

Prevalence and Factors Associated with Anaemia among Pregnant Women Attending Antenatal Clinic in the Second and Third Trimesters at Pumwani Maternity Hospital, Kenya

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Abstract

Background: Anaemia is one of the most common nutritional deficiency diseases observed globally and affects more than a quarter of the world's population. Globally, 41.8% pregnant women and close to one third of non-pregnant women (30.2%) are anaemic. Anaemia during pregnancy contributes to 20% of all maternal deaths and it increases the risks of foetal, neonatal and overall infant mortality. In Kenya, according to the Ministry of Health, the prevalence of anaemia among pregnant women is 55.1%. **Objective:** To determine the prevalence and associated factors of anaemia among pregnant women attending antenatal clinic (ANC) at Pumwani Maternity Hospital (PMH). **Methodology:** A hospital based cross-sectional study design was conducted from 8th June to 18th August, 2015. Systematic random sampling method was used to select 258 pregnant women. Mothers who attended ANC during the study period and who met the inclusion criteria were interviewed and a capillary blood sample was taken. Hemoglobin level was determined by using HemoCue photometer. Data were cleaned, coded and fed into SPSS Version 20.0 for analysis. Descriptive statistics such as frequency, percentage, mean and standard deviation were used to describe selected variables. Pearson's chi-square test and odds ratio (OR) with corresponding 95% confidence intervals (CI) computed to find association between independent and dependent variables. Multivariate analysis was done to determine factors significantly and independently predicting

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anaemia during pregnancy. Results: The present study revealed that the prevalence of anaemia among the pregnant women was 57%. Advanced maternal age (≥ 31 years) (AOR = 2.71; 95% CI = 1.25 - 5.88; P = 0.012) more than 18 - 24 years, government/private employed women (AOR = 2.94; 95% CI = 1.47 - 5.88; P = 0.002) and self-employed women (AOR = 1.91; 95% CI = 1.03 - 3.53; P = 0.039) compared to housewives, not taking iron/folic acid supplementation (IFAS) (AOR = 2.04; 95% CI = 1.14 - 3.64; P = 0.016) and mid-upper arm circumference (MUAC) less than 23 cm (AOR = 2.52; 95% CI = 1.36 - 4.67; P = 0.003) were found to be predictors of anaemia. **Conclusion:** Anaemia among pregnant women is found to be severe public health problem based on the World Health Organization classification of anaemia. Advanced age, employment, not taking IFAS during the current pregnancy and MUAC of less than 23 cm were significantly and independently associated with anaemia during pregnancy. Thus, special attention should be given to pregnant women who are employed and advanced in age. Moreover, they should be educated on the importance of taking iron and folic acid during pregnancy.

Keywords

Anaemia, Associated Factors, Pregnant Women, Prevalence

1. Introduction

Anaemia, defined as a decreased concentration of blood hemoglobin, is one of the most common nutritional deficiency diseases observed globally and affects more than a quarter of the world's population [1]. It is estimated that 41.8% of pregnant women worldwide are anaemic. In Africa, 57.1% of pregnant women are anaemic [2]. In Kenya, the prevalence of anaemia among pregnant women is 55.1% [3]. When the prevalence of anaemia among pregnant women is 40.0% or more, it is considered as a severe public health problem [4]. Anaemia during pregnancy is considered severe when Hb concentration is less than 7.0 g/dl, moderate when Hb level is 7.0 - 9.9 g/dl, and mild when Hb level is 10.0 - 10.9 g/dl [5]-[7]. Anaemia is a major cause of morbidity and mortality of pregnant women and increases the risks of foetal, neonatal and infant mortality [8]. Anaemia during pregnancy contributes to 20% of all maternal deaths [9].

In developing countries, the cause of anaemia during pregnancy is multifactorial and includes nutritional deficiencies of iron, folate, and vitamin B₁₂ and also parasitic diseases, such as malaria and hookworm. Iron deficiency is the cause of 75% of anaemia cases during pregnancy [5] [10]. HIV infection is also implicated with high prevalence of anaemia in sub-Saharan Africa [11] [12]. Iron deficiency anaemia affects the development of the nation by decreasing the cognitive and motor development of children and productivity of adults [5] [13]. Despite its known effect on the population, the available data regarding the determinants of anaemia during pregnancy in Kenya and particularly in Nairobi are limited. Hence, this study was aimed at determining the prevalence and factors associated with anaemia among pregnant women attending ANC at PMH, Nairobi, Kenya.

