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ORIGINAL RESEARCH

Prevalence of Anemia and Its Associated Socio-Demographic Factors Among Pregnant Women Attending an Antenatal Care Clinic at Kisugu Health Center IV, Makindye Division, Kampala, Uganda

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Aims/Objectives: This study sought to determine the prevalence, morphological characterization and associated socio-demographic factors of anemia among pregnant women attending Kisugu Health Centre IV, Makindye Division, Kampala, in Uganda.

Methods: This was a cross-sectional study that employed laboratory analysis of blood samples to determine hemoglobin concentration, and a structured questionnaire to obtain socio-demographic factors associated with anemia during pregnancy.

Results: We enrolled 345 pregnant women aged 15 to 43 years. The median, interquartile range, and mean Hb levels were 8.1g/dL, 6.4 ± 2.1g/dL and 7.9g/dL, respectively. There were 89 participants whose Hb levels were indicative of anemia, giving anemia prevalence of 25.8% (95% confidence interval: 21.6–29.8). Of these, 25 (28.1%) had mild anemia, 46 (51.7%) had moderate anemia, while 18 (20.2%) had severe anemia. Thin blood film examination showed normocytic-hypochromic (75.3%), then microcytic-hypochromic (21.6%), and macrocytic-hypochromic red blood cells (3.4%). The socio-demographic factors of gestational age, parity, and mother's occupation were significantly associated with the risk of anemia ($p< 0.05$).

Conclusion: We report a high prevalence of anemia among pregnant women; with a majority of hypochromic-microcytic anemia. This may necessitate more anemia awareness and it requires institution of nutritional interventions to avert fetal-maternal complications.

Keywords: anemia, morphological characterization, pregnant women, Uganda

Background

Anemia is defined by a reduced level of either circulating red blood cells (RBCs) or hemoglobin (Hb) for an individual's age and sex, which consequently impairs tissue oxygenation.[1] It is a major cause of morbidity and mortality; affecting 1.62 billion people, of which 56 million are pregnant women.[1] According to World Health Organization, anemia in pregnancy (also known as gestational anemia) is defined by hemoglobin (Hb) concentration of less than 11.0g/dL.[2] Numerous studies indicate a high burden of anemia among pregnant women; for example, it was reported at 66.2% in Sudan, 25.2% in Northwest Ethiopia, 90.5% in Hyderabad-Pakistan, 84.5% from 16 districts of 11 states of India, 40.4% in Southeastern Nigeria, and 22.0% in Kampala, Uganda.[3–8]

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Anemia is presented in three clinical forms; as mild when Hb levels are between 10 and 11 g/dL, moderate for Hb between 7.0 and 9.9g/dL and severe for Hb levels below 7.0g/dL.[9,10] The implication is more pronounced as Hb levels reduces with eventual life-threatening consequences, such as preterm delivery, low birth weight babies, APGAR (Appearance, Pulse, Grimace, Activity, Respiration) score less than five at 1 min, intrauterine growth retardation and to the family, it has far-reaching health consequences and social–economic prospects.[11–15] To the fetus, anemia during pregnancy affects cognitive and physical development, and may aggravate death.[16]

The causes of anemia are varied; and, it results from a single, or/and a complex interaction of factors; such as genetic defects, nutrient deficiency, parasitic and chronic infections, blood loss, as well as drug myelosuppression.[17–21] Understanding the prevalence, associated factors and their complex interaction may ease the interventions to lessen the case burden of anemia. This study reports on the prevalence, morphological characterization and associated factors of anemia among pregnant women attending Kisugu Health Centre IV, Makindye Division, Kampala in Uganda.

Materials and Methods

Study Design, and Duration

This study used a cross-sectional design, between the periods of February to October 2016.

Study Participant

These comprised pregnant women attending antenatal care services at Kisugu Health Center IV. We excluded participants who had obstetric emergencies, and those who declined to consent. The study sequentially enrolled pregnant women seeking antenatal care as outpatients at a single urban health facility that receives clients from a suburb. These are mainly individuals of a low-socioeconomic class whose main activity is conduct of business activities for survival.

