



# Anemia & Its Associated Factors Among Pregnant Women Attending Antenatal Clinic At Mbagathi County Hospital, Nairobi County, Kenya

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## Summary

### INTRODUCTION

Anemia is one of the most common nutritional deficiency diseases observed globally. It affects more than a quarter of the world's population. Globally, 41.8% of pregnant women and close to one third of non-pregnant women (30.2%) are anemic. The paper describes factors associated with anemia in pregnant women at Mbagathi County Hospital which admits many patients coming from Kibera. A low income slum in Nairobi. Kenya.

### OBJECTIVE

The objective was to determine the prevalence of anemia and its associated factors among pregnant women attending antenatal care at Mbagathi County Hospital in Nairobi, Kenya.

### METHODOLOGY

A Hospital based cross-sectional study was conducted from September 01 to October 30, 2016 employing a systematic random sampling method to select participants.

Analysis was done using *SPSS version 17.0* to obtain descriptive statistics such as Frequency, Percentage, Mean and Standard deviation. This was used to describe selected variables. *Chi-square test* and *odds ratio (OR)* with corresponding 95% confidence intervals (CI) was computed to determine the association between INDEPENDENT and DEPENDENT variables. Logistic regression analysis was done to determine factors significantly and independently predicting anemia during pregnancy.

### RESULTS

The results revealed the prevalence of anemia among pregnant women to be 40.7% with a significant association of *Helminthic* infestation and anemia ( $p = 0.003$ ). Education showed statistically significant relationship with anemia ( $p = 0.001$ ). There was a strong association between prevalence of anemia and the dietary practices ( $p = 0.003$ ). Anemia among pregnant women is found to be a severe public health problem, based on the World Health Organization classification of anemia.

### CONCLUSION

Thus, this study concluded that routine iron supplementation in pregnancy and early initiation of antenatal clinic attendance could reduce the prevalence of anemia in pregnancy.

Hence, daily intake of foods rich in iron is recommended for women to reduce prevalence of iron deficiency (anemia) during pregnancy. In fact, girl child education can be used to further mitigate anemia in communities.

Moreover, stringent measures should be taken to control parasitic infestations and other risk factors of anemia amongst women by disseminating Information to the public.

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## Introduction

Anemia is one of the most widespread public health problems in the world and is becoming a global burden (*Abriha, 2014*). It is as a result of reduced red

blood cells or less oxygen carrying capacity to meet the body needs. It damages cognitive development, reduces the capacity for physical work and in severe cases it increases the risk of mortality particularly during the



prenatal period (*WHO, 2008*). In pregnancy anemia is defined as *hemoglobin* concentration  $< 11.0$  g/dl or  $< 10.5$  g/dl in the second half of pregnancy as per the World Health Organization. Anemia is classified into mild anemia ( $10 - 10.9$ g/dl), moderate anemia ( $7 - 9.9$ g/dl) and severe anemia ( $< 7$ g/dl).

The prevalence of anemia in Kenya is estimated to be 41.6 % out of which iron deficiency anemia, being one of the most prevalent nutritional deficiency problems, has a prevalence of 26% (*Wanjiru, 2010*).

Recent statistics one of them done by Kilimanjaro Christian Medical University College (KCMUC) indicate that anemia affects 41.8% of pregnant women globally, with the highest prevalence being in Africa and the most affected being people living in the developing countries which are estimated as 95.7% pregnancies (*WHO Statistics report, 2014*).

According to World Health Organization World health Statistics 2005 shows the average prevalence of anemia in the world is 41.8%. Many studies show that anemia in pregnancy is common internationally but Africa and Asia endure the greatest burden.

Indeed Africa and South East Asia have a prevalence estimated to be 61.3% and 52.5%, respectively (*Caroline, 2013*). Anemia is twice as common in these regions compared to America and Europe where the prevalence is estimated at 24.1% and 25.1%, respectively (*Mayaer et al, 2005; E. Ejeta et al, 2014*).

Sub-Saharan Africa is the most affected region, with anemia prevalence among pregnant women estimated at 17.2 million, which corresponds to approximately 30% of total global cases (*Bilimale et al, 2010*).

Although iron deficiency is the most common type of anemia, there are other types of anemia (*Gedefaw. L, et al, 2015*). In fact, poor dietary intake, leading to deficiencies of iron, *folate*, vitamin *B12* and vitamin *A*, as well as intestinal parasitic infections, malaria, *hemoglobinopathies*, HIV infection and inherited disorders have all been shown to cause anemia among pregnant African women (*Antelman et al, 2000; Uneke et al, 2007*).

