

Predictors of Anemia among Pregnant Teenagers Presenting at a Tertiary Level Teaching Hospital in Mid-western Uganda

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Abstract

Objective

To establish the predictors of anemia among pregnant teenagers presenting at Hoima Regional Referral Hospital, mid-western Uganda

Methods

This was a cross-sectional study conducted in the months of August 2021 to October 2021. A total of 288 pregnant teenagers aged between 13 and 19 years attending antenatal care (ANC) at Hoima Regional Referral Hospital (HRRH) were consecutively enrolled. Interviewer-administered questionnaires and laboratory report forms were used to obtain data. Descriptive statistics followed by binary logistic regression were conducted. All data analyses were conducted using IBM SPSS 23.

Results

The prevalence of anemia was 26%, with 53% having mild anemia, 40% moderate anemia, and 7% severe anemia. The key predictors of anemia among pregnant teenagers attending ANC at HRRH were lack of formal education (aOR = 17.39, CI:4.655–64.988; $p < 0.001$), nulliparity (aOR = 0.47, CI:0.225–0.989; $p = 0.047$) and ANC visits less than four times (aOR = 8.80, CI:2.888–27.811; $p < 0.001$)

Conclusion

The prevalence of anemia among pregnant teenagers at HRRH was higher than the estimated national anemia prevalence in this age group. Lack of formal education and poor ANC attendance are the key predictors of anemia at HRRH. Nulliparity is a protective factor for this obstetric complication in this age group of women at this facility.

Introduction

Anemia in pregnancy remains an intriguing global health problem with associated high maternal and perinatal morbidity and mortality. Pregnant women are one of the groups most affected by this condition, more so in the resource constrained nations with about 57% of women noted to be anemic in the sub-Saharan Africa (1, 2). Anemia in pregnancy is reported to increase maternal mortality by 8 to 10 fold and worsens other pregnancy related complications like intrauterine growth restriction, preterm birth, low birth weight, perinatal infection, and obstetric hemorrhages among others (3). Globally, about 16 million teenagers give birth every year mostly in low-and middle-income countries (4). A report by the Uganda Demographic Health Survey (2016) (5) revealed that 24% of the teenagers were either pregnant or had given birth. Teenage pregnancy is associated with higher chances of developing birth and pregnancy-

related complications including very high risks of maternal and fetal death, and low birth weight (6). Teenage pregnancy also increases the risk of developing anemia in pregnancy (7). Pregnant teenagers are three times more at risk of developing anemia during pregnancy compared to the rest of the pregnant women and up to 6.4% pregnant teenager deaths are attributable to anemia in Africa alone (2, 3, 8).

Despite the increasing rates of teenage pregnancy and anemia in pregnancy, there is limited information on anemia in pregnant teenagers in Uganda. Using unpublished data from records at Hoima Regional Referral Hospital from November 2019 to January 2020, out of 750 pregnant teenagers who delivered at this hospital, none of them was screened for anemia, and about one fourth of this number had devastating anemia-related complications even though both the World Health Organization (WHO) and the Uganda Clinical Guidelines (2016) (9) recommend screening and treatment of anemia in pregnancy during antenatal care visits. The present study intends to fill this knowledge gap by evaluating the prevalence of this obstetric complication as well as its key predictors among this vulnerable age group of the women attending ANC clinic at HRRH for future use in early surveillance of the teenagers at extra risk for timely intervention.

Methods And Materials

Study design

This was a hospital based cross-sectional study that covered a period of three months from August 2021 to October 2021.

Study site

The study was conducted at the antenatal care clinic of Hoima Regional Referral Hospital located in the centre of Hoima city, western Uganda, about 230 kilometers from the capital Kampala. HRRH is a public hospital owned by the government of Uganda but also serves as a satellite tertiary teaching hospital for Kampala International University Western Campus. The hospital is well equipped with an overall bed capacity of 400. The facility offers several services among which include obstetrics and gynecology services including antenatal care which attends to about 25 women per day.

Study population

All pregnant teenagers aged 13 years to 19 years in the third trimester who attended the antenatal care clinic at this hospital during the study period were enrolled for the study. We registered no exclusions like pregnant teenagers with emergency obstetric conditions such as antepartum hemorrhage.

