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Nutrition Knowledge and Dietary Intake of Vitamin A and Iron Among Lactating Teenagers in Referral Hospitals in Kisumu County, Kenya

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ABSTRACT

Introduction: Vitamin A and iron are essential micronutrients during lactation and deficiencies could have adverse health consequences for lactating teenage mothers. Teenage pregnancy is one of the main health problems in Kisumu County. Teenage pregnancy was singled out as one of the major health issues facing youth in Kisumu County. The teenage population in the county is faced with increased dietary intake of processed foods and rising prices for fresh, nutrient-dense foods. Kenya lacks adolescent-specific data in its National Health Information Management Systems, which makes it difficult to track micronutrient status of teenagers. Therefore, the aim of this study was to assess the nutrition knowledge and dietary intake and of vitamin A and iron among lactating teenage mothers aged 14-19 years in Kisumu County.

Materials and methods: A cross-sectional analytical study design was adopted, targeting a sample size of 121 mothers with infants aged 0 to 23 months but data was collected on a sample of 104 respondents. Proportionate to size sampling and systematic random sampling were employed to select the intended sample from every hospital. A questionnaire was used to gather information on the maternal demographic and socio-economic characteristics of the mothers. Nutri-Survey software was used to analyze dietary intake data from the 24-hour dietary recall and 7-day food frequency questionnaire. Data for both descriptive and inferential statistics was analyzed using Statistical Package for Social Sciences (SPSS) version 20.0. For relationships, chi -square was utilized between categorical variables while Pearson correlation was used for non-categorical variables. In all the analyses, a P-value of $\leq$ 0.05 was considered significant.

Results: The findings revealed that majority (95.2%) of the teenage mothers were aged between 18 and 19 years. Majority (56.7%) of the mothers were married while 40.4% were single. Majority (95.2%) had one to two children, while 69.2% had attained primary school level of education. About a third (61.5%) of the mothers had inadequate dietary intake of vitamin A which was below the recommended range of 1200mcg per day for the 14-18 years old mothers and 1300mcg for those aged 19 years and above. Almost half (51.9%) of the teenage mothers had inadequate consumption of iron rich foods which was below the recommended range of 10mg/day for age 14 to 18 years and 9 mg/day for those aged 19 years. About a half (48.1%) and (53.2%) of the teenage mothers were found to have moderate nutritional knowledge on vitamin A and iron consumption, respectively. The study revealed

that only individual dietary diversity score and household income per month had a positive correlation (P<0.05) with vitamin A and iron intake.

Conclusion: In conclusion, the study has shown that inadequate dietary intake of vitamin A and iron is a health concern among lactating teenagers despite most of them having moderate nutrition knowledge on the micronutrients. Mainly due to low and medium IDDS as influenced by low household income. The researcher recommends that nutritionists and dieticians in the health facilities should apply skills-based interventions that focus on dietary diversity, food preparation and meal selection for lactating teenagers. Similar studies should be done to establish the barriers and enablers of good nutrition status among lactating teenage mothers and best strategies for interventions at community level since there is limited data on this target group.

Keywords: Nutrition knowledge, dietary intake, vitamin A, iron, lactating teenagers

INTRODUCTION

Background information

Women are regarded as nutritionally vulnerable during lactation (Unisa et al., 2021) because a woman's health and well-being during this stage are greatly influenced by her nutrient intake. Studies have shown that inadequate dietary intake, physiological alterations and diverse socio-demographic factors significantly contribute to these nutrient deficiencies (Gay, 2018). Globally, deficiencies in vitamin A and iron stand out as the most significant as they pose a significant risk to the well-being of populations in low-income countries (World Health Organization, 2004).

Despite an optimistic global decrease over the past 10 years from 1 in 4 to 1 in 5 girls aged 18 years and below being married, the current rate of decline is insufficient to meet the Sustainable Development Goal of ending child marriage by 2030. In Kenya, early marriages have been decreasing. From 2014 to 2022, the proportion of girls aged 15-19 who had ever been married dropped from 13.2% to 8.4% (KNBS and ICF, 2023). Often, child marriage itself is the main path to early childbearing. With 82 births per 1,000 live births, Kenya has the third-highest incidence of teenage pregnancies worldwide (National Council for Population and Development, 2020). This has significantly been attributed to early marriages. A teenage mother is faced with high metabolic demands, unhealthy dietary patterns and nutrition vulnerability which could exacerbate undernutrition as she adds her own immaturity and growth needs to those imposed on her by the pregnancy (Mollborn, 2017).

Iron is necessary for the development of the brain, whereas vitamin A is necessary for good eye vision and overall human health (World Health Organization [WHO], 2004). There are several ocular signs of severe Vitamin A Deficiency (VAD), with xerophthalmia being the most prevalent (WHO, 2014), while inadequate intake of iron could lead to iron deficiency anaemia (IDA) (Steinbicker & Muckenthaler, 2013; Shokrgozar & Golafshan, 2019).

Iron deficiency anaemia is a critical concern for teenage girls and WRA (Gebreyesus et al., 2019; Habib et al., 2020; Mengistu et al., 2019) potentially due to factors such as nutrient deficiencies, diseases, parasites (Engidaw et al., 2018), menstruation (WHO, 2001) and elevated need for iron during pregnancy (Annan et al., 2021). Furthermore, iron deficiency stands as the most widespread micronutrient deficiency among adolescents globally (Bailey et al., 2015). While there is a scarcity of global data specific to lactating adolescents, it is approximated that 30% of adolescents are anaemic (UNICEF, 2012). Moreover, research indicates that about 27% of adolescents residing in LMICs experience anaemia, which is linked to lack of iron (Sharourou et al., 2018). Additionally, adolescents' diets in these countries are characterized by inadequate intake of iron

rich foods and this exacerbated by higher rates of illness due to parasitic infections, which further raises the population's need for iron (Zeleke et al., 2020).

