

HOOKWORM INFESTATION AMONG TEENAGE ANTENATAL MOTHERS AT BUNGOMA COUNTY HOSPITAL AND BUMULA HEALTH CENTRE, KENYA

ABSTRACT

Hookworm infestation (Ancylostomiasis) and the association with hematopoietic micronutrient deficiency, contributes significantly to the etiology of anemia mainly in poor countries. In these countries, teenage pregnancy is a major health problem characterized by high prevalence of anemia, exacerbating physiological distress due to increased oxygen demand. In spite of the high prevalence of this problem, no study has been undertaken in Kenya. This is resultant from the combined metabolic needs of a rapidly growing girl and her developing fetus. Anemia increases risks of feto-maternal and child mortality and morbidity, if preventive interventions are not part of antenatal care for prospective teenage mothers. Hookworm infestation therefore significantly endangers the health of the teenage antenatal mothers in Kenya. The literature revealed no previous study on the problem in the target population.

Objectives: The objective of this study was to explore the necessity for including treatment for worms in the antenatal care programme for the target population. The study will, therefore, aim at determining the prevalence of anemia, Hookworm infestation and the possible etiological role of the latter among teenage antenatal mothers in Kenya.

Methods: A descriptive and cross-sectional health facility-based survey was conducted in 2009 at Bungoma County Hospital and Bumula Health Centre antenatal clinics which sampled 384 consecutively pregnant teenage girls. Diagnosis for anemia was made from hemoglobin concentration (estimated by cyanmethemoglobin spectrophotometry). Hookworm infestation was diagnosed based on the presence of ova in stool using *Ritchie's Concentration* and Direct stool microscopy. SPSS version 12 statistical package was used to analyze data and inference was based on 5% significance level.

Results and conclusions: From the SPSS version 12 results, the prevalence of Ancylostomiasis was 28.4%. the prevalence of anemia was 61% (Hb<100g/L). Severe anemia (Hb<60g/L) accounted for 20%, moderate (Hb≤90g/L) 31.2% and mild anaemia (Hb>90<110g/L) constituted 48.3% of the teenage antenatal mothers. There was a significant association between prevalence of the Ancylostomiasis and anaemia (Chi sq 32.238, p<0.001), corroborated with logistic regression (p<0.05) which showed Hookworm infestation a significant predictor of anemia. Those affected were four (4) times more likely to be anemic (OR: 95% CL: 3.703; 2.287-5.995).

Key words: Anemia, pregnant teenagers, Hookworm, *Ancylostomiasis*

INTRODUCTION

Anemia, defined as having a Hemoglobin (Hb) of <11.0g/dl, is common in pregnancy due to feto-maternal competition for hematopoietic nutrients. This is particularly pronounced in developing countries

especially Sub-Saharan Africa, with a prevalence of 35-72%, where the prevalence of poverty and other determinants of poor nutrition and healthcare are high. Alongside obstetric hemorrhage, it contributes 17-46% of anaemia (WHO 1991).

Anemia is a major factor in women's health, especially among women of reproductive age in developing countries and more specifically in resource limited settings. Severe anemia during pregnancy is an important contributor to maternal mortality (Allen, 2000) as well as low birth weight which is in turn an important risk factor for infant mortality (Steer 2000 & McCormick 1985).

Hookworms and some other helminthic infestations (Manhor et al 2012, Brooker et al 2007) are bound to worsen the anemia. This can exacerbate the physiologic distress occasioned by the demands of the special state of the subjects for increased oxygen and carbon dioxide transport (WHO 1991, Shipala et al 2013).

Hookworm infestation (Ancylostomiasis), alongside hematopoietic micronutrient deficiency, contributes significantly to the etiology of anemia in poor countries and it is a common cause of iron deficiency anemia (Ozumba, 2005). In these countries, teenage pregnancy is a major health problem characterized by high prevalence of anemia, exacerbating physiological distress due to increased oxygen demand, resulting from the combined metabolic needs of a rapidly growing girl and her developing fetus. Anemia increases risks of feto-maternal and child mortality and morbidity, if preventive interventions are not part of antenatal care for prospective teenage mothers (Manhor et al, 2012). Hookworm infestation therefore significantly endangers the health of the teenage mothers.

