Predictors of Anaemia prevalence among pregnant women in urban Ghana: a cross-sectional study

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Abstract

Background Anaemia during pregnancy is a major public health concern. Despite its wide scope and adverse effects including increased maternal and perinatal morbidity and mortality, and long-term adverse effects in the new born, extensive interventions using upstream approaches to public health have largely not been implemented. This study investigated the prevalence and associated factors of anaemia in pregnant women in four health facilities in the Kwabre East Municipality of Ghana. **Method** A cross-sectional survey with a two-stage sampling technique was conducted on 220 pregnant women who attended antenatal care at the selected health facilities. Interview-based structured questionnaires were used. Bivariate and multivariate logistic regression were used to identify predictors. **Results** The prevalence of anaemia was 11.4%. Few women (25) were anaemic and morphologically, 14 had normocytic normochromic (56%) anemia and 9 had Microcytic hypochromic (36) anaemia. Iron deficiency was reported in 19 (8.6%) pregnant women. Iron sulphate intake (AOR [95% CI] = 3.16 [1.15, 7.37], ANC follow-up during pregnancy (AOR [95% CI] = 3.07 [1.59, 7.99], household size of ≥ 5 (AOR [95% CI] = 3.58 [1.75, 9.52], folic acid intake (AOR [95% CI] = 5.29 [2.65, 12.39] and the period in pregnancy AOR [95% CI] = ≥ 36 weeks 3.2 (1.3–4.5) were independent predictors of anemia. **Conclusion** Though anaemia prevalence has been low in urban areas as previously reported, collaborated healthcare measures that aim at eradicating the menace are encouraged. Maternal health care interventions including the administration of folic acid, regular iron sulphate intake and intensive education on early ANC are recommended.

Background

Anaemia is a major public health problem globally among pregnant women in both low and middle-income countries (WHO, 2015; Gupta and Gadipudi, 2018). The menace exerts serious consequences on the health of pregnant women and the unborn baby (WHO, 2008; McLean et al., 2009). In a report released in 2011 by the World Health Organisation (2015), the global anaemia prevalence rates for pregnant women and all women of reproductive age were 38.2% and 29.4% respectively. The prevalence rates of anaemia are more alarming in the regions of South-East Asia, Eastern Mediterranean and Africa, which range from 37.7% to 41.5% for non-pregnant women and 38.9% to 48.7% for pregnant women in these regions, respectively (WHO, 2015). It is disheartening that the highest prevalence of anaemia is among children under five years and pregnant women (Balarajan et al., 2011; Salhan et al., 2012; WHO, 2015).

Anaemia during pregnancy is a major cause of maternal morbidity (Balarajan et al., 2011), and is estimated with a haemoglobin concentration of less than 10 gm/dl. Any patient with haemoglobin of less than 11 gm/dl to 11.5 gm/dl at the start of pregnancy will be treated as anaemic. Anaemia during pregnancy has both maternal and foetal consequences, hence, a major cause of morbidity and mortality among pregnant women especially in developing countries (Akhtar and Hassan, 2012; Elzahrani, 2012; Ali et al., 2019). It is in this regard that the WHO requires blood testing to detect syphilis and severe anaemia as major components of antenatal care among pregnant women (GSS, 2011; WHO, 2015).

The causes of anaemia during pregnancy is multidimensional, however, in developing countries, it is predominantly nutritional deficiencies in iron, folate and vitamin B12. Other causes of anaemia are loss of blood due to bleeding, failure of bone marrow to produce sufficient number of RBCs causing aplastic anaemia, and parasitic diseases (Salhan et al., 2012; Chaparro et al., 2019). Iron deficiency is the most common cause of anaemia and undermines the cognitive development of children and low productivity among adults (Baig-Ansari et al., 2008). Anaemia infections among pregnant women is a public health problem in Ghana (WHO, 2008). However, among the regions in Ghana, anaemia prevalence ranges from as low as 2 percent in the Eastern region to 19 percent in the Northern, Upper East and Upper West regions. There is also a large variance in anaemia prevalence by ecological zone (GSS, 2012). Anaemia was three times higher in the Savannah zone (15%) than in the Coastal (4%) and Forest (5%) zones (GSS, 2012).