Vitamin A is a crucial nutrient for adolescents because of its role in promoting growth and physical maturation (WHO, 2009a). Inadequate levels of vitamin A also play a role in increasing maternal mortality and negatively affecting pregnancy and lactation outcomes and it also it weakens the body's capacity to fight infections (WHO, 2009b). Common characteristics of populations with maternal vitamin A deficiency include low socio-economic status, weak immune systems and insufficient dietary intake (Seid et al., 2015). The increase in vitamin A requirements during lactation is due to the increased vitamin A demand to nourish the breastfeeding child and restore the quantity lost during lactation and this could potentially result in vitamin A deficiency for the mother (Henjum et al., 2015). According to research, women' vitamin A consumption can affect their own vitamin A levels, the composition of their breastmilk, as well as their children's vitamin A status and health outcomes (Gannon et al., 2020). Despite the increased need for vitamin A during lactation, little is known about the prevalence of vitamin A insufficiency among lactating women worldwide and how breastfeeding affects women' vitamin A status.

The Kenyan Ministry of Health (MoH) estimates that 21.3% of non-pregnant women aged 15-49 years, experience iron-deficiency while about 1.1% experience VAD, (Ministry of Public Health Services [MoPHS] & [SCUK], 2011). However, both internationally and in the Kenyan context, there is limited knowledge regarding the prevalence of vitamin A and iron insufficiency among lactating teenage mothers. Study shows a negative correlation between prevalence of IDA and VAD among non-pregnant women even though foods rich in iron and vitamin A are similar. Moreover, the co-existence of VAD and anemia is widely acknowledged (Ahmed et al., 2006; Hashizume et al., 2005; WHO, 2017; Visser et al., 2019). Additionally, pregnant women in Ghana have been reported to have deficiencies of both iron and vitamin A (Gernand, et al., 2019). Similar findings have been observed among pregnant women in Ethiopia (Fite et al., 2023).

Kenya has policies and guidelines on interventions to curb micronutrient deficiencies among lactating women such as advocacy for dietary diversity. There are also policies recommendations and guidelines on nutrition care and support of teenage mothers emphasizing on the need for extra care, more food and more rest than an adult mother. However, the existing adolescent programs are disjointed, characterized by insufficient coverage and lack of effective and efficient implementation, monitoring and evaluation.

Problem statement

In the national and international investment, policy and programming have significantly overlooked the nutritional needs of adolescents. Teenagers in Kisumu County face negative attitudes of healthcare providers, expensive services and inadequate privacy and confidentiality when attempting to access information and/or services related to sexual and reproductive health (Mutea et al., 2020). Teenage pregnancy was singled out as one of the major health issues facing youth in Kisumu County (National Council for Population and Development, [NCPD], 2017). The prevalence of teenage pregnancy in Kisumu County stands at 11.1%, slightly lower than the prevalence of teenage pregnancy in Kenya which stands at 15% (Kenya National Bureau of Statistics (KNBS) and ICF International, 2023).

This has manifested itself in other socio-economic outcomes such as, poor health, illiteracy and poverty in Kisumu (National Council for Population and development, 2021; World Bank, 2016). More than 65% of the county's population reside in informal

housing areas and peri urban areas (Kenya National Bureau of Statistics, 2019). These informal settlements are largely faced with inadequate opportunities for the youth and increased dietary intake of processed foods high in sugar, salt, fat and sugar and rising prices for fresh, nutrient-dense foods (Opiyo & Agong, 2020).

Adolescent mothers are a particularly vulnerable group to nutrient deficiencies due to intense energy utilization and increased nutrient requirements that characterize adolescence. There is concern that millions of teenage girls and women may gravitate to inexpensive, highly processed meals that are heavy in sugar, salt and harmful fats but lacking in vital nutrients as a result of rise in poverty and inequality in low- and middle-income nations (UNICEF, 2023).

The primary dietary causes of both iron and vitamin A deficiency are a diet inadequate in variety and insufficient consumption of animal source foods (Ross & Harrison, 2006). Although, various locally produced foods found in Kenya are rich in vitamin A, micronutrient deficiencies continue to pose a challenge to Kenya's vulnerable populations.

In Kenya, the National Adolescent Sexual and Reproductive Health Policy offers strategies to government ministries and relevant partners on addressing adolescent needs (Ministry of Health, 2015). In spite of these efforts, teenage sexual and reproductive health services are still poorly coordinated, used and implemented. As a result, there is still a vacuum in the availability of these crucial adolescent health services and dietary information.

Many countries, including Kenya, have insufficient adolescent-specific data in their National Health Information Management Systems, which makes it difficult to track certain indicators relating to adolescents. For significant indicators like anemia, vitamin A deficiency and morbidity patterns, which are recorded in maternal population surveys, lactating teenagers' data is usually merged with lactating WRA. This paucity of data poses a significant challenge in programme development for lactating teenagers. Furthermore, out-of-school teenage mothers continue to have low coverage in access of health services. This population faces greater risks of malnutrition due to them being geographically dispersed, being frequently ignored by the health system and likely living in areas with limited resources. Therefore, to address, this gap, this study was aimed at determining the nutrition knowledge and dietary intake of vitamin A and iron among lactating teenagers in Kisumu County.

MATERIALS & METHODS

Research design

A cross-sectional analytical study design was employed, utilizing both qualitative and quantitative techniques for data collection, analysis and presentation. This design was appropriate since the participants were assessed at a single point in time (Katzenellenbogen et al., 1997). The dependent variable in this study was dietary intake of vitamin A and iron. The independent variables were maternal demographics, socio-economic characteristics and nutrition knowledge on vitamin A and iron.

Study area

This study was carried out in referral hospitals in Kisumu County, within Kisumu County, Kenya. Kisumu County area purposively selected as the prevalence of teenage pregnancy in Kisumu County stands at 11.1%, slightly lower than the prevalence of teenage pregnancy in Kenya which stands at 15% (Kenya National Bureau of Statistics (KNBS) and ICF International, 2023). Most of the residents of the area experience challenges such as undernutrition, illiteracy and poor health (KNBS and Society for International Development–East Africa (SIDS), 2013). The common economic activities practiced in Kisumu central sub-county include fishing, agriculture with some residents exploring the limited

opportunities in business and public service (KNBS, 2011).

Target population

This study targeted lactating teenage mothers aged 14-19 years who were breastfeeding their 0-23 months old children at the time of the study. Teenage mothers are faced with high metabolic demands, nutrition vulnerability, inadequate access to health services and limited income generating skills.

