Prevalence of anemia and associated factors among adults in a select population in Lagos, Southwest Nigeria

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Abstract

Background. Anemia is a public health problem affecting people in both the developed and developing world and has serious consequences on health.

Objective. This study determines the prevalence of anemia amongst people of different socioeconomic levels, associated factors, and the prevalence of anemia in populations other than children or pregnant women.

Methods. This is a descriptive cross-sectional study using a pretested interviewer-administered questionnaire to collect data from 387 residents. A multi-stage random sampling technique was used. Analysis of blood samples using the HemoCue301 system and data analysis using SPSS 20. Chi-square test and binary logistic regression were used to test association and determine predictors of anemia respectively, with P<0.05 considered statistically significant.

Results. The mean age of respondents was 35±11.8 years, with 28.9% of respondents being anemic. Female respondents (52.7%) were more than male respondents (47.3%). Female respondents (39.2%) had a higher prevalence of anemia than male respondents (17.5%). There was a significant association between sex, level of education, and anemia status. Being female, having no formal education, or only having a primary school level of education were significant predictors of anemia [odds ratio (OR)=2.55; 95% confidence interval (CI)=1.54, 4.23; P=0.00; OR=12.57; 95%CI=2.39, 66.27; P=0.00; and OR=2.54; 95%CI=1.16, 5.58; P=0.02 respectively].

Conclusion. There was a higher prevalence of anemia among women, younger people, and those with no or only primary levels of formal education. Awareness programs targeted at women and people with lower levels of education are necessary to reduce the overall prevalence of anemia in this region.

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Introduction

Anemia is a public health problem that affects people living in both the developed and developing world.[1] It has serious consequences not just on health but also on economic and social development. Though many suffer from anemia and might be asymptomatic,[2] it is an indicator of poor health and poor nutrition. The more notable effects of severe anemia on the morbidity and mortality of pregnant women and children have long been well documented,[3-6] its effects on the mental and physical development of children and on work productivity of adults, which include fatigue, reduced work capacity, reduced ability to execute activities of daily living and reduced cognitive function,[7] especially in developing countries, is of serious concern.[8,9] Anemia may be caused by several conditions, with iron deficiency anemia being the most significant contributor; about 50% of all cases of anemia are caused by iron deficiency but this varies among different population groups and in different geographical areas, with the local conditions prevalent in the area contributing to the causes.[8,10] Other causes of anemia include micronutrient deficiencies like folate, vitamin A, vitamin B, and riboflavin deficiencies, acute and chronic infections such as malaria, infection with helminths, tuberculosis, HIV, and cancer, and acquired or inherited disorders affecting hemoglobin, red blood cell production or red blood cell survival.[11]

About 800 million children and women are anemic.[1] It is estimated that roughly 43% of children, 38% of pregnant women, 29%

of non-pregnant women, and 29% of women of reproductive age have anemia globally, corresponding to 273 million children, 496 million non-pregnant women, and 32 million pregnant women.[1] The highest proportion of people who suffer from anemia was in Western Sub-Saharan Africa, South Asia, and Central Sub-Saharan Africa.[1] Nigeria is one of the countries listed by the WHO to have a severe burden of this disease, with >40% of the population being anemic. The prevalence of anemia in Nigeria is as follows: children under 5 71%; non-pregnant women (15-49 years) 47.3%, and pregnant women 57.5%.[6] Anemia is responsible for significant morbidity and mortality in Africa and while it is not high on the list of the main global health concerns,[12] in less developed countries, it can contribute unnecessarily and greatly to the depletion of already strained resources and increase the overall burden of disease.[13]

Although numerous studies have been carried out on the prevalence and effect of anemia on the morbidity and mortality of pregnant women, non-pregnant women, and children, relevant data to determine the prevalence of anemia in other populations such as adolescents, men and the elderly are limited.[14] Research has shown that anemia is concentrated in low socioeconomic groups and that there is a strong correlation between the overall economic status of a country and the prevalence of anemia.[6] This study seeks to determine the prevalence of anemia amongst people of different socioeconomic levels in the Eti-Osa Local Government Area, a highly diverse region of Lagos State, as well as associated factors. The study will also determine the prevalence of anemia in populations other than children or pregnant women for which available data for the Nigerian population is limited. It is hoped that more relevant data on anemia that covers as many populations as possible will help in the development of health policies or interventions to combat the condition in diverse groups.

Materials and Methods

Ethical considerations

Approval to carry out this study was first obtained from the Health Research Ethics Committee (HREC) of the Lagos University Teaching Hospital with HREC number ADM/DCST/HREC/APP/082. An informed consent form was signed by every participant before the beginning of the study. Participants agreed to take part in this study of their own free will and were not coerced to ensure their cooperation. The information provided by the participants was kept strictly confidential throughout this study.