Sample Collection and Laboratory Analysis

We collected capillary blood samples by finger pricking with a sterile disposable lancet after careful disinfection with cotton immersed in 70% ethanol. Laboratory investigation to determine Hb levels were determined using HemoCue HB 201^{+} analyzer (HemoCue, Angelholm, Sweden). A drop of blood was allowed to enter the optical window of the microcuvette by capillary action. The microcuvette was placed into the cuvette holder for determination of Hb level, and anemia was considered for Hb levels lower than 11 g/dL.[2,21] It was further classified according to Hb levels, into mild (Hb levels of 10.1 to 11.0g/dL), moderate (Hb levels of 7.0 to 10g/dL) and severe anemia (Hb levels less than 7.0g/dL).[2,19,21,22] Additionally, a drop of blood was collected and used to make a thin blood film. This was stained with Giemsa, air dried and examined for morphological characterization of anemia based on comprehensive film report. Anemia was reported based on: 1) red blood cells size, that is: normocytic, microcytic and macrocytic RBCs, and 2) red blood cells staining that is, normochromic and hypochromic RBCs. Each step of the specimen collection, processing and examination was overseen by an experienced laboratory staff attached to Kisugu Health Centre IV. Quality was ensured by ensuring strict adherence to the standard operation procedures (SOPs) developed from the HemoCue kit insert and controls that were run daily. Stained films were quality controlled by laboratory technologists (FW and FS) attached to Lancet laboratories and Clarke International University, respectively. A conclusive report was made based on technical agreement of the three reports, and verified by the corresponding author (IMT) who participates in a hematology external proficiency testing scheme.

Socio-Demographic Data

This was collected by directly interviewing pregnant women using a structured questionnaire that included age, marital status, parity, education level, respondent's occupation, husband's occupation and physical examination. The questionnaire was pilot-tested using 20 respondents attending antenatal care at International Hospital Kampala, Makindye division, in Kampala and changes were made as required.

Data Analysis

Data were entered using Microsoft Excel 2013, and cleaned. Analysis was done using SPSS version 17.0. Descriptive statistics (mean, frequencies, cross-tabulation) were used to describe study participants and to determine the prevalence of anemia. Univariate Chi square analysis was done to elucidate socio-demographic factors associated with anemia. Explanatory variables considered in the analysis were age, parity, education level, marital status, occupation and gestational age. Such variables associated with the outcome variable ($P<0.05$) in the univariate analysis were included in

the multivariable model in a stepwise approach for independent predictors of anemia. Variables with p values ≤ 0.05 were considered statistically significant.

Ethical Consideration

Ethics Approval and Consent to Participate

We obtained ethical approval from the research and ethics committee of Clarke International University. We too sought for permission from the Director of Health services, Kampala Capital City Authority (KCCA) to enroll participants at Kisugu Health Centre IV. Eligible participants equal or above 18 years of age signed an informed consent, while participants under 18 years signed an assent form in privacy and no incentives were given. We did not seek consent from a parent or legal guardian on behalf of the participants under the age of 18 years as this is not needed as per the guidelines on emancipated minors given in the Uganda National Council for Science and Technology (UNCST).[23] Prior to consent/assent, the study was introduced as part of the directed health talk to the antenatal care attendees. During this, the investigator team explained to all eligible participants in the local language (Luganda) and English to ensure the simplest understandable terms about the study, and participants were given an opportunity to seek for clarity and understanding of the topic. Anonymity of the respondents was ensured at all stages of data analysis. Laboratory results were shared with the attending doctor for prompt antenatal care.

Results

We enrolled 345 pregnant women. The majority of the respondents were in the 21–30 age categories. Their mean age was 27 years (range, 15 to 43 years). The interquartile range, median, and mean Hb level was 6.4 ± 2.1g/dL, 8.1g/dL and 7.9g/dL, respectively. Participants reported various socio-demographics and clinical signs as indicated in Tables 1 and 2, respectively.

There were 89 participants whose Hb levels were indicative of anemia, giving a prevalence of 25.8% (95% confidence interval: 21.6–29.8). Of these, 25 (28.1%) had mild anemia, 46 (51.7%) had moderate anemia while 18 (20.2%) had severe anemia.

Thin-film examination indicated the most prevalent morphological form of anemia as normocytic-hypochromic (75.3%) followed by microcytic-hypochromic (with other poikilocytic features, namely: tear drop and pencil cells) (21.6%), while 3.4% had macrocytic-hypochromic RBCs.

