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Dietary Diversity and Iron Status in Pregnant Women Attending the Antenatal Clinic at Narok County Referral Hospital, Kenya

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ABSTRACT

Dietary diversity is widely acknowledged as a fundamental factor influencing the iron status of pregnant women. Iron deficiency anemia constitutes a pervasive nutritional concern on a global scale, particularly during pregnancy, and it is linked to an array of adverse consequences such as prenatal mortality, low birth weight, preterm birth, and intrauterine growth retardation. Despite this recognition, there exists a notable gap in our understanding of the dietary habits and iron status of pregnant women attending the antenatal clinic at Narok County Referral Hospital, Kenya. To address this gap, we conducted a cross-sectional study, targeting a cohort of 178 pregnant women receiving antenatal care at the aforementioned hospital. The study used a cross-sectional study design with a target population of 178 pregnant mothers attending the antenatal clinic (ANC) in Narok County Referral Hospital, Kenya. A researcher-administered questionnaire, focus group discussion guides (FGD) and key informant interviews (KII) were used to collect data. Logistical regression and Odds ratio were used to control for other factors that affect iron status, and the Odds ratio was used to determine the likelihood of iron deficiency as influenced by dietary diversity. The results revealed that a significant proportion of the pregnant women were aged between 18-24 years (44.4%), were married (71.3%), and engaged in small businesses (52.2%). Approximately one-third of the participants had two children, with 25.3% having had four live births. The majority (68%) reported consuming four meals daily, but the nutrient intake of pregnant mothers generally fell below recommended levels, with 57.9% failing to meet the minimum dietary diversity score for women. A considerable portion (62.4%) exhibited normal nutritional status, while 68.5% were under Iron Folic Acid Supplementation (IFAS); however, adherence to the supplementation regimen was poor. Moreover, 52.2% had hemoglobin levels below 12g/dl, indicating a potential issue with iron deficiency. This study uncovered significant demographic characteristics among pregnant women, particularly noting a significant presence of young, married individuals engaged in small-scale businesses. The dietary patterns highlighted a prevalent intake of four meals, but nutrient intake often fell short of recommended levels. Alarmingly, a substantial percentage exhibited low hemoglobin levels, underscoring the critical necessity for improved nutritional interventions. Specifically, enhancing iron supplementation and promoting dietary diversity is imperative to address the potential risk of iron deficiency among this vulnerable population.

Keywords: Dietary diversity, Iron status, Antenatal clinic, Haemoglobin levels and Nutrition status.

INTRODUCTION

Iron deficiency anaemia is one of the most prevalent nutritional deficiencies during pregnancy and has been regarded as a global challenge (Okube et al., 2016). This situation among pregnant women is dire because the requirement is for both the mother and the foetus (Akther et al., 2015). Iron deficiency anaemia is associated with many health problems in pregnant mothers, including prenatal deaths, low birth weight, premature birth and intrauterine growth retardation. As a result of severe anaemia during pregnancy, it is hypothesized that intrauterine growth is impaired. Moderate anaemia during pregnancy reduces the placenta's surface area, volume and weight (Agbozo et al., 2020). Additionally, anaemia in pregnancy has been linked to neonatal deaths (7%–10%) , foetal losses (20%–28%) and prenatal deaths (30%), respectively (McLean et al., 2009).

Globally, there are an estimated 56 million anaemic women, with 75%–80% suffering from iron deficiency anaemia (McLean et al., 2009). In developing countries, 80% of pregnant women do not meet their Recommended Daily Allowance (RDA) for iron, resulting in clinical and subclinical signs of iron deficiency. More than half (57.1%) of pregnant women in Africa are anaemic, with an overall global anaemia rate of 41.8% to 43.8% (WHO, 2020). In Kenya, 48 % of reproductive-age women and 55 % of pregnant women suffer from anaemia (Kumar et al., 2022; Odhiambo & Sartorius, 2020). The leading cause of anaemia is iron deficiency due to low dietary intake and diseases (Okube et al., 2016).