Study background

The study was carried out in Eti-Osa Local Government Area (LGA) in the southern area of Lagos State, which is one of the 20 local government areas in the state and had a projected population of about 1.4 million in 2016.[14]

Study design

This is a descriptive cross-sectional study that aims to estimate the prevalence of anemia among 387 adults of different socioeconomic groups resident in Eti-Osa LGA, selected by multistage sampling technique.

Study sample

The study was conducted among adults over 18 years of age who agreed to participate in the study and were residents of Eti-Osa LGA for at least three months. Residents who had a history of surgery or blood transfusion in the past two months, bleeding disorders (leukemia, hemophilia, von Willebrand disease, thrombocytopenic purpura, *etc*), active hemorrhage, or who were pregnant women were excluded from the study.

Determination of the sample size

The sample size was calculated using the Cochran formula, using a prevalence value of 51.8% for anemia in adult Nigerians,[2] with a significance level of 95% and an α level=0.05. This gave a minimum sample size of 384. An attrition value of 10% was allowed for contingencies such as non-response or recording errors.

Data and specimen collection

An interviewer-administered, pre-tested questionnaire was used to collect data in line with the objectives of this study. Hemoglobin concentration was analyzed using the hemocue system, which is based on the conversion of hemoglobin to cyanmethemoglobin, and the detection of this by measuring the absorption in a spectrophotometer. The hemocue 301 haemoglobinometer was used, which involves a single-step blood collection device (a microcuvette) covered with dry hemoglobin conversion reagents. The hemocue system has been accepted as the standard method for the measurement of hemoglobin by the International Committee for Standardization in Haematology.[15] The protocol for the use of the hemocue was adapted from the measure DHS+ project guide, *anemia testing in population-based surveys*.[16] Training of inter-

Table 1. Study sample characteristics (N=387).

Variable	Mean±SD [range]	Frequency (%)
Age	34.8±11.8 [18-75]	–
18-39	–	287 (69.0)
40-59	–	105 (27.1)
60-79	–	15 (3.9)
Sex		
Female	–	204 (52.7)
Male	–	183 (47.3)
Education Level		
None	–	11 (2.8)
Primary	–	43 (11.1)
Secondary	–	190 (49.1)
Post-secondary	–	143 (36.9)
Employment status		
Employed	–	339 (87.6)
Unemployed	–	48 (12.4)
Wealth quintiles		
Lowest	–	130 (33.6)
Low	–	161 (41.6)
Medium	–	52 (13.4)
High	–	44 (11.4)
Ethnicity		
Igbo	–	96 (24.8)
Hausa	–	23 (5.9)
Yoruba	–	120 (31.0)
Other	–	148 (38.2)
Body mass index		
<18.5	–	10 (2.6)
18.5-24.9	–	190 (49.1)
25-29.9	–	107 (27.6)
30-34.9	–	63 (16.3)
35-39.9	–	12 (3.1)
≥40	–	5 (1.3)
History of illness in the last 2 months		
Yes	–	83 (21.4)
No	–	304 (78.5)

SD, standard deviation.

viewers on the correct use of the hemocue machine, use of lancets to collect blood samples, and correct disposal of all used materials was conducted by a consultant pathologist of the Lagos University Teaching Hospital. Anemia was defined as a hemoglobin concentration of less than 13g/dL for males and a hemoglobin concentration of less than 12g/dL for females.

Weight measurement was taken using a digital weighing scale and with participants wearing as light clothing as possible. A stiff measuring tape was used to measure height with respondents taking off their shoes and keeping their heads, shoulders, and heels aligned. The weight and height measurements were used to calculate the body mass index (BMI) using the following formula: BMI=weight (kg)/height^2 (m^2).

Data on the possession of household assets were collected and used to create a wealth index using principal component analysis. The household assets asked for were possession of radio, television, mobile telephone, refrigerator, washing machine, cable television, generating set, air conditioner, computer or laptop, electric iron, fan, bicycle, and motorcycle/scooter. All individuals were then divided into quintiles based on their computed asset index score according to the demographic and health survey standard.[17]

Pretesting of the instrument

A pre-test was carried out in one of the wards in Eti-Osa LGA not selected for the study. Unclear questions were modified and the process of questionnaire administration and sample collection was streamlined for a more efficient process.

Data analysis

The data collected using interviewer-administrated questionnaires were analyzed using SPSS version 20. The study results are presented as descriptive summaries using frequency charts and tables. Chi-square tests and Fisher's exact were used to test for associations between categorical variables of interest and anemia status. Subsequently, a binary logistic regression model was used to determine predictors of anemia status in the population. Significance was determined at a P<0.05.

Results

The background characteristics of the respondents are shown in Table 1. Over half (52.7%) of the respondents were female while 47.3% were male. The mean age was 34.8±11.8 years.