Severe anemia causes fatigue, weakness, dizziness and drowsiness. Indeed, pregnant women and

children are particularly susceptible and hence are prone to being affected and at risk as per the global prevalence report (*WHO, 2013*).

The contextual features contributing to anemia among pregnant women are diverse. Interaction of multiple factors like women's socio-demographic, economic, dietary practices and health related factors continues to be the main causes of anemia in pregnant women (*Kefiyalewet et al, 2014*).

Given the high prevalence of anemia in Kenya, this study is assumed to represent prevalence of anemia in the midst of the urban poor in the country. The multifactorial nature and occurrence of this disease makes prevention of anemia to require a cohesive approach.

Other prompting factors are grand multiparity, young age, low socio-economic status, illiteracy, interpregnancy spacing of  $< 1$  year and late appointment (*Bukar M., et al, 2008; Gyorko, 2011*).

Enough information on factors causing anemia in pregnant women is not available in Kenya according to the Kenyan ministry of health resulting in lack of strong measures to reduce the prevalence. It should be known that the availability of local information on the magnitude and related risk factors has a major role in the management and control of anemia in pregnancy.

Thus the study will help to determine the prevalence of anemia and its associated factors in pregnancy. The result is set to help health planners and communities in the prevention of anemia in pregnancy, a widespread preventable condition that has great impact on the health and social economic situations of populations across the globe.

This paves the way forward towards objective intervention measures and also to potentially optimize the antenatal care offered to pregnant women in the area of our study and to the whole country at large.

## Aim

This study aims to determine the prevalence of anemia and its associated factors among pregnant women attending antenatal clinic at Mbagathi County Hospital, in Nairobi County, Kenya's capital city.



## METHODOLOGY

### *Study Setting*

The study was done at Mbagathi District Hospital, which is a Government owned Level Four hospital located in Nairobi West District, Kibera Constituency, Nairobi County. It's a 200 bed capacity facility which offers a wide range of comprehensive health services such as medical, surgical, pediatric, obstetrics and gynecology and basic emergency services.

The Hospital Obstetrics and Gynecology department consists of the maternal and child health/family planning with a gynecology ward and a maternity unit.

The Maternity unit is made up of labor ward, operating theatre, antenatal and postnatal wards and a new born unit. It is managed by two consultant obstetrician / gynecologists, 2 medical officers, two medical officer interns, one clinical officer and nursing staff.

The hospital offers services to the many urban poor around the Nairobi west district Kawangware and Dagoretti.. Since many of Kenyan women seek antenatal care in public hospitals like Mbagathi District hospital, the study was suitable because of the large number of women seen in this facility.

### **Study Design and Participants**

The study design was a descriptive cross sectional hospital based study which used quantitative techniques to collect data from mothers attending the antenatal clinic at Mbagathi District Hospital, Nairobi.

Pregnant women visiting Mbagathi Antenatal Clinic from September 1<sup>st</sup> to October 30<sup>th</sup> 2016 and fulfilled the inclusion criteria were included in the study. Exclusion criteria included those with current severe illness, those below 18 years and those with no mental capacity to sign a consent form.

Subject recruitment was conducted on volunteer basis after having a clear understanding of the research and signing the consent form.

### **Sample Size Determination and Sampling Procedure**

The sample size was determined based on the single population proportion formula using

$$n = Z^2 \times p \times q / d^2$$

with a 95% confidence interval, 5% margin of error and an assumption of 50% anemia prevalence among pregnant women in the study area.

Thus, the total desirable sample size was 289. Since the total ANC followers in the study area were less than 10,000. We used correction formula to calculate the final sample size.

Therefore, considering non-responsive rate (5%), the final sample size for this study was 305. A random sampling method was used to select the first study participant and a systematic random sampling method was used to select the other participants. Thus, every fourth ( $k = 4$ ) pregnant women who met our inclusion criteria was selected.

### **Methods Of Data Collection**

Information on socio-demographic characteristics, obstetric and gynecological history, and dietary patterns were collected with the use of interviewer - administered pretested questionnaires.