Iron deficiency anaemia has a negative impact on the health of many pregnant women and their unborn children, resulting in mental retardation, decreased work productivity and an increased risk of maternal mortality in pregnant women. Due to the increased risk of death from blood loss during delivery in anaemic women, iron deficiency anaemia during pregnancy may result in maternal deaths. Anaemia is associated with 20% of maternal deaths during pregnancy (Owais et al., 2021). To protect the mother and her unborn child from the detrimental impact of iron deficiency anaemia, it is critical that all forms of iron deficiency, whether severe, mild, or moderate in pregnancy, be addressed to ensure the mother's and infant's health.

Inappropriate dietary practices among pregnant women, such as poor nutritional intake, reduced number of meals and insufficient fruit and vegetable consumption, contribute to malnutrition, resulting in complications and a poor birth outcome (Dörsam et al., 2019). It has been suggested that eating foods from various food groups effectively meets iron requirements through dietary diversification. Pregnant women who eat primarily starchy foods may be iron deficient if their diet lacks variety. There is very little data on haemoglobin levels and dietary diversity among pregnant women (Martínez-Galiano et al., 2019). The assessment of pregnant women's nutritional status, particularly concerning their Body Mass Index (BMI), is subject to significant controversy. However, the available data has shown that pregnant women have low haemoglobin levels, low dietary diversity and low iron intake.

Reducing anaemia is a critical global health priority that could enhance maternal and neonatal outcomes in pregnant women. Dietary diversification has been identified as a significant food-based strategy for meeting iron needs that entails eating various foods from various food groups.

Poverty, lack of nutrition knowledge, pregnant women's poor attendance at Maternal Child Healthcare (MCH) and participation of women in pastoralism have been proposed as a few socio-demographic factors associated with insufficient maternal dietary intakes. With the high levels of Iron Deficiency Anaemia (IDA) and existing information gaps on dietary diversity and iron status, this study sought to assess dietary diversity and iron status among pregnant women attending antenatal clinics at Narok County Referral Hospital.

METHODOLOGY

Study Design

We conducted a cross-sectional study to assess the dietary diversity and iron status of pregnant women. The study was carried out at Narok County Referral Hospital, a healthcare facility situated in Narok town, within Narok County, Kenya. We selected this specific hospital due to its accessibility to a significant portion of the population of Narok County, with a particular focus on Antenatal Clinic (ANC) attendance. The hospital caters to a population of approximately 850,920 individuals. It is worth noting that the people of Narok County predominantly engage in pastoralist activities, although there has been a recent shift towards small-scale farming. Additionally, there are extensive tracts of land dedicated to wheat cultivation in the region.

Study Population

The study population included all pregnant women in Narok county. The accessible population encompassed all the pregnant women attending the antenatal clinic (ANC) in Narok County Referral Hospital.

Sample Size

To determine the sample size, the formula of Fisher et al. (1998) as quoted in Mugenda and Mugenda was used. Provided a referenced prevalence rate as the value of P.

Fisher *et al.,* formula was used to determine the sample size: $\mathbf{N=Z^2pq/\ d^2}$

Where:

N – it is the population sample

Z – it is the standard normal deviation which corresponds 95% confidence level (1.96)

p – it is the proportion of pregnant women who are anemic at Narok County Referral Hospital (it is 55%) = 0.55 (Odhiambo & Sartorius, 2020).

q- (1- p) = 0.45

d = 0.05 (statistically tolerated error)

$N= 1.96^2 \times 0.55 \times 0.45 / 0.05^2 = 275$

The population of pregnant women who are anemic is less than 10,000 (Source), and thus the sample was adjusted as follows:

Adjusted sample:

(nf) = n/1+n/N

Where:

n=275 (calculated sample size)

N=450 (The average number of pregnant women attending antenatal clinic Narok County Referral Hospital) (Muvengei, Karanja & Wanzala, 2021).

nf = 384/ 1+275/450 = 175

10% of the sample was added to cater for non-response. Thus, 175+10% non-response =175+17=192. Thus, the study adopted a sample of 192 pregnant mothers.

Data Collection

Systematic sampling was used to select 188 out of the total women attending the clinic. A researcher administered a questionnaire. Key informant interviews (KII) and Focused Group Discussions (FGDs) were used to collect data from the pregnant women.