Almost half of the participants had completed senior secondary school (46.5%), while only 11 (2.8%) participants had no formal education. Most respondents (89.7%) were employed. Wealth quintiles were calculated using household assets, with the greatest number of participants (41.6%) falling into the low quintile.

Most respondents consumed all the food types enquired about in the survey with frequencies ranging from *daily* to *1-2 times a week*. Fish was the food most consumed either *daily* or *4-6 times a week*. Most participants (79.8%) did not take any iron-containing supplement, while of those who did take iron supplements, the majority took them either 1-2 times a week (26.9%) or very irregularly (42.3%). 21.4% of participants had been ill in the past two months. Almost half of the participants had a BMI that fell within the normal range (49.1%). Very few were underweight (2.6%), while almost half (48.3%) were either overweight or obese (Table 2). 28.9% of all respondents were found to be anemic. Of female respondents, more than a quarter was anemic (39.2%) compared to the proportion of male respondents who were anemic (17.5%). Most men who were anemic had mild anemia (71.9%), while more than half of the female respondents who had anemia had moderate anemia (55.0%). More men than women were seen to have severe anemia (12.5% of anemic men against 2.5% of anemic women).

Table 3 shows the chi-square tests of independent categorical variables with anemia status. There was a statistically significant association between sex and anemia (P=0.00), with more women than men having either mild or moderate anemia. There was also a significant association between age and anemia status (P=0.02), with most participants who were anemic falling in the 18-39 age range. There was a statistically significant association between the respondents' level of education and anemia status. Most respondents who were not anemic had completed their senior secondary education or had post-secondary education (89.09%). Logistic regression analyses (Table 4) accounting for 8 study characteristics as predictors of the presence of anemia revealed significant associations between the presence of anemia and respondents' sex and level of education, with females having significantly higher odds of anemia than males [odds ratio (OR)= 2.55; 95% confidence interval (CI)=1.54, 4.23; P=0.00] and respondents' with no formal education and primary level of education having significantly higher odds of anemia compared to respondents with a secondary

Table 2. Dietary habits and use of iron-containing supplements.

Variable	Frequency (%)
Frequency of consumption of red meat (n=387)	
Daily	72 (18.6)
4-6 times/week	50 (12.9)
2-3 times/week	144 (37.2)
1-2 times/week	105 (27.1)
Never	16 (4.1)
Frequency of consumption of chicken (n=387)	
Daily	20 (5.2)
4-6 times/week	21 (5.4)
2-3 times/week	57 (14.7)
1-2 times/week	235 (60.7)
Never	54 (14.0)
Frequency of consumption of fish (n=387)	
Daily	88 (22.7)
4-6 times/week	93 (24.0)
2-3 times/week	113 (29.2)
1-2 times/week	86 (22.2)
Never	7 (1.8)
Frequency of consumption of legumes (n=387)	
Daily	29 (7.5)
4-6 times/week	34 (8.8)
2-3 times/week	70 (18.1)
1-2 times/week	230 (59.4)
Never	24 (6.2)
Frequency of consumption of green leafy vegetables (n=387)	
Daily	76 (19.6)
4-6 times/week	27 (7.0)
2-3 times/week	66 (17.0)
1-2 times/week	213 (55.0)
Never	5 (1.3)
Frequency of consumption of fruits (n=387)	
Daily	66 (17.0)
4-6 times/week	25 (6.5)
2-3 times/week	94 (24.3)
1-2 times/week	194 (50.1)
Never	8 (2.1)
Do you take any supplements that contain iron?	
Yes	79 (20.4)
No	308 (79.6)
If yes, how often do you take them?	
Daily	19 (24.3)
3-5 times/week	5 (6.4)
1-2 times/week	21 (26.9)
Very irregularly	33 (42.3)

Table 3. Chi-squared independence tests of categorical variables of study sample characteristics with anaemia status.

Variable	Chi-squared statistic	Degrees of freedom	P value
Age (grouped)	8.37	-	0.02*1
Sex	16.25	1	0.00*
Education	23.11	-	0.00*1
Employment	0.00	1	0.94
Wealth quintiles	7.31	3	0.06
Ethnicity	0.26	3	0.97
BMI	2.08	-	0.861
History of recent illness	0.87	1	0.35
Red meat consumption	8.08	-	0.091
Chicken consumption	9.63	4	0.05
Fish consumption	3.19	-	0.531
Legumes consumption	6.01	4	0.20
Green leafy vegetables	6.36	-	0.161
Fruits consumption	1.48	-	0.851
Iron supplements	0.92	-	0.941

BMI, body mass index; *statistically significant; 1Fisher's Exact.

Table 4. Study sample characteristics as joint predictors of anemia.