Anemia in pregnancy was defined as Hemoglobin (Hb) less than 11 *g/dl* (*WHO, 2011*). Stool specimens were collected from the study participants and they were examined for intestinal parasitic infections while a finger prick was done to obtain blood for hemoglobin levels and for a thick smear slide for malaria parasites.

*Chi square test* and Logistic regression analysis were done to assess the significance of anemia and independent risk factors associated with anemia.

### **Data Quality Assurance**

To assure the quality of the data, Pretesting of the pre-designed questionnaire guide was carried out at Kenyatta National Hospital Antenatal Clinic before



actual data collection. The participants were given a plastic container to put a stool specimen and a slide was prepared and examine under the microscope for the presence of worms such as *ascaris*, hookworms, *trichuris trichuria* and S. Manson.

Random samples were sent to the Mbagathi Pediatric Laboratory for quality assurance. The Standard operating procedures (SOPs) were followed during specimen collection and other laboratory procedures.

All reagents used were checked for their expiry date and prepared according to the manufacturer's instructions. Training was given for the data collectors to minimize technical and observer biases.

## Method Of Data Analysis

Data was edited, cleaned and checked for its completeness and entered into Microsoft excel then exported to Statistical packages for social sciences (*SPSS*) *Version 17* for analysis.

Data protection was done using a password protected computer to limit unauthorized access to data and protection from loss was achieved by backing up the data on emails, flash disks and hard disks.

Data analysis for all the data sets involved the following steps:

Familiarization, charting and interpretation. Categorical variables were summarized as numbers and percentages.

Logistic regression analysis was done to assess the independent risk associated factors for anemia. All variables with a p value less than 0.05 were considered as statistical significance.

## Ethical Considerations

Ethical clearance was sought from KEMRI Scientific and Ethics Review Committee (*SERU*), KNH/ UON Ethics and Research committee to do a pretest in Kenyatta National Hospital and lastly at Mbagathi County Hospital to be able to carry out the study and access the laboratory facilities.

Laboratory procedures at Mbagathi hospital

were performed in accordance with standard operating procedures.

Those found to be anemic were provided with corrective measures and treated immediately through the Mbagathi Antenatal Clinic.

Written informed consent was obtained from all antenatal mothers who consented to the study, records were coded and Patients' / Clinicians' names were not used.

All the information collected remained confidential and was used for purposes of the study only. Participation was voluntary and no incentives were given. At any stage the participants were free to withdraw from the study or not answer some questions without penalty.

## RESULTS

A total of 305 participants were involved in the study. The mean age of the antenatal mothers was 23.3 years with a standard deviation of 4.2 years. Majority of the study participants, 271 (88.9%) were married with 246 (80.6%) having attained at least a secondary education.

Most of the women 212 (69.5%) had their spouses employed and in business though they earned low incomes, 261 (85.6%) were in monogamous marriages with 207 (67.9%) having a family size of 3 to 5 household members *Table 4.1*.

Majority of the antenatal mothers were multi-gravidas at 67.9% (207) and in their third and second trimester showing that there was late commencement of antenatal booking at 96%.

Over nine percent (9.2%) of antenatal mothers had a miscarriage.

More than ninety percent (94.1%) of the antenatal mothers stated that they were above eighteen years when they had the first pregnancy or when they got married.

191 antenatal mothers had their birth intervals more than 2 years and of those interviewed, 49.5% were on their 2nd or 3rd visit as shown in table 4.2



**Table 4.1:** Socio-demographic characteristics of study population

<b>Characteristics</b>	<b>No.</b>	<b>Percentage(%)</b>
<b>Age</b>		
< 18 yrs	4	1.3
18 - 30 yrs	217	71.1
31 - 45 yrs	82	26.9
> 45 yrs	2	0.7
<b>Education</b>		
Primary	56	18.4
Secondary	144	47.2
College/University	102	33.4
None	3	1.0
<b>Marital status</b>		
Married	271	88.9
Single Mother	29	9.5
Separated/Divorced	5	1.6
<b>Occupation</b>		
Formal employed	65	21.3
Self employed	100	32.8
Casual worker	8	2.6
Not employed	18	5.9
House wife	114	37.4
<b>Family income</b>		
Below 10000	69	22.6
10000 - 20000	139	45.6
Above 20000	42	13.8
Missing	55	18.0
<b>Marriage type</b>		
Monogamy	261	85.6
Polygamy	17	5.6
Others (single, divorced or separated)	27	8.8
<b>Family size</b>		
Less than 2	93	30.5
3-5	207	67.9
Above 5	4	1.3