Inclusion criteria

Lactating teenage mothers ages 14-19 years with children aged 0-23 months and willing to voluntarily participate were included in the study.

Exclusion criteria

Lactating teenage mothers who were critically ill and unable to withstand the interviewing process and those who declined to consent in the study were excluded from this study.

Sampling size determination

From hospital records in October 2019, Jaramogi Oginga Odinga Teaching and Referral Hospital had a population of 80 lactating teenagers and Kisumu County Hospital had 59 lactating teenagers making a total of 139. The sample size was determined using statistical tables by Bartlett et al. (2001) and Israel (2013)

The tables provided the required sample size based on specific criteria. In this study, a p-value of <0.05 was deemed statistically significant and the standard deviation at a 95% confidence level was established as 1.96. The sample size for this study was estimated to be 110 lactating teenage mothers based on a sampling frame of 139 lactating teenagers at Kisumu County Hospital (KCH) and Jaramogi Oginga Odinga Teaching and Referral Hospital (JOOTRH). The realized sample of 110 was increased by 10% to account for non-response, yielding a final sample size of 121 lactating teens. To estimate the sample size of teen mothers in each hospital, proportionate to size sampling was used. There were 70 teenagers at Jaramogi Oginga Odinga Teaching and Referral Hospital and 51 at Kisumu County Hospital.

Sampling techniques

Kisumu County was purposively selected because of the high prevalence of teenage mothers. The study was carried out in Kisumu County Referral Hospital (KCRH) and Jaramogi Oginga Odinga Teaching and Referral Hospital (JOOTRH). These are the two main referral hospitals in Kisumu County. To calculate the sample size of teenage mother in each hospital, proportionate to size sampling was used. From a list of lactating teenagers visiting the post-natal and well-baby outpatient clinics in each hospital, systematic random selection was utilized to choose the appropriate sample. The initial number was chosen from a table of random numbers. After that, each n^{th} number was taken.

Data collection tools

Data on demographic and socioeconomic characteristics, nutrition knowledge and dietary intake of vitamin A and iron among lactating teenagers were gathered using a standardized questionnaire. Maternal demographics and socio-economic data included; age, marital status, household size, access to maternal knowledge, occupation, education and income levels.

The 24-hour recall was utilized to gather thorough data on all meals and drinks that the respondent ingested 24 hours prior to the survey. The 24-hour dietary recall minimizes recall bias and it has been used in several studies (Arimond & Ruel, 2004; Kennedy et al., 2007; Savy et al., 2005). The Individual Dietary Diversity Score (IDDS) serves as an indicator of the nutrient quality in food (FAO, 2010). It was computed by considering 9 food groups derived from information collected in 24-hour dietary recalls. The frequency of foods high in vitamin A and iron was measured using a 7-day Food Frequency

Questionnaire (FFQ). The Food Frequency Questionnaire is a valid and consistent instrument utilized for assessing food security (Vioque et al., 2013).

Ten multiple-choice questions on knowledge were used to evaluate the level of nutrition knowledge. and understanding of vitamin A and iron. The scores were intended to assess vitamin A and iron knowledge on dietary recommendations, amounts of food categories required to sustain health and health. The questionnaire was pre-tested to ensure validity and reliability

Data collection procedures and techniques

Three research assistants were fluent in English, Kiswahili and Luo (the language used by people living in the study region) and they each had a minimum of a Diploma in Food, Nutrition and Dietetics. They were recruited and received five days of training on the research instruments. The ethics, goals and aim of the study, as well as how to utilize the data gathering tools, were covered in a two-day training.

Face-to-face interviews with the mothers took place at the health facilities. The questionnaires were verbally translated to Dholuo and Kiswahili languages during data collection in instances was the respondent was unable to understand English. The provided responses were documented in the questionnaire.

The nutritional intake of the lactating teenagers was assessed using the 24-hour recall approach. The 24-hour recall sheet was used to capture the information after the researcher asked the respondents to list the items and amounts of foods and beverages they had ingested in the previous 24 hours. Household measurements and the Photographic Food Atlas for Kenyan Adolescents, 2018 were used to provide estimates of food portion sizes consumed. Each of the participants were asked to give the ingredients used as well as the amounts of the ingredients. The Food Frequency Questionnaire was used to collect data on the respondents' dietary habits in terms of frequency of intake. This was based on seven-day frequency.

Assessment of nutrition knowledge

Ten multiple-choice questions were used to assess nutrition knowledge. A correct response was coded as 1 and a wrong response classified as 0.A marking scheme was used for the nutrition knowledge assessment. The total score for each mother was calculated from all correct responses with a maximum score of 10.

Data analysis and presentation

Cleaning, coding, entering and analysis data was then done using Statistical Package for Social Sciences Version 20.0.0. Nutri-Survey software was used to analyze dietary intake data from the 24-hour recall and FFQ. The Recommended Daily Allowance (RDA) for vitamin A for Lactating teenagers aged 14-18 years is 1,200µg RAE/day and for mothers aged 19 years is 1300µg RAE/day while iron for lactating teenagers aged 14-18 years is 10mg/day respectively and for mothers aged 19 years is 9mg/day (Institute of Medicine [IOM], 2002). To determine the percentage of respondents who consumed enough nutrients nutrient intakes were compared to RDAs.

Using the information collected from the 24-hour recall the DDS for the participants was derived using the 2010 FAO guideline for measuring household and individual dietary diversity (FAO, 2010). To assess dietary diversity, a scale of 9 food groups; grains, roots and tubers, dark green leafy vegetables, other vitamin A rich-fruits and vegetables, other fruits and vegetables, organ meat, meat and fish, eggs, legumes, nuts and seeds, milk and milk products was considered.

STATISTICAL ANALYSIS

Data from the Individual Dietary Diversity Score was categorized into three levels: low (≤4 food groups), medium (5 food groups), and high (≥ food groups) (FAO, 2010).