Using multivariate analysis, the socio-demographic factors of gestational age, parity and mother's occupation showed a significant association with the risk of anemia ($p< 0.05$), as indicated in Table 3.

Discussion

The prevalence of gestational anemia in this study was 25.8%; this is comparable to 25.2% reported in Northwest Ethiopia.[4] On the other hand, this value is higher than the overall prevalence (22.1%) reported in Gulu and Hoima regional hospitals and 12.1% in Hoima, both located in Uganda.[24] Further, the obtained prevalence is lower than the 32.9% obtained from Gulu in Uganda, 40.4% reported in Southeastern Nigeria, 39.94% in Southern Ethiopia, 53.9% in Southwest Ethiopia, and that compiled by the World Health Organization for the different African countries, namely 34% in Uganda, 62% in Ghana, 61% in Benin, 60% in Gabon, 59% in Togo, 56% in Gambia and 53% in Liberia.[7,24–27] The observed variation is attributed to differences in the socioeconomic status of the different populations studied, a factor that determines nutrition and health-being. This is a phenomenon that has already been reported as evidenced in some studies.[9,20,21]

Further, the majority of the anemic pregnant women in this study had either mild anemia or moderate anemia (28.1%, 51.7%, respectively). This pattern is similar to that reported in Zimbabwe and Ethiopia.[14,18,26,28] Of critical concern, 20.2% of the pregnant women presented with severe anemia, a finding that necessitates urgent and prompt intervention. Additionally, the mild and moderate forms could progress into severe state, hence an obstetric emergency.

Morphological characterization of anemia in this study revealed normocytic-hypochromic and microcytic-hypochromic as the dominant RBC abnormalities. These are features of iron deficiency anemia, and this was found to complicate 96.9% of our respondents. On the other hand, 3.4% had macrocytic-hypochromic RBCs, which are depictive of megaloblastic anemia. This finding is consistent with reports from other studies.[11,14,18,19,27] The explanation for this is multifactorial, however, we attribute it to the fact that the majority were in their second and third trimesters; a stage during which it is thought that hematopoietic nutrients (namely: iron, cobalamin, hematopoietic factors and other micronutrients) demand is greatly increased. Additionally, as a study carried out in a low resource set up with high costs of living, it is likely that dietary support may not guarantee the minimum nutrient requirements of a pregnant woman.

Socio-demographic factors of gestational age, parity, and occupation of the mother were associated with the risk of

Table 1 Socio-Demographic Characteristics of the Respondents (n=345)

Variable	Categories	Frequency	Percentage
Age category (years)	15–20	95	27.5
	21–30	171	49.6
	31–40	78	22.6
	Above 41	1	0.3
Gestational age (trimesters)	1st trimester	77	22.3
	2nd trimester	141	40.9
	3rd trimester	127	36.8
Parity	Nullparity	156	44.3
	Para 1	71	20.6
	Para 2	80	23.2
	Para 3	37	10.7
	>Para 4	1	0.3
Education level	None	1	0.3
	Primary	91	26.4
	Secondary	175	50.7
	Tertiary	78	22.6
Marital status	Married	293	84.6
	Single	49	0.3
	Separated	3	14.2
Mother's occupation	Employed	174	50.4
	Not employed	171	49.6
Husband's occupation status	Employed	301	87.2
	Unemployed	20	5.8

Table 2 Clinical Characteristics of the Respondents (n=345)

Variable	Categories	Frequency	Percentage
Pallor	Yes	65	18.8
	No	280	81.2
Fatigue/weakness	Yes	143	41.4
	No	202	58.6
Dyspnoea	Yes	41	11.9
	No	304	88.1
Palpitation	Yes	64	18.6
	No	281	81.4
Headache	Yes	228	66.1
	No	117	33.9
Dizziness	Yes	205	59.4
	No	140	40.6
Restlessness	Yes	132	38.3
	No	213	61.7

anemia. These features have been reported in other studies.[26,29–32] The association with increasing gestational age is attributed to the increased nutrient demand for the growing fetus and increasing hemodilution.[20,21] On the other hand, the effect of parity and age is ascribed to the depletion of iron stores ensuing continual pregnancies, as shown earlier.[18–20] The effect of mother's occupation is a complex phenomenon, it is plausible from our study setting that their diets are likely to be composed of non-traditional diets and supplements, which is believed to increase their risk of nutrition-related anemia. Also, being an urban set up, their occupation renders one into a state of immobility, as most were involved in non-manual work; this factor may prompt body fluid imbalance, and thus accelerate the hemodilution effect; a factor that has been reported in Africa.[32]