2. Methods

2.1. Study Setting

The study was conducted at Pumwani Maternity Hospital which is a referral maternity hospital located on the East of Nairobi City (country's capital city). The hospital is a pioneer in the provision of maternity care in sub-Saharan Africa. It has 354 obstetric beds, 144 baby cots and 2 theatres. Daily normal deliveries are 50 - 100, and Caesarean Sections are 10 - 15. To date the Hospital remains the largest maternity hospital in the country and sub-Saharan Africa. It is equivalent to a Provincial Hospital in status and is reported to be third busiest maternity hospital in African.

2.2. Study Design and Participants

A hospital based cross-sectional study was conducted from 8th June to 18th August, 2015. The study population included in this study was all 2nd and 3rd trimester pregnant women attending ANC at Pumwani Maternity Hospital.

2.3. Sample Size Determination

The sample size was determined by using single population proportion formula (Fischer *et al.*, 1998; $n = Z^2pq/d^2$) by considering 95% CI, 55.1% proportion of anaemia during pregnancy from the study carried out by the Ministry of Health, Kenya in 2013 and absolute precision of 0.05 which gives a sample size of 380. However, since the population during the study period was below 10,000, sample size adjustment was done using the following

formula, $nf = \frac{n}{1 + n/N}$ resulted in 258 subjects.

where:

nf = The desired sample size (when the study population is less than 10,000);

N = Total population (around 800 antenatal mothers, in the 2nd and 3rd trimesters in 10 weeks period);

n = The desired sample size (when the study population is more than 10,000) which is 380.

2.4. Sampling Method

A review of ANC attendance register showed that about 16 pregnant women in the second and third trimester attend ANC at Pumwani Maternity Hospital daily. Accordingly the study was designed to be performed for 10 weeks during which period an estimated 800 women in second and third trimester were expected to visit for antenatal care. Systematic random sampling method was used to select study participants. The estimated number of 800 pregnant women (2nd and 3rd trimester) in 10 weeks period was divided by the minimum adjusted sample size (258) to give the sampling interval of 3. The first pregnant woman included in the sample was chosen randomly by blindly picking one of three pieces of paper named for the first three visitors. After that, every third pregnant woman who came for antenatal care was recruited in the study until the desired sample size was attained. To avoid double participant recruitment, the research assistants confirmed whether the participants had previously visited the ANC at the hospital and participated in the study during the data collection period.

2.5. Data Collection

A pre-tested semi-structured questionnaire was used to collect data by trained research assistants. Data regarding participants' demographic and socio-economic characteristics, obstetric and medical history, ANC visits and iron and folic supplementation, dietary habits and anthropometric measurements were obtained. Haemoglobin concentration was measured using portable HEMOCUE B-Hb photometer. One drop of capillary blood via finger prick was used to estimate haemoglobin level.

2.6. Data Analyses

Data were analysed using SPSS Version 20. Descriptive statistics such as frequency, percentage, mean and standard deviation were used to describe selected variables. Pearson's chi-square test and odds ratio (OR) with corresponding 95% confidence intervals (CI) computed to find association between independent and dependent variable (anaemia). A P-value of ≤ 0.05 was considered statistically significant. Variables having a P-value ≤ 0.05 in the bivariate analysis were subjected into a multivariate analysis to determine factors independently predicting anaemia during pregnancy.

2.7. Ethical Consideration

Ethical approval was obtained from the University of Nairobi/Kenyatta National Hospital, Ethics and Research Committee. Permission to conduct the study was also obtained from the hospital administration. Written informed consent was obtained from each study participant. Confidentiality was maintained at all levels of the study. Pregnant women who found to be anaemic were advised by the research assistants to seek proper treatment and follow-up.

3. Results

3.1. Socio-Demographic and Economic Characteristics of Respondents

Table 1 shows the socio-demographic and economic characteristics of the pregnant women. The mean age of

Table 1. Socio-demographic and economic characteristics of respondents.