In Kenya, teenage pregnancy is prevalent and it is conservatively estimated to account for school drop of about 13,000 girls per year. In view of these findings and accompanying health risks, including helminthiasis, malaria and anemia, the phenomenon of teenage pregnancy and these health problems requires attention by researchers and the government (Brooker et al, 2007).

There have been few studies on the role of hookworm induced anemia among expectant women in Kenya's rural communities where these parasites are endemic. In fact, literature search reveals that no previous research on ancylostomiasis and anemia among pregnant teenagers specifically in the setting of this study had ever been conducted. The study therefore, aimed at assessing the role of hookworm infestation among the expectant teenage girls at the two rural community health facilities (Brooker et al, 2007).

OBJECTIVES

The objective of this study was to explore the need for including treatment for worms and related anemia in the antenatal care settings countrywide. It therefore, aimed at determining the prevalence of anemia, hookworm infestation and the possible etiological role of ancylostomiasis in anemia among pregnant teenagers.

METHODS AND MATERIALS

The catchment area for Bungoma District Hospital and Bumula Health Centre falls within a zone that may be defined as a resource limited setting, characterized by poor sanitation standards. Like many parts of the wider Western Kenya, these areas have a predominantly youthful population who are largely from low socio-economic stratum. Residents of this setting are mainly peasant farmers and usually visit Bungoma

District Hospital and Bumula Health Centre (a Rural Health Training centre) which provides primary health care services including antenatal and obstetric services within the community.

A descriptive cross-sectional survey which was conducted between October and December, 2009 at Bungoma District Hospital and Bumula Health Centre antenatal clinics whose sample size was 384 consecutively pregnant teenagers.

Blood sample collection and hemoglobin estimation:

Venous blood samples were collected aseptically by swabbing the ante cubital fossae with 70% alcohol. 3-5ml of blood was then drawn into an EDTA vacutainer with a sterile hypodermic needle. The blood was then mixed on a lab roller before being fed into the automated Coulter Act-5 Diff machine to estimate the hemoglobin concentration. Anemia was also categorized microscopically on basis of erythrocyte hemoglobinization patterns, size and morphology, using Giemsa-stained (pH 7.2) thin peripheral blood film as recommended by WHO (WHO, 1991).

Stool collection and examination:

Selected subjects were provided with clean labeled stool containers (screw-capped poly-pots) and instructed to bring small quantities of their stool specimen the next day within an hour of passing the stool. Wet mounts were prepared from the stool specimen using a direct smear with normal saline and iodine. A concentration method using formol/ether was also applied to help identify helminth eggs as well as protozoan cysts.

Statistical analysis:

Data analysis was done using SPSS v12 computer program with an inference based on 5% significance level. Fisher's formula for population sizes >10,000 was employed in deriving the sample size, using $p=0.5$ and $\alpha=0.05$. Chi square (χ^2) was done to compare relationships between categorical variables (hookworm infestation and anemia).

Ethical consideration:

Approval to conduct the study was obtained from the Bungoma District Hospital ethics committee and the Moi University School of Medicine/Moi Teaching & Referral Hospital Institutional Research & Ethics Committee (IREC). Verbal consent was also obtained from the study participants before a questionnaire could be administered and any specimen taken.

RESULTS OF THE STUDY

The age of the study group ranged from 13-19 years with a mean of 16 years. Majority of the 384 respondents had no formal education (62.2%) though 5% had tertiary form of education (Table 1). Many respondents were housewives (73.7%). Majority of the respondents were married (58.9%) but the 41.1% single expectant female and this is an indication of young girls engaging in unprotected sex before marriage.

