blood loss to an 80ml glass.

### Data analysis and ethics

Statistical analysis of the data was achieved using IBM SPSS (Statistical Package for Social Sciences (SPSS version 23) software. Frequencies, mean, and standard deviations were used in the descriptive analysis of the results. The anaemia status was compared to the different categories of independent variables using an Independent sample t-test and cross-tabulation. The relationship between the independent variables and the anaemia status of the study participants was assessed using bivariate analysis at a significance level of 0.05 (p-value) (Gebremedhin and Enquselassie, 2011).

### Ethics approval and consent to participate

The study protocol was reviewed and approved by the Committee on Human Research, Publications and Ethics, of the School of Medical Sciences, Kwame Nkrumah University of Science and Technology (CHRPE/KNUST) Kumasi, Ghana (CHRPE/AP/229/21). Permission to conduct the study on the KNUST campus was also obtained from the office of the Dean of students. Participation in the survey was voluntary and informed consent for participation and publication was obtained from all the participants involved in the study.

## RESULTS

### Sociodemographic information of participants

Based on the ages, the participants were categorized into four groups which were 15-20, 21-30, 31-40, and 41-49). Out of the 206 participants, a majority (58.3%) were between the ages of 21-30 years. Nearly 92.7% of the participants were Christians, with a larger proportion from the College of Science (46.6%). The sociodemographic information of the participants is summarized in Table 1.

**Table 1: Socio-demographic characteristics, nutritional status, history of blood loss, and dietary practice of the study participants**

| Socio-demographic characteristics | Frequency (n-206) | Percentage (%) |
|---|---|---|
| ***Age (year)*** | | |
| 15 - 20 | 85 | 41.3 |
| 21- 30 | 120 | 58.3 |
| 31- 40 | 1 | 0.5 |
| ***Religion*** | | |
| Christian | 191 | 92.7 |
| Muslim | 12 | 5.8 |
| Traditional | 3 | 1.5 |
| ***BMI Category*** **(kg/m²)** | | |
| Underweight:<18.5 | 24 | 11.7 |
| Normal weight:18.5 – 24.9 | 119 | 57.8 |
| Overweight: 25.9-29.9 | 63 | 30.6 |
| ***Oxygen saturation level*** | | |
| Low | 8 | 3.9 |
| Normal | 198 | 96.1 |
| ***Malaria Status*** | | |
| Positive | 0 | 0 |
| Negative | 206 | 100 |
| ***Menstrual Characteristics*** **(Length of blood loss)** | | |
| 2-3 days | 20 | 9.7 |
| 4-5 days | 107 | 51.9 |
| 6-7 days | 79 | 38.3 |
| ***Amount of blood loss per day*** | | |
| =80ml | 37 | 18.0 |
| <80ml | 32 | 15.5 |
| >80ml | 108 | 52.4 |
| No idea | 28 | 13.6 |
| ***Usage of sanitary pad*** | | |
| Twice | 72 | 35.0 |
| Thrice | 127 | 61.7 |
| None | 7 | 3.4 |

| | | |
|---|---|---|
| ***Food Consumption Patterns* (Food category)** | | |
| Cereals | 164 | 79.6 |
| Roots and tubers | 83 | 40.3 |
| Vegetables | 144 | 69.9 |
| Fruits | 73 | 35.4 |
| Meat and poultry | 131 | 63.6 |
| Eggs | 113 | 54.9 |
| Fish and seafood | 75 | 36.4 |
| Pulses and legumes | 75 | 36.4 |
| Milk and milk products | 99 | 48.1 |
| Oils and fats | 167 | 81.1 |
| Sugar/honey | 137 | 66.0 |
| Miscellaneous | 99 | 48.1 |
| ***Dietary Diversity Score*** | | |
| Low | 28 | 13.6 |
| High | 117 | 56.8 |

The anthropometric measures (BMI) of the participants showed that the majority of them had normal weight (57.8%), while 11.7% and 30.6% were underweight and overweight respectively with no obesity recorded.

The Oxygen saturation levels among the majority of the participants were normal (96.1%), with very few being low (3.9%). Meanwhile, none of the participants tested positive on the malaria rapid test kit (Table 1).

The mean dietary intake of the participants was 7.0± 1.6. The majority of the participants (20.4%) consumed seven of the food category. A large proportion of the participants consumed oil/fats (81.1%), followed by cereals (79.6%), and vegetables (66.9%). About 35.4% of them consumed fruits. A high dietary diversity score was observed among the study participants (56.8%) (Table 1).