Variables	n = 258	%
Age in years		
18 - 24	104	40.3
25 - 30	102	39.5
31 and above years	52	20.2
Residence		
Nairobi	258	100.0
Marital status		
Married	219	84.9
Single	38	14.7
Divorced	1	0.4
Occupation		
Self-employed (business)	105	40.7
Government/private employed	69	26.7
Housewife	84	32.6
Religion		
Christian	233	90.3
Muslim	25	9.7
Level of education		
None	5	1.9
Primary	54	21.0
Secondary	121	46.9
Tertiary	78	30.3
Family monthly income		
<10,000 Ksh	68	26.4
10,000 to 30,000 Ksh	127	49.2
>31,000 Ksh	63	24.4

the women was 26.4 years ($SD \pm 4.7$). Out of the 258 participants, 104 (40.3%) and 102 (39.5%) were in the age group of 18 - 24 years and 25 - 30 years respectively. The remaining 52 (20.2%) were 31 years and above. All of the participants were from Nairobi County. Majority of the women were married (84.9%), employed (67.4%) and Christian followers (90.3%). Regarding educational level of the participants 54 (21%), 121 (46.9%) and 78 (30.3%) attended primary, secondary and tertiary level of education respectively. The highest percentage 127 (49.2%) of the participants had monthly income between 10,000 - 30,000 Ksh. About a quarter 68 (26.4%) of them had monthly income of less than 10,000 Ksh.

3.2. Obstetric History of the Pregnant Women

The obstetric history of the participants is presented in **Table 2**. The mean gestational age was 28.2 weeks ($SD \pm 8.1$). The majority 165 (64.0%) of the participants were in the third trimester of pregnancy and 93 (36.0%) were in the second trimester of pregnancy. One hundred and fifty one (58.5%) of the women were multigravida while 107 (41.5%) were primigravida. Of the multigravida women 121 (80.1%) had an inter-pregnancy interval of two years or more. The remaining 30 (19.9%) had birth interval of less than two years.

3.3. Ante Natal Clinic (ANC) Attendance and Taking IFAS

Table 3 shows ANC visits and IFAS supplementation during the current pregnancy. Majority (92.2%) of the participants started attending ANC after 12 weeks of gestation. Most 217 (84.1%) of the women attended ANC

Table 2. Obstetric history of the participants.

Variables	n = 258	%
Number of pregnancy (gravida)		
First pregnancy	107	41.5
Second pregnancy	72	27.9
Third pregnancy	53	20.5
Fourth and above pregnancy	26	10.1
Gestational age (trimester)		
Second trimester	93	36.0
Third trimester	165	64.0
Number of children		
One child	70	56.0
Two children	40	32.0
Three and above	15	12.0
Inter-pregnancy interval (n = 151)		
<2 years	30	19.9
≥2 years	121	80.1

Table 3. Ante natal clinic attendance and taking IFAS.

Variables	n = 258	%
Gestational age at first ANC visit		
<12 weeks	20	7.8
12 - 18 weeks	116	45.0
19 - 24 weeks	101	39.1
25 - 32 weeks	21	8.1
Frequency of ANC visits		
Once	76	29.5
Twice	50	19.4
Thrice	57	22.1
4 times and above	75	29.1
Iron/folic acid supplementation		
Yes	175	67.8
No	83	32.2
Gestational age when the women started taking IFAs (n = 175)		
<12 weeks	13	7.4
12 - 18 weeks	67	38.3
19 - 24 weeks	89	50.9
25 - 32 weeks	6	3.4

for the first time between 12 and 24 weeks of their gestational age. Almost half 89 (50.9%) of the women started taking IFAS at 19 - 24 weeks of gestation. Sixty seven (38.3%) of them started taking IFAS at 12 - 18 weeks of their gestation. Only 13 (7.4%) of the women had started taking IFAS before 12 weeks of their gestation.

3.4. Health Conditions of the Women during the Current Pregnancy

Majority 213 (82.6%) of them reported they did not experience any health problem. Very small number 8 (3.1%)

and 23 (8.9%) of the women reported they had diarrhoea and febrile illnesses for the last one month preceding the study respectively. Majority of the women were sero-negative while 20 (7.8%) were sero-positive (**Table 4**).