Analysis of the nutrition knowledge questionnaire, the rating of the scores was adopted from (Ongosi, 2010) where a rating of 0-4 indicated low knowledge, 5-8; moderate knowledge and 9-12 indicated high knowledge. Descriptive statistics such as frequencies and percentages for categorical data and means and standard deviations for continuous variables were done. To examine relationships between categorical variables, chi-square was utilized while correlation was used to establish if there were any significant relationships between study variables. Statistical significance was set at $p \leq 0.05$.

RESULTS

Demographic characteristics of the lactating teenage mothers

Most (95.2%) of the teenage mothers were aged between 18 and 19 years. The mean age of the mothers was 18.14 years. Slightly more than a half (56.7%) of the mothers were married. Moreover, majority (95.2%) of the mothers had between one and two children (Table 4.1). Additionally, almost a third (69.2%) of the teenage mothers had completed primary school level education (Table 1).

Table 1: Demographic characteristics of the lactating teenage mothers in referral hospitals in Kisumu County

Variable	Response	n (104)	%
Age (completed years)	14-17	5	4.8
	18-19	99	95.2
Marital status	Single	42	40.4
	Married	59	56.7
	Widowed	3	2.9
Parity	1-2	99	95.2
	3-4	5	4.8
Mothers' education level completed	Primary level	72	69.2
	Secondary level	32	30.8
Occupation	Unemployed	50	48.0
	Casual worker	6	5.8
	Formal employment	1	1.0
	Self-employment	5	4.8
	Housewife	27	26.0
	Small-scale farmer	2	1.9
	Student	13	12.5

Socioeconomic characteristics of the lactating teenage mothers

Most (70.2%) of the mothers said there was a health facility available near their homes. Notably half (53.8%) of the teenage mothers had a household size of between five to seven people. Almost a third (70.2%) of the mothers admitted having received nutrition education counselling. Notably, almost half (48.0%) of the teenage mothers were unemployed while only 1% of the mothers had formal employment.

Moreover, almost half (42.3%) the teenage mothers relied on their husband as their primary source of the household income. The level of household income per month was low since almost a third (29.8%) of the mothers had a household income of less than five thousand Kenya shillings a month. Additionally, 28.8% of the mothers had household income of between ten thousand and one Kenya shillings and fifteen thousand Kenya shillings. However, only 3.8% of the mothers had a high household income of between twenty-five thousand and one and thirty thousand Kenya shillings (Table 2).

Table 2: Socioeconomic characteristics of the lactating teenage mothers in referral hospitals in Kisumu County

Variable	Response	n (104)	%
Household size	2-4	41	39.4
	5-7	56	53.8
	>7	7	6.8
Main source of income	Sale of agricultural produce	2	2.0
	Business	8	7.7
	Casual labour	7	6.7
	Husband	44	42.3
	Parents	30	28.8
	Relatives	13	12.5
Household income per month	<5,000	31	29.8
	5,001- 10,000	18	17.4
	10,001- 15,000	30	28.8
	15,001- 20,000	14	13.5
	20,001- 25,000	7	6.7
	25,001- 30,000	4	3.8

Health seeking behaviour of the lactating teenage mothers

Most (70.2%) of the mothers said there was a health facility available near their homes. It was also evident that almost a third (64.4%) of the teenage mothers had to travel for a distance between three to five kilometers in search of a health facility (Table 3).

Table 3: Health seeking behaviour of the lactating teenage mothers in referral hospitals in Kisumu County

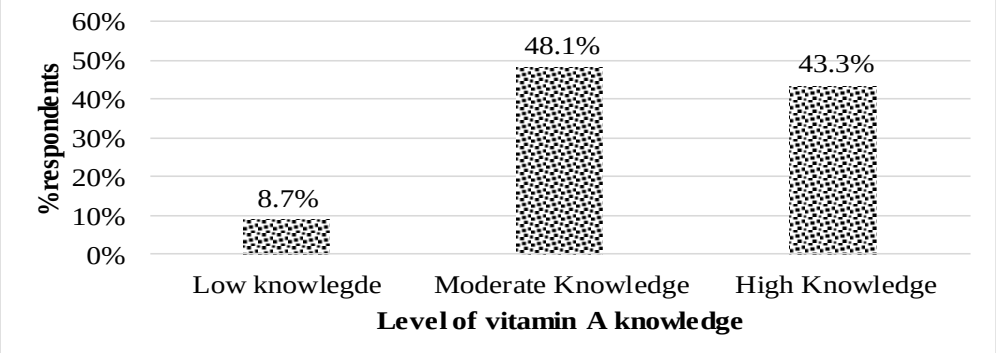
Variable	Response	n (104)	%
Availability of health facility near home	Yes	73	70.2
	No	31	29.8
Distance to health facility in km	1-2	20	19.2
	3-5	67	64.4
	>5	17	16.4
Access to maternal health services for nutrition education counselling	Yes	73	70.2
	No	31	29.8

Nutrition knowledge among lactating teenage mothers

Nutrition knowledge on vitamin A

To establish nutrition knowledge on Vitamin A, mothers were asked questions and rating of 0-4 indicated low knowledge, 5-8; moderate knowledge and 9-12 indicated high knowledge. About half (48.1%) of the teenage mothers were found to have moderate nutritional knowledge on vitamin A (Figure 1). However, only 8.7% of the teenage mothers had poor nutritional knowledge on Vitamin A.

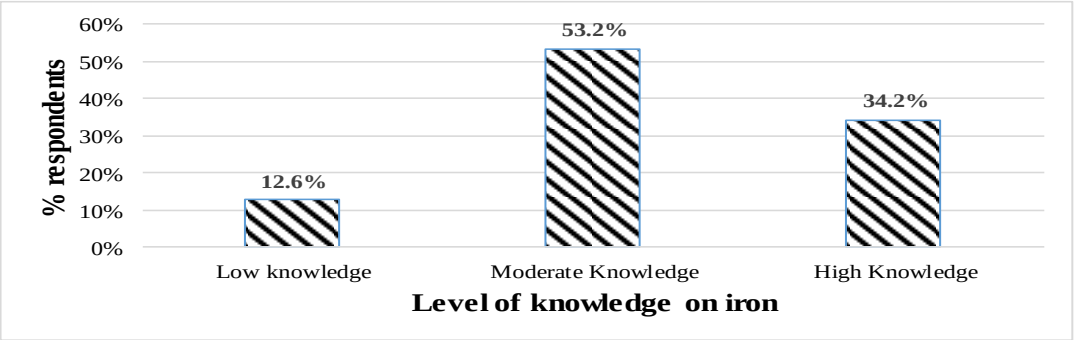
Figure 1: Vitamin A knowledge levels of the lactating teenage mothers in referral hospitals in Kisumu County



Nutrition knowledge on iron

To establish nutrition knowledge on iron, Mothers were asked questions and results were categorized into low knowledge, moderate knowledge and high knowledge. About a half (53.2%) of the teenage mothers had moderate nutritional knowledge on iron consumption (Figure 2). However, only 7.7% of the teenage mothers had low nutritional knowledge on iron.