Table 1: Socio-demographic characteristics of study population		
	Frequency	Percentage (%)
Age(years)		
13-15	71	18.5

16-18	201	52.3
19-21	112	29.2
Education		
No School	269	70.1
Primary	97	25.3
Secondary	18	4.6
Tertiary	0	0
Occupation		
Business	10	2.6
Farmer	5	1.3
Housewife	283	73.7
Teacher	5	1.3
Trader	81	21.1
Marital status		
Married	226	58.9
Single	158	41.1
Worm infection		
Hookworm	109	28.4
Negative	275	71.6
Trimester		
First	118	30.7
Second	167	43.5
Third	99	25.8

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126 Anaemia (Hb <10g/dl) prevalence was significantly high (61%) in the 384 subjects. This was
 127 categorized with percentages as follows: severe anemia (Hb <6g/dl) 20.5%; moderate (Hb ≤
 128 9g/dl) 31.2%; mild (Hb >9<11g/dl) 48.3%. Based on PBF microscopy, the anemia was sub-
 129 categorized as being microcytic hypochromic anemia, 51.8% and macrocytic hypochromic
 130 anemia, 48.2% (Figure 1)

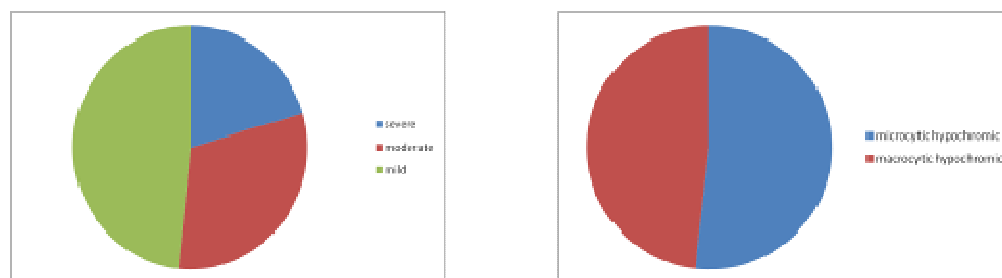
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136 Figure 1. Pie chart for anemia prevalence

137 There was a significant association between prevalence of the two conditions (Chi sq 32.238,
 138 $p < 0.001$), corroborated with logistic regression ($p < 0.05$) which showed hookworm infestation to
 139 be a significant predictor of anemia, with those affected being 4 times more likely to be anemic

(OR: 95% CL: 3.703; 2.287-5.995) Chi square test of association shows a statistically significant relationship, with an observed value of 32.238 against the critical value of 3.81 (Df=1 and α

Hookworm status	Anemia status		Totals	χ^2 value	p-value	OR	95%CL for OR	
	Anemic (%)	Normal or non-anemic (%)					Lower	Upper
Ova present	77 (42.4)	32 (15.9)	109	32.238; df=1; $\alpha=0.05$	<0.001	3.703	2.287	5.995
Ova absent	106 (57.6)	169 (84.1)	275					
TOTALS	183	201	384					

=0.05) [or p=0.001]. This is supported by the multiple logistic regression table below (Table 2).

Table 2. Statistics for hookworm and anemia prevalence in the study population.

The prevalence of Ancylostomiasis was 28.4%. Of the 384 cases studied, 109 had hookworm infestation representing prevalence of 28.4% and of which 77 (42.4%) were anemic (Figure 2). On examining the peripheral blood film, erythrocyte microscopy revealed variations in shape (poikilocytosis), ovalocytosis and few reticulocytes.