Sample size and sampling

A sample size of 288 was considered. This was calculated using the Daniel formula (10) for sample size estimation.

$$n = \frac{z^2 pq}{d^2}$$

Where;

n = Desired sample size

z = z-statistic = 1.96 at 95% level of confidence

p = 25% = proportion of pregnant teenagers with anemia according to Obai et al., (11)

q = 1-p

d = Level of precision = 0.05

Therefore,

$$n = \frac{3.841 \times 0.25(1 - 0.25)}{(0.05)^2}$$

n= 288

Consecutive enrollment of all the study participants was done until the required sample size of 288 was reached. The participants were consecutively selected which ensured that they had equal opportunities to participate in the study. Participants were free to withdraw from the study at any time they wished without coercion or compromise of care they were entitled to

Study procedure

Eligible pregnant teenagers were recruited in the study after consenting in writing, following sensitization, education, and counseling about the study. Laboratory report forms were used to collect data on whether or not the respondent was anemic basing on the hemoglobin status. A self generated structured investigator administered questionnaire was used to obtain data for the predictors of anemia status. Validity of the questionnaire was checked using the Content Validity Index. We got 15 respondents not part of the sample population and gave them the questionnaire and measured the inter-respondent agreement. The agreement of more than 75% was considered as a measure that the items of the questionnaire could give us a true picture of factors associated with anemia in pregnant teenagers at Hoima Regional Referral Hospital. The reliability was achieved using the Cronbach's coefficient alpha test. By using the Cronbach's coefficient alpha of more than 0.8, it was considered that the items of our questionnaire were reproducible and consistent. Sample collection for Complete Blood Count (CBC) to ascertain the hemoglobin levels was done according to the standard WHO protocols by the principle investigator under the guide of the laboratory technologist. The phlebotomy site selected was either the antecubital fossa or forearm, where a vein of good size, visible, straight, and clear was located. A tourniquet was applied about 4-to-5 finger-widths above the venipuncture site and the vein was re-

examined (12). While wearing clean gloves, the chosen site was swabbed with 70% alcohol and allowed to dry completely. The vein was anchored by holding the patient's arm and placing a thumb below the venipuncture site, phlebotomy was performed at approximately 30-degree angle and 4ml of blood was collected and put in well-labeled vacutainers which contained ethylenediaminetetraacetic acid (12). The pressure was applied to the site until bleeding completely stopped. The sample was then taken to the laboratory for complete blood count analysis (12). We used an automated analyzer (Celltac, Automated Haematology Analyzer, MEK-6400. NIHON KOHDEN). The manufacturer-supplied controls were run every morning to ensure that the analyzer was operating within 2.0 standard deviations. The closed model of blood sampling was used; the analyzer automatically sampled blood, processed, analyzed, and printed out the hemoglobin concentration levels. All collected samples were processed and analyzed in the laboratory by a laboratory technologist. Pregnant teenagers with a hemoglobin concentration of less than 11.0 g/dl were categorized as anemic. Anemia was considered severe when the hemoglobin concentration was less than 7.0 g/dl, moderate when hemoglobin was between 7.0g/dl and 9.9g/dl, and mild from 10.0g/dl to 10.9 g/dL.

Data management and analysis

Data were coded and entered in Excel version 2010 and later exported to IBM SPSS version 23. Both bivariate and multivariate logistic regression analyses were carried out. The variables in the final multivariate model were considered significant when $p < 0.05$. The measure of association was reported as odds ratios with corresponding 95% confidence interval and p -value. All statistical analyses were carried out in SPSS version 23.

Ethical consideration

This study was conducted in accordance with the Declaration of Helsinki. Eligible pregnant teenagers both adults and emancipated minors were recruited in the study after consenting in writing, following sensitization, education and counseling about the study. Informed consent from the participants was obtained after fully explaining the details of the study to them in English and Runyoro-Rutooro, the dominant local language for those who did not understand English. Emancipated minors did not require adult relatives to consent. The process of obtaining blood was done gently and professionally to minimize the risk of pain and infection as far much as possible. Personal protective gear like gloving was used throughout the procedure. Standard operating procedures for COVID-19 which included social distancing, use of face masks and regular cleaning of hands using a sanitizer and/or soap. Priority was not given in terms of tribe, interest group, race, or religion. Appropriate treatment for the laboratory conformed anemic teenagers were recommended by the principle investigator and administered accordingly by the ward staff. Nutrition counseling was also done.