Over fifty percent of the women menstruated between 4-5 days whilst a third experienced blood loss between 6 -7 days. More than half of the participants reported blood loss of more than 80ml per day during their menstrual period based on the questionnaire survey. However, 13.6% of the participants were not able to estimate the amount of blood loss per day during menstruation (Table 1).

## Prevalence of anaemia among women of reproductive age (WRA)

Table 2 depicts the prevalence, classification and related information on anaemia. About 92.2% and 35.9% of the participants were aware of and had been diagnosed with anaemia three months before the study was conducted respectively. The mean haemoglobin level was 10.96 ± SD 1.86. The overall prevalence of anaemia was 67.5% (n=139). Out of the 139 anaemia participants, 35.4%, 26.7%, and 5.3% had mild, moderate, and severe anaemia respectively (Table 2).

**Table 2: The prevalence of anaemia, its classification, and other anaemia-related information among among participants**

| Variables | Frequency (n-206) | Percentage (%) |
|---|---|---|
| **Prevalence of anaemia** | | |
| Anaemic | 139 | 67.5 |
| Non-Anaemic | 67 | 32.5 |
| **Classification of anaemia** | | |
| Severe | 11 | 5.3 |
| Moderate | 55 | 26.7 |
| Mild | 73 | 35.4 |
| **Awareness of anaemia** | | |
| Yes | 190 | 92.2 |
| No | 14 | 6.8 |
| Never | 2 | 1.0 |
| **Diagnosis of anaemia in the past 3 months** | | |
| Yes | 74 | 35.9 |
| No | 110 | 53.4 |
| Never | 10 | 4.9 |
| Cannot tell | 12 | 5.8 |

The prevalence of anaemia based on the Dietary Diversity Score among WRA is presented in Figure 1.

Figure 1: Food group patterns with the prevalence of anaemia among women of reproductive age.

The various food groups with the prevalence of anaemia are shown in Figure 1. The results showed that anaemia was prevalent among women with high DDS.

Table 3 depicts the bivariate analysis of factors associated with anaemia. The results showed a statistical significance ($p$=0.047) between anaemia among women of reproductive age and menstrual blood loss.

**Table 3: Bivariate analysis of factors associated with anaemia among the participants**

| Variable | Anaemia status Anaemia (%) n=139 | Normal n=67 | p-value[s] |
|---|---|---|---|
| **Age group** | | | **0.551** |
| 15-20 | 60(43.2%) | 25(37.3%) | |
| 21-30 | 78(56.1%) | 42(62.7%) | |
| 31-40 | 1(0.7%) | | |
| **BMI Category** | | | **0.430** |
| Underweight | 17(12.2%) | 7(10.4%) | |
| Normal | 82(59.0%) | 37(55.2%) | |
| Overweight | 40(28.8%) | 23(34.3%) | |

| | | | |
|---|---|---|---|
| **Menstruation Length of blood loss** | | | **0.110** |
| 2-3 days | 17(12.2%) | 3(4.5%) | |
| 4-5 days | 72(51.8%) | 35(52.2%) | |
| 6-7 days | 50(36.0%) | 29(43.3%) | |
| **Amount of blood loss per day** | | | **0.047*** |
| =80ml | 25(18.0%) | 12(18.2%) | |
| <80ml | 25(18.0%) | 7(10.6%) | |
| >80ml | 71(51.1%) | 37(56.1%) | |
| Don't know | 18(12.9%) | 10(15.2%) | |
| **Usage of sanitary pad** | | | **0.601** |
| Twice | 50(36.0%) | 22(32.8%) | |
| Thrice | 84(60.4%) | 43(64.2%) | |
| None | 5(3.6%) | 2(3.0%) | |
| **Oxygen saturation level** | | | **0.761** |
| Low | 5(3.6%) | 3(4.5%) | |
| Normal | 134(96.4%) | 64(95.5%) | |
| **Dietary Diversity Score** | | | **0.711** |
| Low | 19(20.2%) | 9(17.6%) | |
| High | 75(79.8%) | 42(82.4%) | |

***Significance difference at (P<0.05)**

## DISCUSSION

Addressing the prevalence of anaemia among women of reproductive age is becoming increasingly recognized as important. Numerous studies on this topic have been conducted in various countries, including Ghana (Habyarimana, Zewotir, and Ramroop, 2020; Teshale *et al.,* 2020 & Tandoh *et al.*, 2021).