**Table 4.2 Reproductive Characteristics**

REPRODUCTIVE	NO.	%
<b>Parity</b>		
Primigravida	98	32.1
Multigravida	207	67.9
<b>Trimester</b>		
First	15	4.9
Second	103	33.8
Third	187	61.3
<b>Miscarriage</b>		
Yes	28	9.3
No	274	90.7
<b>First pregnancy age</b>		
Below 18 yrs	18	5.9
Above 18 yrs	287	94.1
<b>Birth Intervals</b>		
<2 years 17	5.6	
≥2 years 288	94.4	
<b>Number of visits</b>		
Once	38	12.5
2 -3 times	151	49.5
<b>More than 3 times</b>	116	38.0

## Anemia Prevalence

The overall prevalence of anemia in this study was 124 (40.7%). The whole study indicated mild and moderate anemia to be predominant at 78 (62.9%) and 45 (36.3%) respectively while only 1 (0.8%) mother had severe anemia as shown in table 4.3. 60 pregnant women had a blood slide that was positive for malaria

parasites as indicated in table 4.4 with 50 having malaria but were not anemic. A stool examination for ova and cyst was done on all the participants and 13 (0.8%) mothers had *helminthic infestation*. 6 mothers had hookworm infestation hence they were referred for treatment within the hospital. *Helminthic infestation* was strongly associated with anemia  $p= 0.003$ .



**Table 4.3: Prevalence Of Anemia Among Pregnant Women At Mbagathi District Hospital**

PARAMETER	NUMBER	PERCENTAGE %
<b>Overall prevalence of anemia n=305</b>		
Anemia	124	40.7
No anemia	181	59.3
<b>Severity of anemia n=124</b>		
10 - 11 g/dl	78	62.9
7 - 9.9 g/dl	45	36.3
Below 7 g/dl	1	0.8

**Table 4.4 : Prevalence Of Parasitic Infection In The Anemic Antenatal Mothers**

Parasite	Hb 10 -11g/dl		Hb 7 - 9.9g / dl		Above 11 g / dl (No anemia)	
	No	%	No	%	No	%
<b>Malaria parasite</b>						
Yes	7	(11.6)	3	(5)	50	(83.3)
No	61	(24.9)	53	(21.6)	131	(53.5)
<b>Helminthic infection</b>						
Yes	9	(37.5)	4	(16.7)	11	(45.8)
No	72	(25.6)	39	(13.9)	170	(60.5)

*Chi square = 8.474, p = 0.003*

## Prevalence Of Anemia In Relation To Reproductive Characteristics

A large number of women in this study (95.1%) initiated antenatal visits in their second or third trimesters, with only 4.9% starting in their first trimester. Majority of study participants were in their third trimester (61.3%) and 33.8% in their second

trimester. The highest prevalence of women with anemia as compared to those without was noted in the third trimester at 25.9%, followed by the second trimester at 13.1%. There was no association between trimester and anemia in pregnancy ( $p= 0.819$ ). The study shows



that the highest prevalence of anemia occurred in the second and third trimesters of pregnancy. The highest prevalence was found in multigravidas without any

association between parity and prevalence of anemia ( $p=0.969$ ). This is summarized in **Table 4.5 below**.

**Table 4.5: Prevalence Of Anemia In Relation To Reproductive Characteristics**

N=305 Reproductive characteristic	Anemia			
	Yes N (%)	No N (%)	Total	P value
Parity				
Primigravida	40 (13.1)	58(19.0)	98	0.969
Multigravida	84 (27.5)	123 (40.3)	207	
Trimester				
First Trimester	5 (1.60)	7 (2.30)	12	0.819
Second Trimester	40 (13.1)	66 (20.3)	106	
Third Trimester		79 (25.9)	108 (35.4)	187

$P > 0.05$  means non-significant,  $n = 305$

## Care Provided to Pregnant Women

All the antenatal mothers were provided with iron supplements. The study shows that 98.7% of the participants were given iron supplementation during their first visit. Only four mothers had not received the iron supplements since it was their very first visit and they were in the first trimester. The study also shows 24 (7.9%) mothers had blood transfusion, 181(59.3%) of the pregnant women slept under an ITN during pregnancy.