Results

75(26%) out of the 288 pregnant teenagers who attended ANC clinic at HRRH had anemia. Majority had mild anemia 40(53%), followed by moderate anemia 30(40%). A few of them however had severe anemia

5(7%). This is shown in figure 1. Following bivariate analysis, seven variables, that is; not educated (cOR=14.29, CI: 5.003-40.792, $p<0.001$), average monthly income of less than 100,000 Uganda shillings (about 28.4 USD) (cOR=2.30, CI:1.346-3.943, $p=0.002$), nulliparity (cOR=0.44, CI:0.239-0.82; $p=0.010$), gestational age less than 37 weeks (cOR=3.61, CI: 1.231-10.477; $p=0.019$), planned pregnancy (cOR=0.52, CI: 0.302-0.883, $p=0.016$), positive history of miscarriage (cOR=0.23, CI: 0.052-0.984, $p=0.048$), and number of antenatal care attendance less than four times (cOR=6.85, CI:2.647-17.743, $p<0.001$), were significantly associated with anemia among pregnant teenagers. This is shown in table 1.

Multivariate analysis revealed that level education, parity, and number of antenatal care visits were significantly associated with anemia among pregnant teenagers at HRRH. Specifically, not being educated increased the likelihood of anemia by more than 17 fold as compared to those of secondary level and above (aOR=17.39, CI:4.655-64.988; $p<0.001$). Meanwhile, nulliparity was protective in that it reduced the chances of having anemia by 53% (aOR=0.47, CI:0.225-0.989; $p=0.047$). Lastly, antenatal care visits less than four times increased the odds of pregnant teenagers getting anemia by more than 8 fold (aOR=8.80, CI:2.888-27.811; $p<0.001$). This is presented in Table 2.

Prevalence of anemia among pregnant teenagers in the third trimester attending ANC at HRRH

Table 1

Bivariate analysis for the key predictors of anemia among pregnant teenagers in the third trimester attending ANC at HRRH (N = 288)

Variable		Has Anemia		cOR(95%CI)	<i>p</i>
		Yes(n = 75)	No(n = 213)		
Age	< 18	7	13	1.58(0.607–4.133)	0.347
	≥ 18	68	200	1.00	
Level of education	None	20	5	14.29(5.003–40.792)	< 0.001*
	Primary	20	83	0.66(0.465–1.593)	
	Secondary and above	35	125	1.000	
Residence	Rural	47	157	1.31(0.741–2.299)	0.357
	Urban	28	56	1.00	
Total monthly income	≤ 100,000Ugx	43	86	2.30(1.346–3.943)	0.002*
	> 100,000Ugx	32	127	1.00	
Marital status	Single	30	63	1.59(0.918–2.745)	0.098
	Married	45	150	1.00	
Number of family members	< 5	43	142	0.78 (0.455–1.344)	0.374
	≥ 5	32	71	1.00	
Cultural dietary restrictions	Yes	14	55	0.76(0.930–3.320)	0.352
	No	61	158	1.00	
Gravidity	Primigravida	56	152	1.22(0.650–2.154)	0.083
	Multigravida	19	61	1.00	
Parity	0	53	180	0.44(0.239 – 0.082)	0.010*
	≥ 1	22	33	1.00	

Gestational age	< 37	71	173	3.61(1.231–10.477)	0.019*
	≥ 37	4	35	1.00	
Planned pregnancy	Yes	26	124	0.52(0.302–0.883)	0.016*
	No	49	89	1.00	
Birth interval	< 18 months	20	40	0.86(0.116–4.856)	0.762
	≥ 18 months	2	3	1.00	
Excessive menstruation within 3months prior to conception	Yes	63	166	1.48(0.928–4.063)	0.078
	No	12	47	1.00	
History of miscarriage	Yes	2	23	0.23(0.052–0.984)	0.048*
	No	73	190	1.00	
Received education about anemia and/or nutrition during pregnancy	Yes	64	194	0.67(0.300–1.513)	0.339
	No	11	19	1.00	
Number of ANC attendance	< 4	65	148	6.85(2.647–17.743)	< 0.001*
	≥ 4	10	65	1.00	

* $p < 0.05$. cOR = crude odds ratio, CI = confidence interval, Ugx = Uganda shillings

Table 2

Multivariate analysis for the key predictors of anemia among pregnant teenagers in the third trimester attending ANC at HRRH (N = 288)