The prevalence of anaemia was determined using a portable haemoglobin meter URIT 12, similar to a study conducted by Tandoh et al. (2021). This study found that the overall prevalence of anaemia among women of reproductive age (15-49 years) was 67.5%, with the major form of anaemia being mild anaemia (35.4%). Other reported values of anaemia from different countries were 32.8% in Turkey (Pala and Dundar, 2008), 19.2% in Rwanda (Habyarimana, Zewotir, and Ramroop, 2020), and 34.85% in East Africa (Teshale et al., 2020), which were lower than the overall prevalence found in this study. However, other similarly high prevalence rates have been reported in other studies, such as 65.6% and 66% in Nepal (Baral and Onta, 2009; Nepal Demographic and Health Survey, 2011), 42% in Ghana (Spring, 2016), 41% in Nepal (Gautam et al., 2010), and 63.4% in Turkey (Kocaoz, 2019). The differences in anaemia prevalence between these countries could be attributed to cultural factors related to diet and geographical areas. Furthermore, the high prevalence of anaemia in this study might also be due to illnesses or other risk factors that were not assessed, as many participants were unaware of their sickle cell status.

Anaemia was more prevalent among women aged 21-30 years, aligning with a study conducted in Ethiopia where women aged 25-39 had the highest risk of anaemia (Gebremedhin and Enquselassie, 2011), as well as a study in Mexico reporting a higher prevalence among women aged 20-29 (Monárrez-Espino and Martínez, 2001).

However, some studies over the years have not found an association between age and anaemia. Examples include studies conducted in Tanzania (Massawe et al., 2019), India (Bentley, 2003), and Nigeria (Dim and Onah, 2007).

Heavy menstrual bleeding (HMB) is objectively defined as total blood loss per menstrual cycle consistently exceeding 80 ml (Sriprasert, 2017; Kocaoz, 2019). However, defining HMB based on quantified blood loss is primarily useful for research purposes, as accurately measuring menstrual blood flow remains challenging. While validated pictorial blood loss assessment charts exist, their practical utility is largely confined to research studies and is not widely applicable in clinical care (Magnay et al., 2020). This study found that women with blood loss of 80 ml or more were more prevalent (18.0% and 52.4%, respectively) compared to those with blood loss of less than 80 ml. The prevalence of heavy menstrual bleeding was higher (18.0%) in this study than in another study in Iran (15.2%) (Kazemijaliseh et al., 2017), and a study conducted among university students in Europe (21.8%) (Gursel et al., 2014).

In this study, the number and percentage of women with blood loss of 80 ml and more were the most anaemic, with blood loss greater than 80 ml contributing 51.1% to the prevalence of anaemia. Additionally, 61.7% of women reported using more than two sanitary pads per day. According to Kocaoz et al. (2019), causes for increased menstrual blood loss could include irregular ovulation, medications, hormone-related issues, or other illnesses, which may explain the excessive menstrual blood loss observed in women of reproductive age.

Other studies have revealed that risk factors such as lack of iron intake, hookworm infestation, malaria parasitaemia, diet, infection, and genetics are associated with anaemia. However, the most common contributing factors to anaemia in Ghana include iron deficiency, haemoglobinopathies, micronutrient deficiencies, inflammation, and other communicable diseases such as malaria and helminthiasis (*Wegmüller et al., 2020*). From 2002 to 2012, the prevalence of malaria infection among non-pregnant women of reproductive age ranged from 39% to 49%, and this was associated with anaemia. In the current study, none of the women tested positive for malaria, making it very difficult to relate malaria to the prevalence of anaemia. Hence, malaria had no significant impact on anaemia in this study, making our findings inconsistent with a previous study conducted in Ghana (*Spring, 2016*).

To account for this discrepancy, according to the WHO (*2017*), the criteria for malaria RDTs (Rapid Diagnostic Tests) for diagnosis require detecting densities greater than or equal to 25 parasites per microliter of blood. However, the recommended sensitivity of RDTs to *P. falciparum* is ≥95% at ≥100 parasites per microliter. The results of RDTs are either negative or positive, indicating the absence or presence of malaria parasites, respectively. However, the results can sometimes be false-positive or false-negative. A negative test does not always exclude malaria, as certain factors can alter the certainty of the results. Some of these factors could include insufficient malaria parasites in the blood to yield a positive result. Additionally, malaria infection can be caused by another species of the malaria parasite. Due to this, RDTs are designed to detect a particular type of malaria species (*WHO, 2004*). In contrast to the results of this study, other studies have detected positive results for malaria using different malaria RDT products (*Orish et al.*, 2013).