Of the 124 antenatal mothers who did not sleep under ITN, 80 (64.5%) was due to financial constraints and myths created by the individuals while the rest gave no reason. There was a strong relationship between sleeping under a net and anemia ( $p=0.002$ ). Anemia prevalence was found to be largely connected with using of treated mosquito nets. 103 (56.9%) who slept under the mosquito nets were not anemic while 78 (62.9%) had no anemia yet they never slept in treated mosquito nets. This is summarized in the **tables below**.

**Table 4.6.: Care Provided to Mothers**

N=305 Variable	Anemia				Total
	Yes No	%	No No	%	
Iron Supplement	301	98.7	4	1.3	305
Blood Transfusion	24	7.9	281	92.1	305
Mosquito Nets	181	59.3	124	40.7	305

$P < 0.05$  means Statistical significance,  $n=305$



## Nutritional and Dietary Practices

203 (66.6%) of the antenatal mothers stated that they had received nutrition education. *Chi square* results were presented as per the questions on the dietary intake to help in finding the association between anemia and dietary intake.

The results on daily meal frequency and right dietary intake were analyzed using the *chi square*. The results indicated that daily meal frequency of the respondents and right dietary intake was statistically significant to anemia prevalence among the antenatal mother.

The *chi-square* result 11.033 indicated a direct relationship between the daily meal frequency and the anemia prevalence meaning that poor meal intake

of the mothers was a major factor towards anemia prevalence ( $p= 0.026$ ). There was also a significant relationship between right dietary intake and anemia ( $p=0.025$ ), with a chi-square result of 11.139

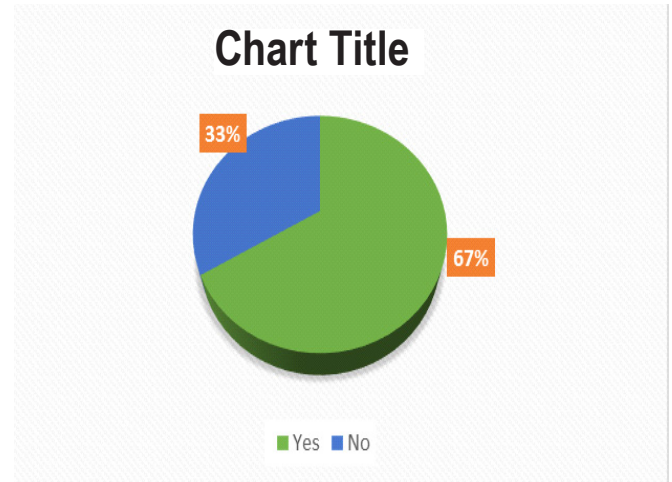


Figure 4.1 Nutrition Education For Antenatal Mothers

## Logistic Regression Analysis Of Dietary Practices & Anemia Prevalence

A logistic regression analysis to determine the independent predictors for the outcome variable among the antenatal mothers was done on some dietary practices. The strength of statistical significance was measured by adjusted odds ratios (AOR) and

95% confidence intervals. The daily meal frequency and right dietary intake in the daily meals were the independent variables predictors of anemia prevalence which revealed (AOR = 3.57, 95% CI = 1.81–3.26) and (AOR = 2.15, 95% CI = 0.64–2.83) respectively as shown in **Table 4.8**.

Table 4.7 Chi Square Test For Dietary Intake

N=305 Variable	Anemia	
	Chi Square	P Value
Daily meal frequency	11.033	0.026
Right Deatary intake	11.1390	0.025

$P < 0.05$  Means statistical significance,

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**Table 4.8:** Dietary Practices Associated With Anemia Among Pregnant Women Attending Antenatal Clinic.

N=305	Anemia			
	Yes	No		
Description	N (%)	N (%)	Cov (95%CL)	AOR (95% CL)
<b>Daily meal frequency</b>				
Less than or equal to	2 24 (42.1)	33 (57.9)	1.41(0.927-0.937)	3.57(1.81-3.26)
3 times	87 (40.7)	127 (59.3)	0.3(0.739-0.756)	2.63(0.91-2.95)
More than 3 times	13 (38.2)	21 (61.8)	1	1
<b>Eating right diet</b>				
Yes	104 (42.3)	142 (57.7)	1.12(0.542-0.562)	2.15(0.64-2.83)
No	20 (33.9)	39 (66.1)	1	1

*p < 0.05 means statistical significance*

### **Association Between Dietary Intake & Anemia**

The relationship between the dietary intake and anemia among the study participants showed a high consumption of meat, poultry products, green vegetables and liver.