Variables	B	OR (95% CI)	P value
Constant	-2.13	0.12	0.10
Age -0.00	0.99 (0.97, 1.02)	0.79	
Sex			
Male	ref	ref	-
Female	0.94	2.55 (1.54, 4.23)	0.00*
Education			
Secondary	ref	ref	-
None	2.53	12.57 (2.39, 66.27)	0.00*
Primary	0.93	2.54 (1.16, 5.58)	0.02*
Post-secondary	-1.03	0.90 (0.50, 1.63)	0.73
Employment			
Unemployed	ref	ref	-
Employed	-0.04	0.97 (0.47, 1.97)	0.92
Ethnicity			
Yoruba	ref	ref	-
Hausa	-0.29	0.75 (0.25, 2.22)	0.60
Igbo	0.36	1.43 (0.75, 2.72)	0.28
Other	0.02	1.02 (0.56, 1.85)	0.95
Body mass index			
≥40	ref	ref	-
<18.5	-0.73	0.48 (0.04, 5.79)	0.57
18.5-24.9	0.23	1.26 (0.19, 8.49)	0.81
25-29.9	-0.11	0.89 (0.13, 6.07)	0.91
30-35.9	-0.06	0.94 (0.13, 6.59)	0.95
36-39.9	0.09	1.09 (0.12, 10.25)	0.94
Wealth quintiles			
High	ref	ref	-
Lowest	0.96	2.61 (0.86, 7.90)	0.09
Low	0.99	2.68 (0.93, 7.71)	0.07
Medium	0.80	2.22 (0.72, 6.85)	0.17
History of recent illness			
Yes	ref	ref	-
No	-0.30	0.74 (0.42, 1.31)	0.31

*Significant; OR, odds ration; CI, confidence interval; ref, reference category.

level of education (OR= 12.57; 95% CI: 2.39, 66.27; P=0.00 and OR= 2.54; 95% CI=1.16, 5.58; P=0.02 respectively).

Discussion and Conclusions

This study found the prevalence of anemia to be 17.5% in males and 39.2% in females. This mirrors the global point prevalence of anemia which is reported to be higher in females than in males.[18] However, the prevalence of anemia among this population was higher than that among apparently healthy university students in Ebonyi state which was 9.9% in males and 15.8% in females.[19] Age was also found to be significantly associated with anemia in this study, with the highest proportion of anemic respondents falling within the 18-39 age range. The higher prevalence of anemia in this age group might account for the higher prevalence of anemia found in the study done in Edo State which was carried out among participants between 21 and 35 years old, which reported a prevalence of 19.5% in males and 81.8% in females.[2] A study carried out by Sholeye *et al*. in 2017 also found that the majority of respondents with anemia were 25 years old.[20]

No formal education or primary school level was found to be a predictor of the presence of anemia as most of those who were not anemic had at least senior secondary school education. Two independent studies carried out in Aungarabad, India, and Dhaka, Bangladesh found a statistically significant association between the level of education and the presence of anemia in the participants of the studies, as the lower the level of education, the greater the probability of suffering from anemia.[21,22]

Consumption of iron-rich foods or taking iron supplements was not found to have any association with anemia in this study. A study carried out by Shill *et al.* also found that consumption of fish, meat, poultry, and iron-rich food was not significantly associated with anemia.[23] Though almost 80% of respondents did not take any iron supplements, their consumption of iron-rich foods, especially fish, appeared to be adequate. Iron deficiency anemia, as previously stated, is responsible for almost half of the world's anemia burden.[8] The best sources of iron are meat, poultry, and fish, with secondary sources of iron from plant sources. The consumption of these foods has an important effect on the total iron status of the body.[24] Oral iron supplementation is the current first-line therapy for iron deficiency anemia.[25] The greatest number of respondents who were anemic (74%) fell within the normal and overweight range of BMI, though this association was not found to be significant and may have been because almost half of the respondents (49.1%) fell within this range. It also points to the fact that anemia in these respondents may be mainly due to iron deficiency and not to undernutrition, which is also an important cause of anemia in the populace. Some studies have shown a higher prevalence of anemia among underweight people,[7,24] while others found anemia in all BMI categories.[26] This study had similar results to Ugwuja *et al*. in showing that there is no statistically significant association between anemia and BMI.

Women remain the sex with the higher prevalence of anemia. Campaigns specifically directed at women to educate them on the risks of anemia and how to prevent it should be put in place. Shill *et al.* also showed that proper awareness of nutrition, and improved dietary lifestyle, including anemia prevention, should be implemented at all levels of education to prevent anaemia.[26]

Limitations

Despite its strengths in the relatively large sample size recruited and the significant research gap it sought to fill, this study was limited by its design. Being a cross-sectional study, conclusions may not be generalizable. Also, a significant part of the data relied on respondents' honesty and recall while participating in the survey.

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