There have been a number of studies on pregnancy anaemia including those in Ghana (Ewusie et al., 2008; Fuseini et al., 2010; Engmann et al., 2014; Anderson, 2017; Nonterah et al., 2019), Tanzania (Stephen et al., 2018; Ali et al., 2019; Ojoniye et al., 2019), Nicaragua (Lubbock and Stephenson, 2008), Nigeria (Adesina et al., 2011; Okafor et al., 2013; Paul et al., 2016; Sholeye et al., 2017), Ethiopia (Melku et al., 2014; Alene, and Dohe, 2014), Pakistan (Baig-Ansari et al., 2008; Khan et al., 2010) and Vietnam (Aikawa et al., 2006). Specifically, the work of Khan et al., (2010) study focus on pregnant women from tertiary health facilities in urban setting and was limited to iron, folate and cobalamin deficiency in anaemic pregnant women. While Ewusie et al., (2014)

exclusively focus on under 5 children among Ghanaian population, Aikawa et al., (2006) stress on risk factors for iron-deficiency anaemia among pregnant women living in rural Vietnam. While Anderson (2017) considers multiple factors including anaemia, obesity, hypertension and diabetes among residents of selected communities in Ghana, Fuseini et al., (2010) in their study in the Kassena-Nankana district of Northern Ghana examined the association between anaemia and Plasmodium and or intestinal helminth infections during pregnancy.

In the Kwabre East Municipality, the trend of anaemia pregnancy cases from 2009–2012 has been progressively encouraging. In 2009, there were 1,851 (37.8%) reported cases, 2010 had 1,428 (29.6%) cases, 2011 witnessed 1,115 (24.3%) cases and in 2012, 1,032 (23.2%) cases were reported. In 2013, 825 pregnancy anaemia cases were recorded with 430 reported in 2014 (KEMHD, 2015). There have been downward trend in anaemia prevalence among pregnant women in the municipality. Anaemia prevalence among pregnant women is a major indicator used to assess the effectiveness of interventions focused on maternal healthcare. According to the Municipal Health Directorate (2015), the key reason for low anaemia prevalence is the implementation focused ANC by the government of Ghana, which helps pregnant women to be taken care of by a particular healthcare provider through the period of pregnancy. Despite the intervention, the prevalence still exists, though in lower rates. There is therefore, the need to undertake a study to determine the factors contributing to anaemia prevalence in the municipality six years after the implementation of the focused ANC. The findings from this study therefore, would be useful in informing maternal health policy and interventions in Ghana.

Methods

Study setting

The study area is one of the 32 newly carved Municipalities by the government of Ghana in 2018. The Kwabre East Municipality was carved out of the former Kwabre Sekyere District in 1988. It is located almost in the central portion of the Ashanti region and within latitudes 6° 44' North and longitudes 10° 33' to 10° 44' West (GSS, 2012). The Municipality has a total land area of 246.8 square kilometres constituting about 1.01% of the total land area of Ashanti Region. The population of the Municipality according to the 2010 Population and Housing Census stands at 115,556 with 55,106 males 60,450 females. Data from the Kwabre East Municipal Health Directorate (2015), reveal that ANC utilisation level is high and most pregnant women make use of the service purely on the intense education the health directorate has embarked towards achieving the WHO standards of service use.

Study Design and Sampling

This study forms part of a larger research that investigated the socioeconomic determinants of antenatal care utilisation of pregnant mothers in selected health facilities in the Kwabre East Municipality. The study adopted a facility-based cross-sectional survey design to investigate the predictors of anaemia prevalence among pregnant women in the Municipality. These health facilities are publicly owned and were purposively sampled based on the administrative divisions of the Municipality and the free maternal health policy introduced by the Ghana government in 2003.