The study revealed that over 50% of the pregnant mothers interviewed took the above diet during the week though not consistently. (Table 4.9) shows that a larger number of pregnant mothers 159 (53%) who consumed meat in their diet did not have anemia as compared to those who had 100 (33.4%).

This was very consistent with the result of poultry products and liver except the consumption of green vegetable which was clearly shown that it was consumed by all antenatal mothers.

The result shows that 283 (92.8%) of the mothers consumed green vegetables for more than 3 days a week. There was a strong association of green vegetables consumption and anemia ( $p= 0.0001$ ).

The study did not show any association between the consumption of meat, poultry products and liver and anemia among the antenatal mothers.



**Table 4.9: Association Between Dietary Intake And Anemia Among Antenatal Mothers**

Description		>11 g/dl	10-11 g/dl	7-9.9 g/dl	p value
<b>Meat inclusion in the diet</b>					
	Yes	159 (52.1)	65 (21.3)	35 (11.5)	
	No	1(0.3)	12 (3.9)	6 (2.0)	0.419
<b>Times they consume meat in a week No =259</b>					
	1-3 days	79 (25.2)	32(10.5)		14 (4.9)
	>3days	80(26.2)	33 (10.8)	21 (96..9)	0.672
<b>Poultry products inclusion in the diet</b>					
	Yes	158 (52.70)	65 (21.7)	41 (13.7)	
	No.	21 (7)	12 (4)	3 (1)	0.356
<b>Green vegetables inclusion in the diet</b>					
	Yes	180 (59.8)	77 (25.6)	44 (14.6)	
	No.	0	0	0	0.001
<b>Liver inclusion in the diet</b>					
	Yes	135 (45)		48 (9.16)	26 (8.7)
	No.	45 (15)	28 (9.3)	18 (6)	0.043
<b>Number of times consumed</b>					
	1-3 days	106	37	18	
	>3 days	16	6	5	
<b>Times they consumed poultry products</b>					
	1-3 days	79	43	20	
	>3 days	76	22	21	
<b>Number of times they consumed</b>					
	1-3 days	10	6	2	
	>3 days	170	71	42	

$P < 0.05$  means statistically significance,  $P > 0.05$  means no significance

Different types of food taken by the study participants in relation to anemia prevalence,



## DISCUSSION

Anemia in pregnancy is one of the most widespread public health problems especially in developing countries and has significant health, social and economic consequences.

The prevalence of anemia in this study is 40.7 %, (95% CI of 31.6-42.5%) is a sign that anemia during pregnancy is still a major challenge in Kenya despite of efforts being put in place to mitigate anemia prevalence in pregnancy.

The results of this study provide more evidence of the confluence of well-established underlying factors among all population groups given the locality of the study.

This study is in line with a study done in northwestern Ethiopia by Melku and others which showed anemia prevalence to be 36.1%. (*Melku et al, 2015*). More than one third of antenatal mothers were found to be anemic.

This prevalence is higher than that reported elsewhere (Caroline 2013, Nairobi) and (Khadija 2006, Kakamega) at 36.2%, (95% CI of 31.4-41.3%) and 25.7% (95% CI of 20.7-31.2%) respectively. The prevalence of anemia in our study was lower than the average (57.1%) reported for the African region (*Klemm R, et al, 2011*), but consistent and slightly lower than the 41.6% reported by the Kenyan Demographic and Health Survey of 2014.

The variance between these results could be attributed to differences between socioeconomic status and education level probably as a result of differences in diet and nutrition health talks that has been rolled out in many antenatal clinics.

According to the Kenya demographic and health survey 2008-09, only 15% of pregnant mothers obtained antenatal care in the first trimester in Kenya and only about half (47%) received care before 24 weeks (second trimester) (*KDHS, 2008/2009*).

This study found that only 5.0% of pregnant mothers initiated antenatal care in their first trimester and 34.1% and 61.9% in their second and third trimester respectively. This is in line with the KDHS study

which concluded that during the first trimester pregnant mothers do not attend the clinic hence there being very low attendance of antenatal care (*KDHS, 2009*).

Thus the study shows that the prevalence of anemia was higher in pregnant women in the second and third trimesters. The risk of developing anemia was significantly higher in second and third trimester since it was the time many antenatal mothers stated the visits at the hospital.