Figure 2: Nutrition knowledge on Dietary Intake of Iron of the lactating teenage mothers in referral hospitals in Kisumu County



Dietary intake of Vitamin A and iron

Commonly consumed food sources

The proportion consuming Vitamin A rich food were Orange flesh and sweet potatoes (45.2%), Omena (83.7%) and fresh milk (88.5%). For iron it was kales (97.1%), cow peas (51.9%), beef (81.7%) and chicken (42.3%). (Table 4)

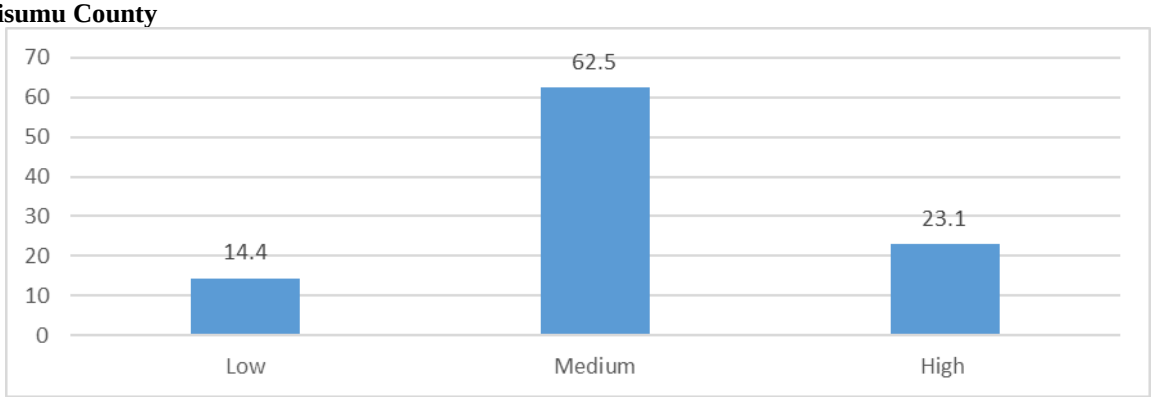
Table 4: Dietary intake of Vitamin A of the lactating teenage mothers in referral hospitals in Kisumu County

Variable	Response	n (104)	%
Vitamin A	Orange flesh and sweet potatoes	47	45.2
	Omena	83	83.7
	Fresh milk	92	88.5
Iron	Kales	101	97.1
	Cow peas	54	51.9
	Beef	85	81.7
	Chicken	44	42.3

Individual dietary diversity score

The mean Individual Dietary Diversity Score (IDDS) was 5.32 ± 2.53 food groups (Range; 3-10). Majority (62.5%) of the participants were in the medium category (Figure 3)

Figure 3: Individual dietary diversity score among the lactating teenage mothers in referral hospitals in Kisumu County

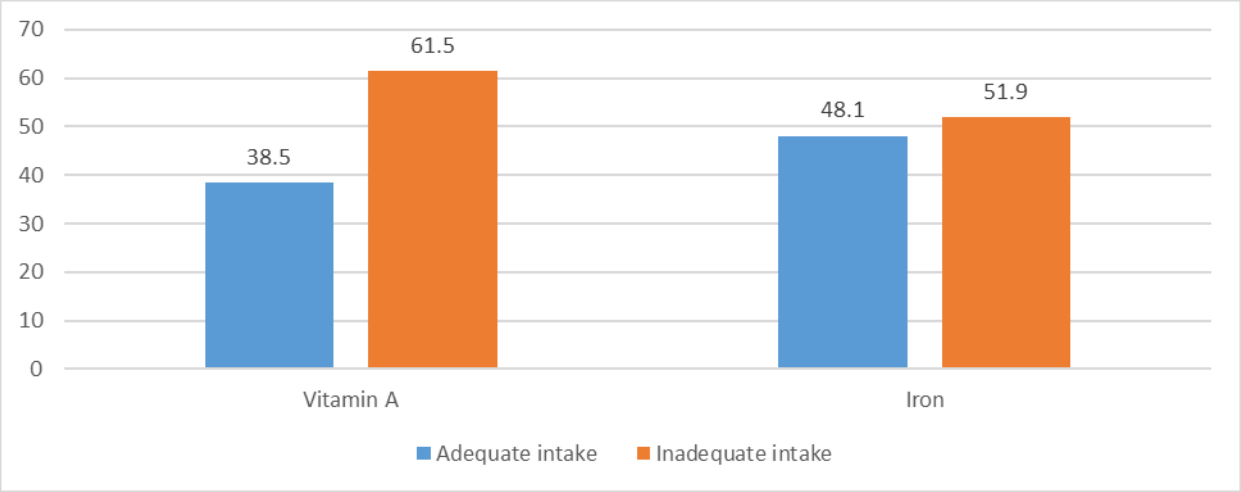


Adequacy of vitamin A and iron intake

For vitamin A, almost two thirds (61.5%) of the teenage mothers were found to have consumed inadequate amount of vitamin A. Notably, the consumption of vitamin A using the food groups was found to be inadequate. The average vitamin A consumption for the teenage mothers was 1143 ± 630.677 (Table 4.3) which was below the recommended range of 1200mcg per day for the 14-18 years and 1300mcg for 19 years and above (Institute of Medicine [IOM], 2002).