The study used a three-stage sampling technique to select the respondents. At the first stage, purposive sampling technique was used to select the four health facilities located in Asonomaso, Mampong, Antea, Sakra Wonoo in Municipality based on administrative divisions. Using the Municipal Health Information Management System software, a total of 1010 pregnant women constituted the sampling frame from the four health facilities. Consequently, the proportional sampling technique was used to select 220 pregnant women aged between 15–49 were selected for the study (Table 1). Structured questionnaires were used to collect data from study participants. Data collected from respondents included demographic characteristics, health status, family planning services, social support systems, quality of service, choice of facility, level of utilisation, and views on caregivers.

The sample size was obtained by using the fractional approach, which suggests that any fraction of an intended population that is 10% or more is deemed representative especially if the sample is scientifically selected (Monette, 2005). In a related study by Bush and Burns (2000), it was revealed that a sample size of 5% of a population of study is deemed to achieve its purpose if it was scientifically chosen. Hence, the sample size of 22.6% of the total population from the selected health facilities was deemed to be

scientifically chosen. The proportional stratified sampling technique was used to determine the sample sizes using the formula; $n = (n_i/N)S$, where n_i = facility population, N = total population and S = sample size. The same formula was used based on the variance in population of study respondents from selected facilities. As a result, the margin of error for the determination of the sample size was 0.02 and the proportion of the study population likely to agree that pregnancy anaemia is a major public health concern was assumed as 10% (0.10). The figures were then substituted into the formula outlined by Moser and Kalton (2007) for determining sample size. The formula is given as:

[Due to technical limitations, this equation is only available as a download in the supplemental files section.]

Data Collection and analysis

The selection was based on the level of antenatal care attendance at the selected prenatal outpatient departments of selected facilities. Using the Municipal Health Information Management System software (KEMHD, 2015). In effect, a list of pregnant women aged between 15–49 was obtained from the antenatal care units of the sampled health facilities. Subsequently, simple random sampling technique was used to select 220 pregnant women for the study. Data collected from respondents included demographic characteristics, health status, family planning services, social support systems, quality of service, choice of facility, level of utilisation, and views on caregivers.

A face-to-face interview using structured questionnaire was employed to obtain data about sociodemographic characteristics, dietary habit, ANC followup, multivitamin intake, taking meat and animal products, sulphate intake, folic acid intake, sleeping under insecticide treated nets (ITNs), use repellents/coils/sprays and nutrient supplementation at their pregnancy period at the time of data collection. Blood pressure, height and weight and body mass index (BMI) of respondents were calculated in the forms of (weight (kg)/height (m²)). Serum ferritin levels using the DPC Immulite 1 ferritin assay (Diagnostic Products Corporation, Los Angeles, USA) were taken. Again, erythrocyte sedimentation rate (ESR) were measured using the Sediplast system (LP Italiana Spa, Milan, Italy); Diagnostic Products Corporation, Los Angeles, USA); complete blood counts (CBC) were performed using Sysmex KX–21 Hematology Analyzer (Sysmex Corporation, Kobe, Japan) were run on venous blood samples. The WHO criteria on anaemia (haemoglobin concentration ≥ 11 g/dL, (Beutler and Waalen, 2006)) were strictly used in this study. Also, urine and stool samples using iodine were also obtained to determine the presence of pathogens in the intestines of study participants.

Raw data for the study were first entered into SPSS version 21 and then imported into STATA version 20 statistical package for analysis. Descriptive statistics in the form of standard deviation, means, and percentages were carried out using tables. Again, the binary logistic regression analysis was to evaluate the difference in anaemia prevalence in relation to the relevant variables. To assess the strength of association and statistical significance in bivariate analysis, odds ratio, and 95% CI for odds ratio were calculated to determine their significant levels.

Results

Characteristics of Study Participants

A total of 220 pregnant women with a mean ($\pm$ SD) age of 30.46 ± 6.16 were included in the study. 43% (95) of study respondents were at the first trimester, followed by 38% (83) in their second trimester with 19% (42) of respondents in their third trimester (Figure 1). Table 2 summarises the characteristics of the study participants.