From a study done in Kakamega by Khadija, it was found that a pregnant woman with previous history of anemia was twice more likely to become anemic as compared to one without history of anemia and this has a more severe outcome for both the mother and the child (*Khadija, 2006*).

Only one case (0.8%) of severe anemia was detected in the present study while majority of those found to be anemic were mild and moderate anemic at 62.9% and 36.3% respectively (*Table 4.3*). Cyril and *Hyacinth (2007)* reported 40.4 percent of Nigerian pregnant women were anemic, the majority of them being mildly anemic and with no case of severe anemia

A World Health Organization report states that anemia in pregnancy peaks in the third trimester (*WHO 2012*). In this study, the prevalence of anemia was highest in the third trimester at 42.2% coinciding with the period when hemo-dilution is highest indicating that this may have aggravated the anemia.

The high prevalence may also be attributed to late initiation of antenatal care. This causes late detection and missing of opportunity to correct the deficiency through iron supplementation and diet counseling early in pregnancy.

A study done in Ethiopia identified malaria to be a major cause of anemia in pregnancy (*Alem, Meseret, et al, 2013*) This study found it to be a significant factor since 7 mothers were found to have a positive blood smear for malaria parasite even though the study was done in Nairobi. Which is not a malaria endemic area.

Majority of the patients diagnosed with malaria sited that they lacked treated mosquito bed nets in their homesteads and they lived near dumpsites and a slow running river.



In the present study, the prevalence of anemia was higher among pregnant women having a meal frequency of less than or equal to 2 times per day as compared to pregnant women who had a meal frequency of 3 or more times a day ( $p=0.026$ )

A logistic regression analysis revealed two predictors to be significantly associated with anemia among antenatal mothers.

These were : (a) Meal frequency  
(b) right dietary intake.

This is so because the pregnant women having a meal frequency of less than or equal to 2 times per day were at a higher risk of developing anemia as compared to pregnant women who had a meal frequency of 3 or more times a day (AOR = 3.57, 95% CI = 1.81– 3.26) (**Table 4.10**).

This result is consistent with other studies conducted by *Mekelle* (2013) in Uganda. Which indicated that; an increase in meal frequency per day throughout the pregnancy period increases the mothers energy and nutrient levels.

Hence; preventing anemia (AOR = 3.88, 95% CI = 1.93, 7.79) and in Ethiopia (AOR = 2.18, 95% CI = 1.06– 4.91). (*A. Abriha, et al, 2014; Abel G. and A. Mulugeta, 2015*).

The study highlights the prevalence of anemia to be significantly higher among antenatal mothers who did not use the right diet during the pregnancy period as compared to those mothers who used the right diet (AOR = 2.15, 95% CI = 0.64–2.83) (**Table 4.10**).

It is clear that those who did not use the right and prescribed diet were at a double risk to be anemic as compared to pregnant women who took the right diet as prescribed during their antenatal visits.

## CONCLUSION & RECOMMENDATION

The study concludes that the prevalence of anemia in antenatal mothers was significantly higher in the last two trimesters of pregnancy, low socioeconomic status, low education level and those with poor nutrition and dietary habits. Thus the highest proportion of anemia occurred in the third trimester of pregnancy at 63.7% and also Mild/moderate anemia was highest at

the two trimesters of pregnancy that is 32.3% during second trimester and 63.9% during third trimester.

The factors identified in this study as predicting anemia should be addressed. Parasitic infestation in pregnancy was significantly related with anemia. Hence all women coming to antenatal clinics should be screened for worm infestation through routine stool tests.

The antenatal care should include de-worming for prevention of anemia. The study highlighted the multiple factors associated with anemia like women's socio-demographic status, economic status, dietary practices and health related factors to be the main causes of anemia in pregnant women at Mbagathi hospital, thus it is clear that such factors needs to be addressed to aid in bringing down the prevalence of the disease.

Intervention including health, nutrition and dietary education about causes of anemia and its risk factors and ANC follow-up should be given top priority. Measures to control parasite infestation and any diseases should be put in place.

The health department should implement the WHO recommendation that *anti-helminthic* therapy be provided for pregnant women in the third trimester of pregnancy to control hookworm infection and also the need for the promotion of insecticide-treated bed nets (ITNs) and intermittent preventive treatment (IPTp) to protect pregnant women in the area from malaria.

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