For iron, almost half (51.9%) of the teenage mothers had inadequate consumption of iron. Additionally, the mean dietary intake for the iron was not optimal since the mean consumption was 8.53 ± 3.521 mg and this was less than the daily required amount of the teenage mothers which is 10mg for age 14 to 18 years while for age 19 years and above it is 9 mg in a day (Figure 4).

Figure 4: Adequacy of vitamin A and iron intake among the lactating teenage mothers in referral hospitals in Kisumu County



Relationship between study variables and dietary intake of vitamin A and iron among lactating teenagers

The study for income and dietary diversity score had a significant relationship ($p<0.05$) with dietary intake of both vitamin a and origin but no significant relationship ($p>0.05$) as noted with knowledge (Table 5)

Table 5: Relationship between study variables and dietary intake of vitamin A and iron among lactating teenagers

		P value
Income	Vitamin A	0.01
	Iron	0.04
Knowledge on dietary intake	Vitamin A	0.51
	Iron	0.38
Dietary diversity score	Vitamin A	0.02
	Iron	0.04

DISCUSSION

Demographic and socioeconomic characteristics of lactating teenage mothers

Majority of the teenage mothers in this research were between the ages of 18 and 19 years. This was consistent the KDHS 2022 data illustrates a steep rise in the proportion of teenagers experiencing pregnancy as they grow older; pregnancy rates surged from approximately 3% among 15-year-olds to 31% among 19-year-olds (KNBS and ICF, 2023). This may be related to less parental and adult supervision (Juma et al., 2014) and possibly greater time for sexual encounters (Njue, Voeten, & Remes, 2009).

Majority of the teenage mothers were married. This was in agreement with a study that showed that early marriages are prevalent in Nyanza region has the second highest (46%) of early marriages in Kenya (Okello et al., 2023). Majority of the

mothers had between one and two children. This could be so because young parents may delay having more children until they are more financially secure (Safdari-Dehcheshmeh et al., 2023). Additionally, the study population resided in an urban area where family sizes tend to decrease and other obligations are possibly prioritized. The results were in line with a research carried out in Nairobi, Kenya, where most lactating mothers had just one child (Ongosi, 2010). Nevertheless, this finding contradicted a study conducted in Kenya, where a group of adolescent mothers and exhibited a tendency to have a larger number of family members and children in their households compared to the group of non-adolescent mothers (Kumar & Huang, 2021).

Education is paramount especially among women of reproductive age since it empowers them to make decisions that affect their health as well as their infants (Dadzi & Adam, 2019; Hundera et al., 2015; Win & Ko, 2018). According to this study's findings, the majority of teenage mothers only had primary school education. The findings agree with a study conducted in Kenya, which revealed that mothers with a history of adolescent pregnancy were less likely to have secondary or higher education compared to mothers without such a history (Kumar & Huang, 2021). Additionally, a study conducted in Mandera County, Kenya, noted that illiteracy was high among pregnant adolescents (Abdirahman et al., 2019).

Majority of the teenage mothers acknowledged there was a health facility near their home. This was in line with a research carried out in Transmara East Sub-County Narok County, Kenya where most (67.2%) of the lactating teenage mothers accessed the health services within one to five kilometers (Okeyo et al., 2019). Additionally, most of the mothers said they had received nutrition education counselling and were generally satisfied with quality of nutrition services provided in the health facilities. However, this was in contrary to Kumar et al., 2018 who emphasized that pregnant and parenting adolescents from economically and socially disadvantaged settlement contexts in Kenya encountered numerous hardships, including limited access to healthcare services.

Majority of the teenage mothers were unemployed and relied on their husband for sustenance. This can be the case since childcare obligations limit their options for returning to school or looking for work. Similarly, studies conducted in Sub-Saharan Africa, show that majority of adolescent mother were unemployed (Lempp et al., 2018; Kumar & Huang, 2021).

Most of the teenage mothers had a household income of less than five thousand Kenya shillings indicating they were from poor economic backgrounds. The Kenya Poverty Report (2023) classifies individuals (or households when income is calculated collectively) who spend below KSh 7,193 monthly in urban regions as experiencing general poverty or being categorized as overall poor. Notably a study done in Nairobi, Kenya showed some of the lactating mothers earned less than five hundred shillings and some of them didn't know the amount since they either relied on their spouse for sustenance (Ongosi, 2010).

Nutrition knowledge on vitamin A and iron among lactating teenage mothers

Nutritional knowledge has been found to positively influence or not influence the dietary choices of an individual (Baytekus et al., 2019). Micronutrient deficiencies among adolescents have received limited attention, despite their heightened nutritional vulnerability (PAHO, 2011). The current study found majority of the teenage lactating mothers to have moderate knowledge on vitamin A and iron knowledge. This may be attributed to the contribution on non-governmental programs targeting pregnant and postpartum adolescents in Kisumu County which have achieved notable advancements in enhancing health and social outcomes for teenage mothers. Concurring with this

study, another investigation carried out in Uganda showed most of the mothers had sufficient knowledge in vitamin A (Nankumbi et al., 2022). In Kenya, a study found that schoolchildren in Nairobi have a moderate understanding of nutrition and exhibited inadequate dietary practices correlated with a negative attitude (Mbithe et al., 2008). A study conducted in Zimbabwe showed that despite adolescent girls contributing to cooking and production of meals at home, most still had inadequate levels of nutrition knowledge (Reese-Masterson & Murakwani, 2016). However, a study in Mandera, Kenya indicated lack of adequate nutrition knowledge among young pregnant adolescents (Abdirahman et al., 2019). Despite possessing moderate nutrition knowledge, adolescents' dietary intake does not necessarily reflect this understanding.

Dietary intake of vitamin A among lactating teenage mothers

Vitamin A is one of the nutrients required by the body for various functions such as immunity and normal development of the foetus (Adams, 2016). The current study found that majority of the teenage mothers had consumed orange fleshed sweet potatoes. The value of the orange fleshed sweet potato is recognized for its significant contribution to addressing Vitamin A deficiency and its role in improving vitamin A status among postpartum women in Kenya (Girard et al., 2017). However, in Mwanamukia Nairobi, lactating women had the low consumption of sweet potatoes (Nkirigacha et al., 2016).