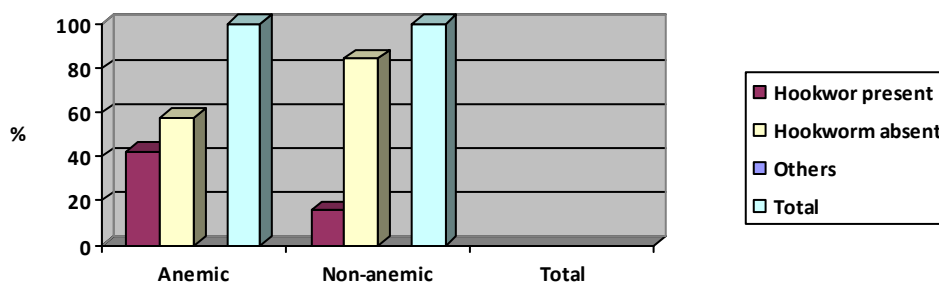


Figure 2. Bar graph for correlation of hookworm infestation with anemia.

Discussion

There is need to improve the understanding of the effect of hookworm infestations on the frequency of anemia in pregnancy. This may help in the design of appropriate management strategies targeted at reducing adverse pregnancy outcomes often associated with hookworm parasites. The prevalence of 28.4% for hookworm found in this study is similar to 30% reported by Ozumba et.al. in Nigeria (Ozumba 2005) but higher than 23% reported by Ndyomugenyi in Masindi, Uganda (Ndyomugenyi 2008).

The high prevalence findings of the intestinal helminthiasis observed in this study could be attributed to the common practice of defecating in the farms and bushes where no pit latrines are found and the low socioeconomic status in the study population. This is so because poverty and ancylostomiasis, it may be argued, are faithful bedfellows. Poverty implies primitive living conditions which promote the spread of the hookworms.

The chronic loss of blood caused by ancylostomiasis turns the scale against the bone marrow and disturbs the equilibrium maintained between blood formation and destruction. The 42.4% prevalence anemia in this study is consistent with 40.4% reported by Dim and Onah in Nigeria (Dim 2007) but higher again than 28% by Ndyomugenyi et al in Masindi, Uganda (Ndyomugenyi 2008). In practice, most hospitals use a hemoglobin level of <10g/dl as the indicator for anemia. This is justified on the basis of work done by Lawson (Lawson 1969) which showed that serious harm to mother and fetus did not occur until the hemoglobin value was below 10g/dl. The significant relationship between hookworm infestations and anemia is obvious in our findings in this study in that over 42% of the 109 with hookworm were anemic. Hookworm infestations results in iron loss from the infested intestinal lumen where it is estimated that a load of 1000 hookworm ova per gram of feces is associated with loss of 1 mg of iron per day (Harrison 2001). And although not evaluated in this study, there is an assumption that rural dwellers have poor nutritional intakes. This may also have contributed to the high prevalence of anemia among the study group.

Anemia, even if it is the tolerated mild to moderate types, may adversely affect the sense of wellbeing of the affected and this may in turn decrease their work capacity due to physical exhaustion and fatigue. Other consequences of hookworm infestation associated with anemia in pregnancy are cardiovascular distress, reduced mental performance, reduced immunity, reduced peripheral blood reserves in mothers and intrauterine growth retardation, prematurity, and low birth weight in newborns.

These consequences only then suggest that hookworm infestation on maternal health merits all women of child bearing age living in endemic areas be subjected to periodic antihelmintic screens and treatment. WHO recommends that infected expectant women be treated after their first trimester (Bethony 2006). Despite this suggestion, only Madagascar, Nepal and Sri Lanka have added antihelmintic treatment to their antenatal programs (Brooker 2008)

Conclusion

We conclude that the prevalence of anemia in pregnancy is high in Kenyan rural settings and that hookworm infestations have significant impact on the prevalence. Based on this evidence and other studies, we suggest that during antenatal care (ANC)s there should be routine screening for malaria and helminth infestations, followed by a single dose of Albendazole after the first trimester along with iron and folic acid supplements. This can cause significant elevation of hemoglobin and serum ferritin levels thereby reducing maternal and perinatal morbidity and mortalities, prematurity and low birth weights in our poor communities.

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