3.5. Anthropometric Measurements

An assessment of weight, height and MUAC was done for all the pregnant women. Majority 169 (65.5%) of the women had above 24.9 body mass index (BMI) and 88 (34.1%) of them had normal BMI (18.5 - 24.9). The mean MUAC for the women was 25.1 cm (SD \pm 3.5). About three quarter 187 (72.5%) of the women had MUAC of 23 cm or above and about a quarter 71 (27.5%) of the women had MUAC of less than 23 cm (**Table 5**).

Table 4. Health conditions of the women during the current pregnancy.

Variables	n = 258	%
Any health problems during the current pregnancy		
Yes	55	21.3
No	213	78.7
Occurrence of diarrhoea for the last one month preceding the study		
Yes	8	3.1
No	250	96.9
Occurrence of febrile illnesses for the last one month preceding the study		
Yes	23	8.9
No	235	91.1
Treating for worms in the last 6 month preceding the study		
Yes	66	25.6
No	192	74.4
Treating for malaria in the last 6 month preceding the study		
Yes	24	9.3
No	234	90.7
HIV status of the women		
Sero-positive	20	7.8
Sero-negative	238	92.2

Table 5. Anthropometric measurements.

Variables	n = 258	%
Weight		
45 - 60 Kg	76	29.5
61 - 75 Kg	103	39.9
76 - 90 Kg	63	24.4
>90 Kg	16	6.2
Height		
140 - 150 cm	30	11.6
151 - 160 cm	105	40.7
161 - 175 cm	123	47.7
Body Mass Index (BMI)		
<18.5	1	0.4
18.5 - 24.9	88	34.1
>24.9	169	65.5
MUAC		
<23 cm	71	27.5
\geq 23 cm	187	72.5

3.6. Life Style Habits

The majority 241 (93.4%) of the women said they drink beverages (tea, cocoa or coffee) and 66.0% of them drink these beverages in less than 20 minutes before/after meals. More than half 143 (55.4%) of the women ate meals three times per day. One third 86 (33.3%) of the women avoided certain foods such as red meat 28 (32.6%) and green vegetables 26 (30.2%) due to vomiting 37 (43.0%) and heart burn 19.8%. A few mothers 51 (19.8%) craved for non-food substances and the common type of craving was stone 44 (86.3%). All of the women reported they never smoke cigarettes and almost all (98.4%) of the women said never taken alcohol (**Table 6**).

3.7. Prevalence of Anaemia

The cut-off point of Hb concentration for diagnosis of anaemia during pregnancy was taken at 11 g/dl (McLean *et al.*, 2008). The overall prevalence of anaemia (Hb < 11 g/dl) was 57.0% with 95% CI of 51.0% to 63.0%. The mean Hb concentration was 10.32 gram/deciliter (g/dl) with a SD of ± 1.72 g/dl. In terms of severity, mild anaemia was 26.5%, moderate anaemia was 70.7% and severe anaemia was 2.7%.

3.8. Factors Associated with Anaemia Using Unadjusted and Adjusted Logistic Regression

In the bivariate analysis, participants' age, marital status, employment status, iron and folic acid supplementa-

Table 6. Life style habits of participants.

Life style habits	n = 258	%
Whether the women had taken beverages (tea, cocoa, or coffee)		
Yes	241	93.4
No	17	6.6
Time when the women had taken these beverages		
<20 min before/after meals	159	66.0
≥ 20 min before/after meals	82	34.0
Not applicable	17	
Number of meals per day		
Twice	63	24.4
Thrice	143	55.4
Four or more times	52	20.2
Foods avoided during the current pregnancy		
Yes	86	33.3
No	172	66.7
Reasons for avoiding the foods (n = 86)		
Heart burn	17	19.8
Vomiting	37	43.0
Loss of appetite	8	9.3
Don't know	11	12.8
Others	13	15.1
Craving for non-food substances		
Yes	51	19.8
No	207	80.2
Type of craving		
Stones	44	86.3
Charcoal	1	2.0
Soil	4	7.8
Tooth paste	2	3.9

tion during the current pregnancy, febrile illness, HIV status and nutritional status (MUAC) were significantly associated with anaemia among the pregnant women. However, following multivariate analysis maternal age, employment status, nutritional status (MUAC) and iron and folic acid supplementation during the current pregnancy remained significantly and independently associated with anaemia.