Fresh milk was consumed by most of the teenage lactating mothers. Even though the mothers were accessed in a health facility, most of them had access to fresh milk in their residence. Moreover, dietary patterns and nutritional adequacy among the youth in Nairobi, Kenya revealed that milk and its products were rarely consumed (Kimani et al., 2021).

Small fish are among the least expensive fish species when compared to other sources of animal protein (Funge-Smith & Bennett, 2019). This study found most of the teenage lactating mothers consuming the Silver cyprinid (Omena). This could be attributed to the fish being available in Kisumu because of its closeness to Lake Victoria. Additionally, majority of households cited frequent consumption of Omena due to its low cost in a Food and Nutrition Baseline Survey Report in Kisumu (Nasongo & Okeyo-Owuor, 2017). Similar results were also observed in lactating women in Western Kenya who ate more fish than was generally recommended (Quarpong et al., 2023). However, fish was consumed by less than half (30.6%) of the lactating mothers according to research done in Kenya (Ogallo et al., 2023).

Inadequate vitamin A consumption is a major problem among mothers who are lactating particularly from economically disadvantaged backgrounds. This study identified insufficient vitamin A intake among lactating teenage mothers. This aligns with another study done in Western Kenya which indicated that while vitamin A insufficiency was common in the region, most of the lactating mothers had little knowledge of vitamin A deficiency and the sources of foods high in vitamin A (Oyunga et al., 2016). Similar findings were documented among women in Kenya were there was a high risk of low dietary consumption of vitamin A rich food (Kishino et al., 2022). Additionally, foods high in vitamin A are not widely consumed in East African countries (Wolde & Tessema, 2023).

Dietary intake of iron among lactating teenage mothers

Iron is required by the human body for various biological processes. It plays a crucial role in oxygen synthesis and various other cellular processes (Abbaspour et al., 2014). The body cannot synthesize iron and therefore a need for dietary intake of iron. Heme iron is the best source of iron (Moustarah & Mohiuddin, 2019). Most of the study respondents reported eating beef

as an iron source. Similar findings were documented in research in Western Kenya were the respondents reported ingesting more beef than the average amount that was recommended (Quarpong et al., 2023). Similar dietary intake was reported among women in Kenya where beef stew was among the commonly consumed foods over lunch and dinner (Kishino et al., 2022). Contrary to this, research conducted in Nakuru, Kenya, showed the majority of the women, had not consumed meat, fish and poultry over the previous 24 hour preceding the study (Gitagia et al., 2019) and in Nairobi, where there was low consumption of animal proteins among the youth (Kimani et al., 2021).

Furthermore, most of the teenage lactating mothers consumed kales which is classified as dark green leafy vegetables. This could be attributed to the good quality, cost and availability of kales in Kisumu County (Nasongo & Okeyo-Owuor, 2017).

Notably despite consumption of iron rich foods, most of the teenage lactating mothers had an inadequate iron intake. This may be due to consumption of foods which are low in iron bioavailability. This was contrary with findings from Sub-Saharan Africa which showed less than half (30%) of the lactating mothers had inadequate dietary intake of iron (Wessells et al., 2019). An earlier contradictory study done in Nairobi showed lactating mothers were consuming an adequate intake of iron (Ongosi, 2010). The significantly higher prices associated with the iron-rich food items that were consumed less frequently might be a reason for the dietary patterns shown in this study population.

Individual dietary diversity score of vitamin A and iron among lactating teenagers

The study findings from this study showed that more than half of the mothers had medium dietary diversity. In contrast, a study conducted in Kenya found that around thirty percent of adolescents did not meet their Recommended Dietary Allowances (RDA) for energy, indicating inadequate food intake during this critical nutritional stage (Munene et al., 2019). However, another study focusing on youths aged 15 to 24 in Nairobi, Kenya, reported moderate levels of fruit and vegetable consumption. within the past 24 hours (Catherine et al., 2021).

Relationship between income and vitamin A and iron intake of vitamin A and iron among lactating teenagers

There was no discernible correlation between household income level and vitamin A intake among the study's respondents. This finding is consistent with a study carried out in Nigeria, which demonstrated that variations in income level did not lead to significant changes in the consumption of vitamin A (Adamu & Yusuf, 2012). However, this was in contrast with a study conducted in Ethiopia which showed that lactating mothers from affluent socioeconomic backgrounds were more likely to have an impact on vitamin A consumption. (Aserese et al., 2020). Additionally a study done in India showed lactating mothers from affluent regions were more likely to meet the required vitamin A intake (Rajpal et al., 2021). Similar study done in Pakistan showed that level of income improved on the consumption of vitamins and micronutrients (Shabnam et al., 2021).

A study in Senegal on factors influencing the food-intake practices affecting iron deficiency anemia among Senegal mothers also revealed that income level influenced the food-intake practices affecting iron deficiency anemia (Oh & Lee, 2020).Similarly, a study done in India found unemployed lactating women were more likely to have a poor dietary iron intake due to poor purchasing power (Siddiqui et al., 2017). On the other hand, a study conducted in India showed that there was no association between employment status and iron level among lactating mothers (Rai & Mishra, 2021).

The amount of iron consumed was shown to be significantly correlated with monthly household income among the study respondents. The purchasing power of an individual affects dietary intake and ultimately nutrition status (Fallo et al., 2019). This was in line with an Indian research that found lactating mothers from economically advantaged areas were more likely to consume the necessary amount of iron (Rajpal et al., 2021). In addition, socioeconomic level was shown to have an impact on the food-intake practices that affected iron deficiency anaemia among Senegalese mothers (Oh & Lee, 2020). Similar findings were made in an Indian study that found breastfeeding mothers without jobs were more likely to have poor dietary iron consumption due to their restricted ability to buy food (Siddiqui et al., 2017). However, a research done in India found no relationship between lactating mothers' employment status and their iron levels (Rai & Mishra, 2021).

Relationship between nutrition knowledge on vitamin A rich foods and dietary intake of vitamin A and iron among lactating teenagers

The current study result found a significant relationship between maternal nutritional knowledge on vitamin A and dietary intake of Vitamin A. This contradicts a Tanzanian research that found lactating women's knowledge of nutrition did not significantly affect their use of foods high in vitamin A (Ndau et al., 2016). In a research among lactating mothers done in Ethiopia, similar results were revealed (Aserese et al., 2020).