The dietary pattern and nutritional assessment of the respondents revealed that, 40.5%, 68.2%, 32.3%, 73.2%, 90.9% and 68.8% took folic acid, fruit after meals, green leafy vegetables, meat and other animal products, iron sulphate and multivitamin, respectively. Among study respondents, 31.8% did not take fruit after meals during pregnancy, 67.7% did not take leafy vegetables, 13.2 did not take multivitamin, 26.8 did not take meat and other animal products, and 59.5 did not take folic acid in their pregnancies (Table 3).

Prevalence and predictors among study respondents

The study revealed anaemia prevalence among pregnant women as 11.4 %. Study respondents who have had the habit of taking iron sulphate, eating meat and animal products, not taking multivitamin and eating fruits after meals were 19.3%, 24.5%, 24.1% and 31.3 respectively, were found to be anaemic (Table 3). Again, 15.4%, 24.6%, and 19.1% of pregnant women who did not follow-up on their ANC visits, did not sleep under ITN, and did not take folic acid in their present pregnancies respectively were all found to be anaemic (Table 3). The results show that iron sulphate intake (AOR [95% CI] = 3.16 [1.15, 7.37], ANC follow-up during pregnancy (AOR [95% CI] = 3.07 [1.59, 7.99], household size of ≥ 5 (AOR [95% CI] = 3.58 [1.75, 9.52] and folic acid intake (AOR [95% CI] = 5.29 [2.65, 12.39] were independent predictors of anaemia. The types of anaemia found in pregnant women in this study were normocytic normochromic (56%), followed by microcytic hypochromic (36%) and lastly macrocytic normochromic (8%) of the overall 25 anaemic women as displayed in Table 5.

On the health characteristics on haemoglobin levels of pregnant women, participants were split into two groups, early; ≤ 24 weeks and late; ≥ 36 weeks. Using the stepwise algorithm on multivariate analysis, the odds of being iron deficient among pregnant women who were ≥ 36 weeks of pregnancy (AOR 3.2) were more likely to be increased than their counterparts in the ≤ 24 (AOR 1) weeks group (Table 4). Again, the odds of being anaemic were increased if women were iron deficient (AOR 2.4). The study presents low prevalence of anaemia and iron deficiency, which are 11.4% and 8.6% respectively.

The study parameters considered age, household size, occupation status and education of pregnant mothers if they influenced anaemia prevalence among study participants. These variables were then added in the multiple regression analysis to determine their level of significance. Their results show that the z statistic presented marginal effects at variance at 10%, 5% and 1% (Table 6). This indicates that anaemia prevalence among older pregnant women compared to their younger counterparts is at variance among a particular population group.

Discussion

Prevalence and Predictors of Anaemia

According to the Ghana multiple Indicator Cluster Survey (GSS, 2011), iron deficiency is one of the major causes of anaemia among pregnant women. This study revealed iron and anaemia prevalence rates of 11.4% and 8.6% among study respondents. These rates are considerably lower than most of those previously reported including those of Adesina et al., (2011) reported 33.1% and Nybo et al., (2007) reported 20.0%. Again, Thirukkanesh and Zahara (2010) reported anaemia prevalence of 42.3% and Aikawa et al., (2006) reporting anaemia prevalence as 43.2%. In a related study, Lassey et al., (1999) indicated that 56% of urban pregnant women in Ghana had haemoglobin levels below the 11 g/dL threshold while Mockenhaupt et al., (2000) reported on the prevalence of anaemia and iron deficiency as 54% and 46% respectively on 540 rural pregnant women. Again, the findings of this study is in line with the work of Engmann et al., (2008) on anaemia and iron deficiency in pregnant Ghanaian women from urban areas who reported anaemia and iron deficiency prevalent rates as 34% and 7.5, respectively. The possible reason for the low rates in anaemia and iron deficiency anaemia among pregnant women in the present study could be due to the progressive improvement of ANC services alongside the focused ANC adopted by the Kwbre East Municipal health directorate.