Pregnant women aged 31 years and above were about 3 fold more likely to be anaemic [AOR = 2.71; 95% CI = 1.25 - 5.88; P = 0.012] compared to those aged 18 - 24 years. Government/private employed pregnant women had 2.9 times [AOR = 2.94; 95% CI = 1.47 - 5.88; P = 0.002] and those who were self-employed had 1.9 times [AOR = 1.91; 95% CI = 1.03 - 3.53; P = 0.039] more likely to be anaemic compared to those who were housewives. Pregnant women who did not take iron supplementation during the current pregnancy were 2 times more likely to develop anaemia [AOR = 2.04; 95% CI = 1.14 - 3.64; P = 0.016] than those who took the supplements. Pregnant women with MUAC of less than 23 cm were about 2.5 fold more likely to be anaemic [AOR = 2.52; 95% CI = 1.36 - 4.67; P = 0.003] compared to those who had MUAC of 23 cm and above (Table 7).

Table 7. Factors associated with anaemia using unadjusted and adjusted logistic regression.

Variables	Anaemic, n (%)	Non-anaemic, n (%)	COR (95% CI)	AOR (95% CI)
Age in years				
18 - 24	56 (53.8%)	48 (46.2%)	Reference	Reference
25 - 30	53 (52.0%)	49 (48.0%)	0.93 (0.54 - 1.60)	1.00 (0.56 - 1.78)
31 years and above	38 (73.1%)	14 (26.9%)	2.33 (1.13 - 4.80)	2.71 (1.25 - 5.88)*
Religion				
Christian	134 (57.5%)	99 (42.5%)	1.25 (0.55 - 2.86)	
Muslim	13 (52.0%)	12 (48.0%)	Reference	
Marital status				
Single	28 (73.7%)	10 (26.3%)	2.40 (1.11 - 5.17)	2.00 (0.86 - 4.65)
Married	118 (53.9%)	101 (46.1%)	Reference	Reference
Level of education				
Primary	32 (59.3%)	22 (40.7%)	1.18 (0.59 - 2.39)	
Secondary	69 (57.0%)	52 (43.0%)	1.08 (0.61 - 1.92)	
University/college	43 (55.1%)	35 (44.9%)	Reference	
Occupation				
Self-employed (business)	65 (61.9%)	40 (38.1%)	2.17 (1.21 - 3.89)	1.91 (1.03 - 3.53)*
Government employed	46 (66.7%)	23 (33.3%)	2.67 (1.38 - 5.17)	2.94 (1.47 - 5.88)**
House wife	36 (42.9%)	48 (57.1%)	Reference	Reference
Family monthly income in Ksh				
<10,000	40 (58.8%)	28 (41.2%)	0.88 (0.44 - 1.77)	
10,000 - 30,000	68 (53.5%)	59 (46.5%)	0.71 (0.38 - 1.31)	
>30,000	39 (61.9%)	24 (38.1%)	Reference	
Number of pregnancy (gravida)				
1st (primigravidae)	62 (57.9%)	45 (42.1%)	1.01 (0.42 - 2.41)	
2	37 (51.4%)	35 (48.6%)	0.78 (0.31 - 1.91)	
3	33 (62.3%)	20 (37.7%)	1.21 (0.47 - 3.15)	
4 and above	15 (57.7%)	11 (42.3%)	Reference	
Gestational age (trimester)				
Second trimester	56 (60.2%)	37 (39.8%)	1.23 (0.73 - 2.06)	
Third trimester	91 (55.2%)	74 (44.8%)	Reference	
Child spacing				
First pregnancy	68 (63.6%)	39 (36.4%)	1.50 (0.88 - 2.55)	
<2 years	14 (46.7%)	16 (53.3%)	0.75 (0.34 - 1.68)	
≥2 years	65 (53.7%)	56 (46.3%)	Reference	