Furthermore, several studies have revealed a substantial link between knowledge of foods high in vitamin A and intake of those meals (Jones et al., 2005; Nankumbi et al., 2022).

The study's findings revealed no relationship between maternal iron consumption and dietary awareness of iron. Similarly, a study conducted by Spronk et al. (2014), indicated that Maasai women's understanding of nutrition did not affect their dietary consumption of iron. However, a study carried out in Ghana revealed that women's dietary consumption of iron was significantly influenced by their level of nutrition knowledge (Adjei-Banuah et al., 2021).

Relationship between individual dietary diversity score and dietary intake of vitamin A and iron among lactating teenagers

Inadequate vitamin A intake is a concern in different age groups due to inadequate dietary diversity. One of the key strategies to improve vitamin A intake is through dietary diversity. Researchers have also documented that irrespective of age, women are at risk of nutrient inadequacy due to sufficient intake of vitamin A and other micronutrients (Devarshi et al., 2021). Age did not affect the diversity of among women living in areas with minimum agricultural potential in Nakuru County, Kenya (Gitagia et al., 2019). Moreover, according to research conducted among women in Laikipa County, Kenya, there was no statistically significant correlation between age and dietary diversification (Kiboi et al., 2017).

This study showed a significant relationship between dietary diversity and vitamin A and iron intake. This suggests that as dietary diversity improved, the nutrient intake of the respondents also increased. Similarly, a study conducted among pregnant adolescents in Ethiopia, found that the prevalence of insufficient dietary practices was notably linked to a negative attitude towards dietary diversity (Tesfaye et al., 2024). The high prevalence of inadequate dietary practices among lactating teenagers is a significant public health concern as it can lead to micronutrient deficiencies, which can impact maternal outcomes. These findings highlight the need for interventions aimed at improving vitamin A and iron intake among lactating teenagers.

CONCLUSION

The study has shown that inadequate dietary intake of vitamin A and iron is a health

concern among lactating teenagers in Kisumu County. Additionally, most the mothers had low to medium moderate dietary diversity, and as such, they still failed to meet the recommended daily allowance of vitamin A and iron. The insufficient intake of these nutrients was attributed to the low-income levels and low quantities of food consumed by the respondents.

Most of the mothers had a moderate nutrition knowledge of foods rich in vitamin A and iron. However, this nutritional knowledge did not significantly predict their consumption of these nutrients. Despite many mothers accessing health facilities for nutrition education and counseling, this did not translate into improved dietary intake of vitamin A and iron. The study also revealed that teenage mothers face numerous barriers, such as early marriage, unemployment, dependency, low income and low education levels, which likely contribute to their inadequate intake of these micronutrients. This observation may be because nutrition education and counseling provided at health facilities was not sufficient to enhance and diversify dietary intake in this high-risk group.

Only nutrition education, counseling and household monthly income showed a significant relationship with iron intake. This is likely because iron is a key nutrient emphasized during pregnancy nutrition counseling, with mothers being encouraged to increase their intake of iron-rich foods to improve maternal and birth outcomes. However, many iron-rich foods are expensive, which likely contributed to the low consumption of iron, as most mothers reported having a household income of less than Ksh.5000 (35 USD). Additionally, the mothers largely relied on their husbands for this income and it can be argued that the husbands may have had significant influence over how it was spent. Therefore, the inadequate consumption of iron-rich foods by the mothers could be attributed to their inability to make key dietary decisions, despite having moderate knowledge about iron-rich foods.

Recommendations

Since the study revealed that nutrition knowledge, did not translate into improved dietary intake of vitamin A and iron, it is crucial that nutritionists and dietitians in the health facilities apply skills-based interventions that focus on dietary diversity, food preparation and meal selection for lactating adolescents. Additionally, involving caregivers and bread winners in the nutritional needs of these teenage mothers is important in ensuring access to healthy and nutrient dense diets.

Iron-rich food consumption has been proven to be influenced by poverty and many respondents have modest salaries and rely on their husbands for support. Adolescents should be included in the planning and execution of programmes by the coalition of stakeholders that supports adolescent programming, advocacy activities and coordination. It should be possible to increase household income through secure employment possibilities that are built around keeping teenagers in school. Older and/or out-of-school adolescents can develop entrepreneurial skills for start-up businesses in vocational training centers.

The study revealed that knowledge of foods rich in vitamin A and iron does not directly translate to adequate intake of vitamin A and iron respectively. The ministry of agriculture can also intensify training programmes for lactating teenagers in certain practical skills. By using techniques like kitchen gardening and growing a range of vegetables rich in micronutrients, they may attain a diverse diet.

Both the national and county governments in Kenya must collaborate on initiatives to address teenage pregnancy. These efforts should include comprehensive sexual and reproductive health programs, that have proven successful in postponing early sexual activity and the establishment of adolescent-friendly environments within primary health centers.

Declaration by Authors

Ethical Approval: Approved

Graduate School of Kenyatta University and Kenyatta University Ethical Review Committee (KUERC) provided research authorization and ethical clearance respectively while a research permit was obtained from the National Council for Science, Technology and Innovation (NACOSTI) License No. NACOSTI/P/21/ 9022. Permission to carry out the study was sought from JOOTRH Ethics and Review Committee and Hospital Administration of JOOTRH through the Chief Executive Officer. Administrative authority to conduct the study was sought from Kisumu County Hospital. Informed consent (written or thumb print) was also obtained from the respondents aged 18-19 years before participating in the study after the study objectives, methodology and benefits were clearly explained.

For teenagers under 18 years of age who were still in the care of their parents/ guardians, informed assent for children and parental consent was obtained from their parents or guardians. To ensure confidentiality, names and other means of identity were not used in this study. Additionally, data collected was also assured and maintained during and after the study. Mothers who were found to have deficiencies of vitamin A and/or iron were referred to the nutrition department at the respective hospitals for nutrition education and counselling on appropriate dietary intake. These included maintaining social distance, wearing masks and frequent hand washing or sanitization.

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