Variable		<i>p</i>	aOR(95%CI)	<i>p</i>
Level of education	None	< 0.001	17.39(4.655–64.988)	< 0.001
	Primary	0.633	0.72(0.360–1.420)	0.338
	Secondary and above		1.00	
Total monthly income	≤ 100,000Ugx	0.002	0.82(0.416–1.618)	0.568
	> 100,000Ugx		1.00	
Parity	0	0.010	0.47(0.225–0.989)	0.047
	≥ 1		1.00	
Gestational age	< 37	0.019	2.03(0.530–7.735)	0.302
	≥ 37		1.00	
Planned pregnancy	Yes	0.016	0.80(0.419–1.511)	0.485
	No		1.00	
History of miscarriage	Yes	0.048	0.29(0.053–1.558)	0.149
	No		1.00	
Number of ANC attendance	< 4	< 0.001	8.80(2.888–27.811)	< 0.001
	≥ 4		1.00	

aOR = adjusted odds ratio, CI = confidence interval, Ugx = Uganda shillings

Discussion

The prevalence of anemia among pregnant teenagers in the third trimester attending antenatal care clinic at Hoima Regional Referral Hospital was 26%. This finding is comparable to findings of Mahamoud et al., (13) in Kampala, Uganda where the prevalence of anemia among pregnant teenagers was noted to be 25.8%. The participants in the two studies likely had the same characteristics since they were both done in Uganda. In comparison with a cross-sectional study conducted in Ethiopia where the prevalence of anemia was 11.1% among 443 pregnant teenagers (14) and a study done in Northern Tanzania where the prevalence of anemia was 18.0% among pregnant teenagers (15), our study found a higher prevalence of anemia among pregnant teenagers. The reasons for this discrepancy could be due to the differences in the geographic, cultural, and dietary profiles of these different study sites. This prevalence, however, was lower than that found in a study done by Jusoh et al., (7) on pregnant teenagers in northwestern Malaysia where the prevalence was 53.1% and in one done in Kenya by Sowayi and Kagwiria, where it was 61% (16). Regarding severity, this study found that mild anemia was the most common rated at

(53%), followed by moderate anemia rated at 40%, and lastly, severe anemia rated at 7%. This was consistent with the findings of a study done in Kenya by (16), which showed that the majority (48.3%) had mild anemia, 31.2% had moderate anemia and 20.5% had severe anemia. Therefore, regardless of the environmental, population, and methodological differences, the severity of anemia may vary from study to study.

The present study has elucidated three factors, that is; level of education, parity, and the number of antenatal care attendance as the independent predictors of anemia among pregnant teenagers in the third trimester attending antenatal care clinic at Hoima Regional Referral Hospital ($p < 0.05$). This study established that being a pregnant teenager who is not educated increased the likelihood of having anemia by more than 17fold as compared with those have attained secondary school and above. This finding is comparable to findings in a hospital-based cross-sectional study done by Yadav et al., (17) in Nepal which found that education levels lower than secondary increased the chances of being anemic by three as compared to those with secondary level or higher education. We think that uneducated pregnant teenagers are generally more likely to have a lower socio-economic status with inadequate nutrition and poor health-seeking behavior, as compared to their educated counterparts. Well planned and implemented government policies aimed at strengthening girl child education at all levels of schooling might therefore help in not only reducing the number of teenage pregnancies but also to alleviate such associated problems for those who might suffer the pregnancy.

This study also established that being a pregnant teenager who had not delivered before was regarded as protective. Specifically speaking, the current study has established that nulliparity reduces the chances of having anemia by 53% among pregnant teenagers within the catchment of Hoima Regional Referral Hospital, Midwestern U ganda. This result was comparable to the study results of other researchers such as Anwary et al., (18) in Afghanistan and Gedefaw et al., (19) in Ethiopia who both found that multipara women were three times more likely to be anemic as nulliparity women. Compared to their multiparous counterparts, nulliparous teenagers do not suffer the maternal nutritional depletion that results from the cumulative effect of successive pregnancies and lactations (20). If a new pregnancy begins before the complete restoration of iron and folate, the woman is at a much higher risk of maternal anemia from both iron and folate deficiencies with subsequent adverse pregnancy outcomes. This may explain the observation noted in our present study.