Continued

Gestational age at first ANC visit				
<12 weeks	12 (60.0%)	8 (40.0%)	0.66 (0.25 - 1.75)	
12 - 18 weeks	58 (50.0%)	58 (50.0%)	1.02 (0.38 - 2.71)	
19 - 24 weeks	61 (60.4%)	40 (39.6%)	2.13 (0.56 - 8.19)	
25 - 32 weeks	16 (76.2%)	5 (23.8%)	Reference	
Taking IFAS during the current pregnancy				
Yes	91 (52.0%)	84 (48.0%)	Reference	Reference
No	56 (67.5%)	27 (32.5%)	1.92 (1.11 - 3.31)	2.04 (1.14 - 3.64)*
Frequency of ANC visits in the current pregnancy				
Once	49 (64.5%)	27 (35.5%)	1.35 (0.70 - 2.60)	
Twice	29 (58.0%)	21 (42.0%)	1.02 (0.50 - 2.12)	
Thrice	26 (45.6%)	31 (54.4%)	0.62 (0.31 - 1.25)	
4 times and above	43 (57.3%)	32 (42.7%)	Reference	
Taking tea, cocoa, or coffee (beverages)				
Yes	136 (56.4%)	105 (43.6%)	0.71 (0.23 - 1.96)	
No	11 (64.7%)	6 (35.3%)	Reference	
Number of meals consumed per day				
Twice	41 (65.1%)	22 (34.9%)	2.33 (0.61 - 10.30)	
Thrice	78 (54.5%)	65 (45.5%)	1.50 (0.32 - 5.77)	
4 times	24 (55.8%)	19 (44.2%)	1.358 (0.37 - 6.70)	
5 times	4 (44.4%)	5 (55.6%)	Reference	
Foods avoided during the current pregnancy				
Yes	45 (52.3%)	41 (47.7%)	0.75 (0.44 - 1.23)	
No	102 (59.3%)	70 (40.7%)	Reference	
Craving for non-food substances during the current pregnancy				
Yes	32 (62.7%)	19 (37.3%)	1.35 (0.71 - 2.53)	
No	115 (55.6%)	92 (44.4%)	Reference	
Diarrhoea for the last one month preceding the study				
Yes	3 (37.5%)	5 (62.5%)	0.44 (0.13 - 1.89)	
No	144 (57.6%)	106 (42.4%)	Reference	
Febrile illness for the last one month preceding the study				
Yes	18 (78.3%)	5 (21.7%)	2.96 (1.06 - 8.23)	2.30 (0.76 - 6.92)
No	129 (54.9%)	106 (45.1%)	Reference	Reference
Treating for worms in the last 6 month preceding the study				
Yes	33 (50.0%)	33 (50.0%)	0.68 (0.39 - 1.21)	
No	114 (59.4%)	78 (40.6%)	Reference	
Treating for malaria in the last 6 month preceding the study				
Yes	14 (56.0%)	11 (44.0%)	0.96 (0.42 - 2.20)	
No	133 (57.1%)	100 (42.9%)	Reference	
HIV status of the women				
Positive	16 (80.0%)	4 (20.0%)	3.27 (1.06 - 10.06)	2.68 (0.82 - 8.75)
Negative	131 (55.0%)	107 (45.0%)	Reference	Reference
MUAC				
<23 cm	54 (76.1%)	17 (23.9%)	2.32 (1.25 - 4.30)	2.52 (1.36 - 4.67)**
>23 cm	108 (57.8%)	79 (42.2%)	Reference	Reference

Abbreviations: COR = Crude Odds Ratio, AOR = Adjusted Odds Ratio, CI = Confidence Interval, *P < 0.05, **P < 0.01, ***P < 0.001.

4. Discussion

The present study showed that the prevalence of anaemia among pregnant women was high at 57%. According to WHO classification of the public health importance of anaemia, it is a severe public health problem [4]. This finding is slightly higher than the Kenya national prevalence of anaemia in pregnancy at 55.1% [3]. It is also much higher than to the study carried out in Kakamega County (Kenya) reported at 40% [14] and unpublished finding from Mbagathi District Hospital, Nairobi at 36.2% [15]. This variation can be due to the fact that the participants of this study did not include pregnant women in the first trimester as anaemia is more common in the second and third trimesters. However, the figure is relatively comparable to other studies conducted in African countries such as Nigeria at 54.5% [16] and Ethiopia at 56.8% [17]. But it is lower than the findings from Uganda at 63.1% [18] and Egypt at 62.2% [19] and higher than Tanzanian finding at 47.4% [20].