The variations in anaemia prevalence among these studies could also be attributed to the differences in broader health systems and health responses targeted at the well-being of pregnant women. The difference in anaemia prevalence in the current study could further be attributed to improvement in the standard of living, with personal hygiene and the planned initiative of the government of Ghana to meet the sustainable development goal 3 by 2030. In a study by Akowuah et al., (2018), it was found that the Ghana health services has instituted focused antenatal care which enables individual pregnant mothers to receive health care from a particular health staff in the entire period of pregnancy. The findings indicate that the predictors of anaemia among pregnant women are iron sulphate, low use of ANC during pregnancy, large household size, and folic acid. This supports observations from Ghana (GSS, 2010; Fuseini et al., 2010; Nonterah et al., 2019), in Tanzania (Ali et al., 2019) and Nicaragua (Lubbock and Stephenson, 2008) which revealed that older pregnant women are more susceptible to be anaemic compared to their younger counterparts. In addition, a comparative study between Indonesia and Ghana by Mocking et al., (2018) revealed similar study outcomes.

In the study, logistic regression analysis indicated that age was a key predictor of anaemia among pregnant women with beta coefficient and z statistic of 1.44 and 8.27 respectively. This observation is in agreement with Melku et al., (2014), who in their work on the prevalence and predictors of maternal anaemia during pregnancy in Gondar, Northwest Ethiopia, found that older pregnant women were more prone to anaemia than their younger counterparts. Possible reason for age as a predictor of maternal anaemia might be due to the poor feeding pattern of older pregnant women and the experience on safe multiple pregnancies, which do not make most of them attend ANC at early stages of pregnancy. The study demonstrated that mothers who have family size of more than ≥ 4 members were more likely to be anaemic (AOR = 3.58, 95% CI: 1.75, 9.52) as compared to their counterparts with ≤ 2 low family sizes (AOR = 1). This finding is in agreement with the work of Ali et al., (2019) which indicates that the higher the family size of pregnant women, the less are they able to fully utilise ANC services partly because of financial constraints they may be set with. Thus, such women easily become anaemic. However, the findings of Al-Mehaisen et al.'s, (2011) study in Jordan showed no significant difference of anaemia prevalence and household size. This variation could partly be due to geographical differences in study areas as in the case of Jordan.

Limitations of the Study

One of the limitations of this study is that the number of pregnancies and childbirths of respondents in relation to history of anaemia prevalence was not enquired. Again, the study could not determine which of the predictors preceded the other, because of the cross-sectional study design used. The final limitation of the study was the exclusion of both tertiary and primary health facilities as the study was executed in secondary care facilities that were in primarily urban centres.

Conclusion

The study reports a relatively low prevalence of anaemia and iron deficiency among pregnant women in urban Ghana compared to those previously reported. The focused ANC organised by the Municipal Health Directorate for pregnant women could be among the reasons for the low prevalence. In terms of morphological types of anaemia, the predominant types reported by the study were normocytic normochromic, microcytic hypochromic and macrocytic normochromic. The main predictors of maternal anaemia were age of pregnant women, household size, ANC follow-up during pregnancy, folic acid intake in present pregnancy, the sleeping under ITNs. In order to control the prevalence levels of anaemia and iron deficiency, the broader healthcare system is encouraged to make available folic acid in facilities and pregnant women must be encouraged to take more folic acid in addition to fruits at all times especially during pregnancies. Intense education on the need to fully utilise ANC must be strengthened to ensure early detection of potential pregnancy-related complications. Again, education on maternal health promotion should include sleeping in ITNs. In addition, programmes and policies aimed at reducing pregnancy anaemia should target mothers with large household sizes since such families tend to be financially handicapped.

Abbreviations

Adjusted Odds Ratio AOR

African Progress Panel APP

Antenatal Care ANC

Ghana Statistical Service GSS

Kwabre East Municipal Health Directorate KEMHD

Insecticide Treated Net ITN

World Health Organisation WHO

Declarations

Ethics approval and consent to participate

Ethical approval was sought from the Committee on Human Research, Publication and Ethics from the Komfo Anokye Teaching Hospital and the Kwame Nkrumah University of Science and Technology, Kumasi. Verbal consent was sought from study respondents. This was done to ensure respondents' anonymity and was approved by the ethics committee.