The findings from this study showed that there was no significant effect of BMI on the anaemia status of the women. In another study, however, Habyarimana et al. (2020) reported that BMI had a significant effect on anaemia status, whereby underweight women were more anaemic than normal and overweight women (*Habyarimana, Zewotir, and Ramroop, 2020*). In this study, however, the prevalence of anaemia among normal-weight women was higher than that of underweight and overweight women. This result was consistent with studies from China (*Qin et al., 2013*), where the prevalence of anaemia in normal-weight women was higher than in overweight and obese women. Inferring from this, a higher BMI may not necessarily imply better micronutrient status.

Others have reported that anaemia causes weakness in oxygen delivery (*Jamnok et al., 2020*). In addition, studies on pulse oximetry (*Keller, 1989*) revealed that anaemia affects oxygen saturation levels. However, in this study, there was no significant effect of oxygen saturation level on anaemia and vice versa. Keller's studies (*1989)* noted that, although a pulse oximeter is good at measuring oxygenation, it may have some limitations since factors such as low flow, ambient light, and motion can affect the accuracy of the results.

Despite the high dietary diversity score reported among the majority of the WRA (Women of Reproductive Age) participants, anaemia was still highly prevalent among them, making this study inconsistent with other studies done on the effect of DDS (Dietary Diversity Score) on anaemia in Ethiopia (*Deli, Tamiru, and Zinab, 2018*) and in Ghana (*Saaka and Abdul, 2015*).

# CONCLUSION AND RECOMMENDATION

The prevalence of anaemia in women of reproductive age at KNUST, Ghana, was relatively high. The findings from this study revealed that excessive blood loss during menstruation was the main factor associated with the prevalence of anaemia among women of reproductive age. Women experiencing excessive bleeding can replenish blood loss by consuming iron-rich foods, supplementing their diet with iron and other essential micronutrients, or using blood haematinics. Moreover, since most of the research conducted over the years has focused on anaemia in children and pregnant women, similar attention should be given to non-pregnant women, as they are very prone to the negative effects of anaemia.

# LIMITATION

Although the estimated sample size was 374, only 265 participants voluntarily agreed to take part in this study, which was further reduced to a total of 206 based on the exclusion criteria. This potentially introduces some limitations due to the reduced sample size. Some women may have felt discomfort about participating in the study, which could have contributed to the lower number of participants. However, despite the relatively small sample size, the study made a positive contribution by highlighting important trends and areas for further research, even though the findings may not be fully generalizable to the general population of Ghana.

## Acknowledgements and Declaration of Conflict of Interest

### Competing interests

The authors declare no conflict of interest.

## Ethics Approval and Consent to Participate

Ethics approval for this study was sought from the Committee on Human Research, Publications and Ethics, of the School of Medical Sciences, Kwame Nkrumah University of Science and Technology (CHRPE/KNUST) Kumasi, Ghana (CHRPE/AP/229/21). Permission to conduct the study on the KNUST campus was also obtained from the office of the Dean of students. Participation in the study was voluntary and informed consent for participation and publication was obtained from interested women of reproductive age.

All the methods in this study were carried out by the guidelines stipulated in the KNUST policy on ethics.

### Consent for Publication

As part of the consent to participate, consent for publication was given by the study participants.

### Consent for Acknowledgement

Not Applicable.

### Funding

This study was self-funded.

### Data Availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

## Authors' contributions:

**Marina Aferiba Tandoh:** Overseeing the proposal concept development, data collection, data entry, manuscript writing and review of manuscript.

**Winifred Opoku Agyemeang**: Proposal development, data collection, data entry and analysis, and manuscript writing.

**Emmanuella Takyi Brago:** Study implementation, data collection and interpretation and draft manuscript.

**Samuel Selorm Attu:** Statistical analysis and interpretation of the data and review of the manuscript.

**Asare Emmanuel Domfeh:** Proposal concept development, data analysis and reviewing of draft manuscript.

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