Observed also was that pregnant teenagers who had had antenatal care attendance of less than four were more than 8 fold likely to be anemic than the teenagers who had attended more than four times. This finding was consistent with results in studies carried out by Jusoh et al., (7) in Malaysia, Yadav et al., (21) in Nepal, and Anlaakuu and Anto (22) in Ghana, as all these studies showed that pregnant teenagers with less than four antenatal care clinic visits had higher chances of having anemia than those four visits or more. Certain antenatal care packages such as early trimester screening for hemoglobin status and appropriate intervention for those detected with anemia, health education of every pregnant woman about anemia in pregnancy, its complications and prevention, timely initiation on iron and folate supplements, deworming to prevent hookworm infestation, and intermittent presumptive treatment for

malaria are all key components of Uganda's antenatal care package and these are all known to have a serious preventive impact on anemia in pregnancy. In view of this result, strict implementation of already existing government policies which emphasize more antenatal care reviews for the at risk pregnancies including teenage pregnancies at all levels of health service delivery is very crucial.

Study strengths

This is the first documented study reporting the prevalence and the key predictors of anemia among pregnant teenagers attending antenatal care in this particular area of Uganda.

Study limitations

The fact that this study was institutional based impacted on our overall prevalence and therefore we could not include full details of the baseline population and number of pregnant teenagers in this whole study area. Also, given the type of design of this study, we could not establish a causal relationship between the predictor factors and the anemia. Lastly, given the scope of the study, many important variables such as ethnicity and dietary practices could not be studied.

Conclusion

The prevalence of anemia among pregnant teenagers was notably high in this setting. Lack of formal education and poor antenatal care attendance are the key predictors of anemia among pregnant teenagers at Hoima Regional Referral Hospital.

Declarations

Availability of data

The data that were used to obtain the findings are available from the corresponding authors if needed.

Competing interests

The authors declare no conflict of interest in regard to the publication of this work.

Funding

None

Authors' contributions

Sadiq Mohamoud Hassan participated in conception and design of the proposal, collection of the data and analysis. Simon Byonanuwe assisted in study design, analysis and drafting of the manuscript. Yarine Fajardo, Maxwell Okello, Ubarnell Almenares and Rogers Kajabwangu were involved in

reviewing this work for accuracy and content at different levels right from conceptual design to manuscript writing. All the authors had ample time to read and approve the final manuscript.

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Ethical approval and consent of participants

This study was approved by the Research Ethics Committee of Kampala International University, approval number UG-REC- 023.

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Figures

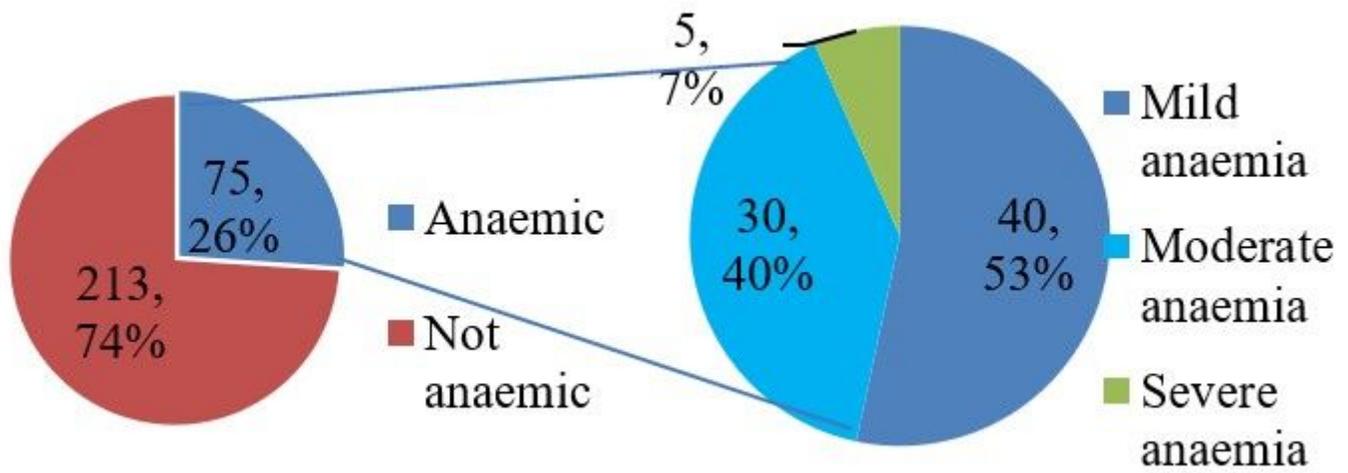


Figure 1

Prevalence of anemia among pregnant teenagers in third trimester attending ANC at HRRH.