Inclusion and Exclusion Criteria

The study subjects encompassed pregnant women attending the antenatal clinic at Narok County Referral Hospital, which is a primary facility for delivery services within the county. Inclusion criteria

necessitated a willingness to participate, while the exclusion criteria encompassed individuals with chronic illnesses or those who declined to provide consent.

Ethical Considerations

The research was carried out with the requisite permissions granted by Kabarak University's Ethical Review Committee and NACOSTI. Approval to conduct the study was duly obtained from both Kabarak University's Graduate School and Narok County Referral Hospital. Informed consent was obtained from the participants. This approach ensured voluntary participation and data protection for the research team.

RESULTS

Socio-economic characteristics of the pregnant women

As indicated in Table 1, the predominant age group (44.4%) fell within the range of 18-24 years, suggesting a tendency for women to become pregnant at a relatively young age. A significant majority (71.3%) of the participants were married, and a notable portion (34.3%) had two children. Furthermore, the highest level of education achieved by the majority of the pregnant women was primary education. Additionally, a substantial percentage (52.2%) of the participants were involved in small business enterprises.

Table 1: Socio-economic characteristics of the pregnant women

n=178			
Variable	**Characteristics**	**n**	**%**
Age	< 18 years	23	12.9
	18-24	79	44.4
	25-34	64	36.0
	35-44	12	6.7
Marital status	Married	127	71.3
	Separated/ Divorced	4	2.2
	Single	44	24.7
	Widowed	3	1.7
Education level	Primary	69	38.8
	Secondary	58	32.6
	College	25	14.0
	University	17	9.6
	None	9	5.1
Occupation	Formal employment	18	10.1
	Casual labour	39	21.9
	Small Business	93	52.2
	Farming	22	12.4
	Pastoralism	6	3.4
Number of children	0	27	15.2
	1	48	27.0
	2	61	34.3
	3	23	12.9
	4	8	4.5
	5	6	3.4
	>6	5	2.8

Reproductive health characteristics

The study revealed that 41% of pregnant women were in the gestational age range of 13-24 weeks, and 46% reported initiating their first ANC visit after completing four months of pregnancy. Among the participants, approximately 25.3% had experienced four live births, while 12.9% had given birth 2 to 5 times. Notably, a minority of 9.6% had not yet experienced childbirth, as detailed in Table 2.

Table 2: Reproductive health characteristics

Variable	Characteristics	n	%
Gestational weeks	0-12 weeks	38	21.3
	13-24 weeks	73	41.0
	25-36 weeks	51	28.7
	>37weeks	16	9.0
When first attended ANC 1	0-2 Months	9	5.1
	2-3Months	21	11.8
	3-4Months	65	36.5
	Above 4months	83	46.6
Parity	0	17	9.6
	1	27	15.2
	2	23	12.9
	3	31	17.4
	4	45	25.3
	5	23	12.9
	>6	12	6.7

Dietary diversity among pregnant women

In this study, data on participants' dietary habits were gathered through the utilization of 24-hour recall and dietary diversity questionnaires. It was observed that the majority of pregnant women (68%) consumed four meals, with a smaller percentage (6.2%) having either two or five meals. A significant portion, specifically 69.1%, met or exceeded the recommended daily kilocalorie intake of 2200 or more, and 40.4% reached the Recommended Dietary Allowance (RDA) for iron, which is set at 30 mg per day. However, the findings indicated that a majority of the participants (57.9%) did not achieve the required Dietary Diversity Score for Women (DDS-W), as detailed in Table 3.

Table 3: Dietary diversity among pregnant women

Variable	Characteristics N=178		n	%
Number of meals	2		11	6.2
	3		35	19.7
	4		121	68.0
	5		11	6.2
Kcal	<2200	Inadequate	55	30.9
	2200-2500	Adequate	123	69.1
Iron	<30 mg	Inadequate	106	59.6
	30 mg	Adequate	72	40.4
MWDDS	Met MWDDS		75	42.1
	Did not meet MWDDS		103	57.9

Hemoglobin levels among pregnant women

Table 4 reveals that approximately half of the respondents (52.2%) exhibited low hemoglobin levels, which were below 12g/dl. A substantial portion of pregnant women (41.6%) demonstrated a normal hemoglobin range, falling between 12-16g/dl.