In the present study the odds of anaemia were observed to rise as maternal age advances. Pregnant women aged 31 years and above were significantly more anaemic compared to those mothers 18 - 24 years. This result is in agreement with the previous studies conducted in Kisumu District of Kenya [21], Ethiopia [22], Tanzania [23] and Egypt [24] which found that late pregnancy has significantly increased risk of developing anaemia. It is generally believed that anaemia in pregnancy increases with rising parity and maternal age. Besides the general body weakness with advanced maternal age, older women are expected to be multigravida. Multigravida may induce anaemia by reducing maternal iron reserves at every pregnancy and by causing blood loss at each delivery [25].

The proportion of anaemia was significantly more among employed participants compared to the housewives. This finding is in line with studies conducted in Pakistan [26] and Brasil [27]. This was not unexpected, where women often need to work outside the home because of low family income. These women could not have enough resting time as a pregnant mother and enough time to attend ANC compared to housewives. Furthermore, most of these women would be considered underemployed, *i.e.*, employed but with jobs that were unsteady and low-paying. This can greatly contribute to the well-being of the women and the positive outcome of the pregnancy.

The odds of developing anaemia was significantly more among pregnant women who did not take iron and folic acid supplements. This finding corroborates with previous studies such as in Ethiopia [17] [28], Uganda [29], Nigeria [30], Vietnam [31] and India [32] which indicated that lack of iron supplementation is among the most significant risk factors for developing anaemia during pregnancy. The reason for this might be pregnant women who take their iron tablets which can help them to increase their hemoglobin level and prevent anaemia during pregnancy time. Even if the woman had a normal amount of iron before pregnancy, more is needed during pregnancy due to increased demand. This requirement is not met by food alone in developing countries like Kenya, and therefore oral iron supplementation is justified [16].

Pregnant women with MUAC of less than 23 cm had higher prevalence of anaemia. This finding is consistent with previous studies in Western Kenya [33], Ethiopia [17], India [34] and Nepal [35], which found that MUAC of less than 23 cm significantly increase the risk of developing anaemia. This can be explained by the fact that undernourished pregnant women have a higher probability of being deficient of micronutrients and therefore more likely to develop anaemia. Pregnancy is the most nutritionally demanding period in a woman's life. Consequently, pregnant women are advised to eat more diversified diet than usual [36].

5. Limitation of Study

One of the limitations of this study is the nature of the study design, being as a cross-sectional study design, it does not show which preceded anaemia or the risk factors. This limits measuring the cause and effect relationship. Second, it did not classify the types of anaemia based on red blood cell morphology which would give clear picture on the types of anaemia. Third, as the current study was conducted entirely within one hospital and all the participants were from Nairobi County, differences of geographic location were not assessed. Therefore, generalizability to other hospitals and rural areas in the country may not be possible.

6. Conclusion

Anaemia is found to be a severe public health problem in the study area. Late pregnancy, employment, not taking IFAS during the current pregnancy and MUAC of less than 23 cm were significantly and independently associated with anaemia during pregnancy. Special care should be given during late pregnancy and for employed pregnant women to prevent anaemia. Nutritional counseling on consumption of more diversified and extra meal

and iron-rich foods and iron/folate supplementation are recommended to prevent anemia in pregnant women. Further research (more robust) on risk factors of anaemia during pregnancy including urban and rural communities should be carried out to strengthen and broaden these findings.

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Competing Interest

The authors declared that they have no competing interests.

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Abbreviations

ANC: Antenatal care; AOR: Adjusted odds ratio; CI: Confidence interval; COD: Crude odds ratio; Hgb: Hemoglobin; IDA: Iron deficiency anemia; MUAC: Middle upper arm circumference; OR: Odds ratio; SPSS: Statistical package for social science; WHO: World Health Organization.