Consent for publication

Not applicable

Availability of data and material

The ethical committee reserves the right to share data

Competing interests

The authors declare no competing interests regarding the publication of this paper.

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Authors' contributions

AJA is the principal investigator of the study and participated in its conception and design. AJA and EOA carried out the literature review and drafted the entire manuscript. AJA and AOA participated in data collection and were involved in the analysis. EOA meticulously reviewed the manuscript. All authors read and finally approved the manuscript.

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Tables

Table 1: Study facilities and their Selected Sample Sizes

Facility	N _i	N n	$n_i = \frac{N_i}{n} \cdot N$
Asonomaso	337	1010 220	73
Mamponteng	400	1010 220	87
Antoa	135	1010 220	30
Sakra Wonoo	138	1010 220	30
Total	1010	220	220

Table 2: Sociodemographic characteristics of pregnant women on anaemia prevalence (n = 220).

Variables	Means	Std. Dev.
Age	30.46	6.16
Household Size	3.825	1.24
Occupational Status dummy		
Employed	0.88	0.33
Unemployed	0.12	
Educational Status		
Non formal	0.06	0.24
Primary	0.05	0.22
Middle/JHS	0.3	0.46
Secondary/SHS	0.295	0.46
Vocational/Technical	0.155	0.36
Tertiary	0.14	0.35
Insurance Status dummy		
Uninsured	0.23	0.42
Insured	0.77	

Due to technical limitations, Table(s) 3-5 are only available as a download in the supplemental files section.

Table 6: Logistic regression analysis of factors influencing anaemia in pregnancy

Dependent variable: Anaemia prevalence						
Independent Variables	Coef (β)	Std. Err.	z	Marg. Eff. (dy/dx)	Std. Err.	z
Socio-economic characteristics						
Age	1.44	0.48	3.79***	0.03	0.01	8.27***
Household Size	2.85	1.07	2.84***	0.08	0.02	3.72***
Occupational Status dummy	5.35	2.69	1.78**	0.11	0.04	3.42***
Educational Status						
Non-formal	-1.73	2.34	-0.74	-0.04	0.05	-0.72
Primary	-4.31	2.36	-1.83*	-0.10	0.05	-1.97**
Secondary/SHS	-3.81	1.62	-2.35**	-0.09	0.03	-2.81***
Vocational/Technical	-2.57	1.83	-1.40	-0.06	0.04	-1.42
Tertiary	-1.57	2.08	-0.75	-0.03	0.04	-0.75
Geographical distance						
By Car	-2.53	1.49	-1.70*	-0.07	0.03	-2.05**
Others	-1.63	4.72	-0.35	-0.04	0.12	-0.37
Anaemia predictors						
ANC follow-up during pregnancy	2.57	1.08	2.46***	0.06	0.03	3.79***
Taking fruits after meal	3.84	2.68	2.23**	0.06	0.05	2.87***
Iron sulphate Table intake	-0.60	2.35	-0.30	-0.01	0.04	-0.49
Folic acid intake during pregnancy	2.37	1.55	2.87***	0.01	0.05	3.57***
Sleeping under ITN	1.92	0.83	2.89	0.13	0.03	3.94***
Multivitamin intake	-1.49	1.54	-1.23	-0.14	0.04	-1.04
Use of repellents/coils/sprays	-8.51	2.68	3.17***	-0.27	0.04	-7.51***
Eating green leafy vegetables	2.35	1.72	1.43	0.06	0.03	1.89*
Eating meat/animal products	2.47	1.83	2.55**	0.10	0.04	1.72*
Constant	-39.81	10.57	-3.69			
LR chi2(19) = 167.59***						
Pseudo R2 = 0.81						
Log likelihood = -18.89						

NB: *, ** and *** represent significance at 10%, 5% & 1% respectively.

Figures

Figure 1

Stage of Accessing Antenatal Care by Respondents

Supplementary Files

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