Table 4: Haemoglobin levels among pregnant women

Variable	Characteristics	n	%
Haemoglobin levels g/dl	< 12 g/dl	93	52.2
	1-16 g/dl	74	41.6
	>16 g/dl	11	6.2
	Total	178	100

Maternal Nutritional Status during Pregnancy

The nutrition status of pregnant mothers was assessed, revealing that 62.4% of them had MUAC measurements exceeding 23 cm, while 37.6% had MUAC measurements below 23 cm. This indicates that the majority of pregnant women exhibited a normal nutritional status, as depicted in Figure 4.1.

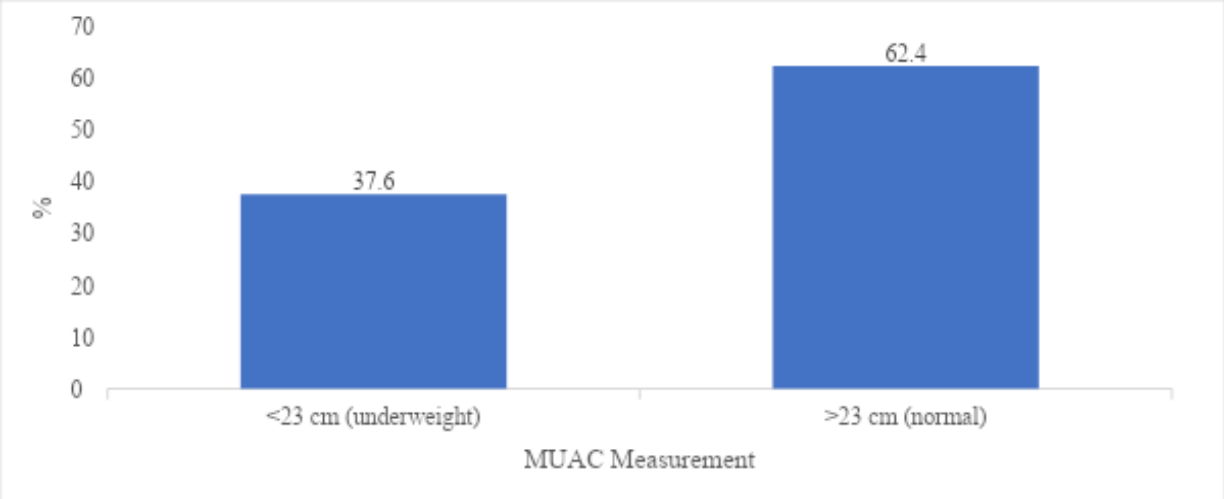

Figure 4.1 Nutrition status among pregnant women in Narok county referral Hospital.

Association between dietary diversity, haemoglobin levels and nutrition status among pregnant mothers

A strong correlation (p=0.001) was found between the frequency of meals consumed by pregnant women and their minimum dietary diversity. Additionally, taking IFAS and adhering to it significantly and positively (p=0.035) influenced the haemoglobin levels of pregnant women. (Table 5). The study did not find a significant association between marital status, parity and number of children with dietary diversity, haemoglobin levels and nutritional status among pregnant women.

Table 5: Relationship between marital status, parity and number of children with dietary diversity, haemoglobin levels and nutritional status among pregnant women.

Haemoglobin levels	DDS	**0.001***
	Number of meals	0.021*
	IFAS intake	0.035*
	Marital status	0.0674
	Gestation period	0.026*
	Parity	0.127
	Number of children	0.0942
	Nutrition status	0.412*
	Income	0.0634*
	Education level	0.003*

DISCUSSION

Age plays a crucial role in determining pregnancy outcomes. The study noted that a significant majority of pregnant mothers fell within the 18-24 age bracket, aligning with the findings of Kiboi et al. (2017), which reported ages ranging from 16 to 49 for mothers. Additionally, the majority of pregnant mothers in this study were married (71.3%), a finding consistent with the research conducted in Laikipia, where 89% of pregnant mothers were married, as also observed by Kiboi et al. (2017).