The results of this study ought to be interpreted in light of the following shortfalls; a) We did not investigate other causes of anemia like parasitic infestation, b) whereas haemoglobinopathies are known to exist in our set up, this study did not confirm them as possible causes of the observed anemia cases, c) bone marrow examination which is a gold standard diagnosis for anemia was not done, therefore our value may not conclusively depict the actual anemia burden in this population, d) although human immunodeficiency virus is endemic in our set up and a co-founder of anemia, we did not adjust for this, e) iron studies were not performed and iron deficiency was based on blood film as the hypochromic and microcytic picture can as well be present in thalassemia and haemoglobinopathy, f) microcytic-hypochromic anemia is seen in other conditions including sickle cell disease and B-thalassemia. These were not confirmed among our study participants as Hb electrophoresis was not done, g) Other demographic factors that cause anemia such as body mass index (BMI) and smoking were not elucidated for this study, h) our study population consisted of pregnant women in a cross-sectional survey, we do not know whether they had had anemia before conception; on this basis, we presumed that the anemia diagnosed was pregnancy related, f) diagnosis of anemia was based on the use of a single-capillary blood test.

Conclusion

The prevalence of anemia in pregnancy in this study was 25.8%. The study also revealed nutrient-deficient anemias, namely: iron deficiency and megaloblastic anemias as the major types of anemia in this population. Factor analysis indicated gestational age, parity, and occupation of the mother as predictors of anemia. Based on our findings, there is a need for prenatal nutrition care system that emphasizes better use of essential nutrients including

Table 3 Multivariate Analysis of Socio-Demographic Factors Associated with Gestational Anemia

Variable	Categories	Hemoglobin Status		*P*-value
		Anemic (%)	Normal Hb (%)	
Age (years)	15–20 21–30 31–40 >41	36 (37.9%) 39 (22.8%) 14 (17.9%) 0	59 (62.1%) 132 (77.2%) 64 (82.1%) 1 (0.4%)	0.16
Gestational age (trimester)	1st 2nd 3rd	29 (38.2%) 26 (18.4%) 34 (26.8%)	47 (61.8%) 115 (81.6%) 93 (73.2%)	0.008*
Parity	Prime gravida Para 1 Para 2 Para 3	58 (65.2%) 11 (12.4%) 13 (14.6%) 7 (7.9%)	98 (38.3%) 60 (23.4%) 30 (11.7%) 1 (0.4%)	0.001*
Education level	None Primary Secondary Tertiary	1 (1.1%) 32 (36%) 47 (52.8%) 9 (10.1%)	0 59 (64.8%) 128 (73.1%) 69 (27.0%)	0.131
Marital status	Married Single Separated	69 (77.5%) 20 (39.2%) 1 (1.1%)	223 (87.1%) 30 (11.7%) 2 (0.8%)	0.075
Mother's occupation status	Employed Not employed	27 (30.3%) 62 (69.7%)	147 (57.4%) 109 (42.6%)	0.049*
Husband's occupation status	Employed Unemployed	75 (84.3%) 5 (5.6)	226 (88.3%) 15 (5.9%)	0.397

Note: * indicates a variable with statistical significant p-value.

iron, minerals and vitamins of high biological value and execution of interventions modified to check anemia prevalence and severity among pregnant women. As iron deficiency during pregnancy is linked life-threatening consequences to both maternal and unborn child, it is critical that early diagnostic and interventional measures are put in place to avert the possible complications in a high-risk population. This is supported by studies that have found a rapid replenishment of iron stores with significant Hb levels over a period of week 12, and an improvement in quality of life until delivery.[33,34]

Abbreviations

Hb, hemoglobin; IDA, iron deficiency anemia; RBCs, red blood cells; WHO, World Health Organization.

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Author Contributions

All authors participated in study conception and design, data acquisition, analysis and interpretation, drafting or revising the article, gave final approval of the version to be published, and agree to be accountable for all aspects of the work. All authors contributed to.

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Disclosure

The authors declare that they have no competing interests.

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