The study found a low level of education among pregnant women as the highest education level attained was primary education (38.8%), with few who had attained college and university level(14% and 9.6% respectively). This was similar to a study conducted in Narok by Okeyo et al. (2019), which found that most of the pregnant adolescents (30.3%) had stopped going to school while 27.9% had completed primary school and only 9.2% were undertaking tertiary level. In contrast, Kiboi et al. (2017) study found that 52% of the respondents reported secondary education as their highest level of education. According to Azene et al. (2021) study, pregnant women who can read and write were 82% more likely to consume diversified food than those who cannot read and write. This was also supported by another study in Ethiopia, which reported that pregnant women who have acquired at primary school education and above were 2.11 times more likely to eat dietary diversity food compared to non-educated women. The study is also consistent with a study by Kimiywe et al. (2017), which showed that more educated women, 2.78 times, consumed minimum dietary diversity food than non-educated women.

On occupation, most of the pregnant women were businesswomen operating small businesses but earning a monthly average of below Ksh. 10,000. Contrary to our finding, Kimiywe et al. (2017), study in Laikipia noted that about 40% of the household heads were in formal salaried employment. However, the study further indicated that most households had a monthly income of below Ksh 10,000, which was similar to our study findings.

On dietary diversity, a significant number of pregnant women (57.9%) had a low dietary diversity. This finding was similar to that of Okeyo et al. (2019), who found that most of the pregnant mothers did not meet the minimum number of food groups (at least four groups) to reach the medium diet diversity. According to Choudhary et al. (2010), poor people often face difficulties in accessing a diversified diet. Catalano et al.'s (2012) study highlighted the critical importance of ensuring sufficient nutrition to meet the increased nutrient requirements of the developing fetus within the mother's body. This not only supports the immediate health and well-being of the mother but also lays a strong biological foundation for her future health, productivity, and overall welfare. Okeyo et al. (2019) indicated that nutritional deficiency at this formative stage of life can be detrimental to the individual's future health and further affect the offspring. Pregnant women are therefore advised to consume an optimally nutritious diet to reduce chances of deficiencies such as vitamin A deficiency, which is susceptible during the third trimester (Okeyo et al. 2019).

The study indicated that most pregnant mothers (69.1%)) had a normal nutrition status. These findings contradicted the findings of a study by Catalano et al. (2012), who found that pregnant and lactating adolescents in Trans Mara East Sub-County, Kenya, had a poor nutrition status due to weak delivery of nutrition services.

The low haemoglobin level among pregnant mothers in the study was consistent with the study by Verma & Shrivastava (2016) indicated that anaemia during pregnancy was associated with a significantly increased risk of Low birth weight (LBW). Iron Folic Acid Supplementation (IFAS) adherence was low among pregnant women, which was similar to the Konje et al. (2022), who found that initiating ANC in the 2nd or 3rd trimester and lower or no formal education were significantly associated with poor compliance. The study showed that most pregnant mothers attended the first ANC clinic when they were above four months of pregnancy. This is also supported by a study in Tanzania, where only 24% of pregnant women attend ANC clinics before the 24th week of their pregnancy (MOH, 2016).

CONCLUSION

The study underscores the limited dietary diversity among pregnant women, impacting the consumption of various food groups. While most mothers displayed normal nutrition status based on MUAC measurements, their nutritional status was notably linked to dietary practices, emphasizing the need for a more diverse diet. Moreover, a majority of mothers exhibited low iron levels, marked by reduced hemoglobin levels, influenced by inadequate adherence to iron and folate supplementation. Pregnancy-related anemia remains a significant concern, given the suboptimal compliance with WHO-recommended preventive measures.

RECOMMENDATIONS

We recommend the following actions based on the study findings: implementation of nutrition education programs to enhance dietary diversity among pregnant women and raise awareness of balanced diets. Efforts should be directed towards improving adherence to iron and folate supplementation, including innovative strategies like mobile health reminders. Encouraging early initiation of antenatal care during the first trimester is essential for timely intervention in cases of iron deficiency anemia. Leveraging community outreach programs for the dissemination and promotion of these recommendations is critical to achieving improved maternal and infant health outcomes.

Conflict of interest

Authors declare no conflict of interest.

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