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ASSESSMENT OF DIETARY DIVERSITY, ANTENATAL CARE, FOOD TABOOS, MEAL FREQUENCY, AND NUTRITIONAL STATUS OF PREGNANT ADOLESCENTS IN RURAL MALAWI: A CROSS-SECTIONAL STUDY

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ABSTRACT

High rates of pregnancy during adolescence in Malawi compromise the nutritional status of adolescent mothers and their infants. When a pregnant adolescent is malnourished, she is at risk for health complications. Research focusing on the nutritional status of pregnant adolescents in Malawi is minimal. The purpose of this study was to assess dietary diversity, antenatal care, food taboos, meal frequency, and nutritional status of pregnant adolescents in rural Malawi. The study included sixty-two pregnant adolescents between 15-19 years old. Data collection included the use of a pre-tested questionnaire, standardized dietary diversity survey and measurements of mid-upper arm circumference (MUAC), height, and hemoglobin. Statistical analysis included descriptive analysis, linear and logistic regression. Mean (SD) age was 17.7 (1.2) years. Mean MUAC was 25.9 (2.0) cm; 31% had MUAC <25 cm. The occurrence of stunting was 19% and 21% were ≤150 cm tall. The mean hemoglobin was 10.37 (1.93) g/dL and 66% were anemic. The mean dietary diversity score was 4.06 (1.18) and 69% did not achieve minimum dietary diversity (score ≥ five.) No participants consumed dairy and only 7% consumed eggs. Eating meat and poultry or dark green leafy vegetables predicted a 1.31g/dL (p-value = 0.0306) or 1.08 g/dL (p-value =0.0331) increase in hemoglobin levels, respectively (R^2=0.15). Food taboos during pregnancy were common (35%). Compared to the Malawi National Nutrition Guidelines, 87% were not eating daily from each of the six food groups and 74% were not meeting the recommended meal frequency during pregnancy (three meals and at least one snack/day). Less than 50% consumed foods from legumes/nuts and animal food groups. The majority (63%) did not take antenatal supplements and only 37% consumed ferrous sulfate. Only 52% received advice about nutrition during pregnancy and few (8%) received advice about infant and young child feeding. Girls who received nutrition advice were more likely to take an iron supplement [OR=4.19 (1.82-9.68), *p*=0.0008] compared to those who did not. As the number of antenatal visits increased, the participants were more likely to take a supplement [OR=11.88 (3.40-41.49) *p*=0.001]. Interventions for pregnant adolescents in rural Malawi should occur early in pregnancy and include education on dietary diversity, increasing hemoglobin levels, meal frequency, food taboos, antenatal supplements and infant and young child feeding.

Key words: Adolescent nutrition, Pregnant adolescents, Dietary diversity, Food taboos, Hemoglobin

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INTRODUCTION

Malnutrition is one of the most significant risk factors for complications during pregnancy and childbirth. Well-nourished adolescent mothers are less likely to experience complications, despite being young. If an adolescent is unable to meet her nutritional needs and develops malnutrition during pregnancy, this can lead to a continued cycle of complications. Research has shown correlations between maternal malnutrition, risk for anemia and hemorrhage, and mortality from complications during pregnancy and childbirth [1].

According to the World Health Organization (WHO), nearly 16 million girls between 15-19 years of age give birth every year worldwide [2]. In 2017, the Malawi Demographic and Health Survey (MDHS) reported that the adolescent fertility rate (live births/1,000 adolescents) was 136, a slight decline from 152 in 2010. Approximately 59% of adolescents in Malawi began childbearing by 19 years old. Childbearing in adolescence is more common in rural (31%) than urban areas (21%) and in adolescents with no formal education and in the lowest wealth quintile [3].

One of the preventable causes of death among female adolescents is complications from pregnancy and childbirth. Adolescent pregnancy is associated with higher morbidity and mortality for the mother and infant. In 2017, the MDHS reported that 497 deaths/100,000 women were pregnancy related and 14.5% of female adolescent deaths were maternal deaths. Additionally, Malawi has high perinatal, neonatal, infant, child, and under-5 mortality rates. Neonatal and under-five mortality rates in Malawi were highest for children born to younger mothers (less than 20 years old), and the highest proportion of low birth weight infants were delivered by the mothers in the central region compared to the northern and southern regions of Malawi [3]. Infants born to young mothers living in the central region were more likely to have low birth weight and have high risk for mortality before their fifth birthday. Previous research in Malawi has found that newborns born to young Malawian adolescents were shorter compared to those born to adults. Birth weight, head circumference and mid-upper arm circumference (MUAC) were also lower in infants born to young adolescents [4].

To ensure pregnant adolescents meet their increased nutrient needs, it is important that they consume a diverse diet. Research has shown that dietary diversity is associated with adequate nutrient intake [5]. Prior evidence has shown correlations between dietary diversity and improved pregnancy outcomes. Individual maternal dietary diversity scores have shown a protective effect against low birth weight [6,7]. In addition to consuming a diverse diet, the number of meals and snacks consumed, known as meal frequency, is also important during pregnancy. Pregnant women who eat less frequently had lower energy intake during pregnancy [8]. Consuming the recommended meal frequency of three meals and at least two snacks per day has protective effects against preterm delivery [8,9].

Many adolescents living in rural areas of Malawi receive medical attention very late in pregnancy, if at all. Not receiving early medical attention can be harmful as pregnant adolescents are at risk for gaining less weight during pregnancy compared to adult

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mothers [10]. Despite their risk of malnutrition during pregnancy and adverse birth outcomes, few research studies have focused on these specific concerns in rural Malawi. The purpose of this study was to assess dietary diversity, antenatal care, food taboos, meal frequency, and nutritional status of pregnant adolescents in a rural area of Malawi.

MATERIALS AND METHODS

This cross-sectional study occurred in the catchment area of Child Legacy International (CLI) located near Msundwe, in the central region of Malawi during October and November in 2016. Data collection occurred at CLI Hospital, Nthondo Health Centre, and Chileka Health Centre. Sampling was purposive; inclusion criteria were females between 12-19 years with pregnancy of any trimester. Sixty-two participants were included in the study. Each participant provided verbal agreement and written consent to enroll in the study. Before consenting, participants were informed of the study's purpose and the methods of data collection. An incentive of 1,000 Malawi kwacha (approximately 1.0 USD) was given to each participant. Approvals from Oklahoma State University's Institutional Review Board and from the College of Medicine Research and Ethics Committee at the University of Malawi were obtained.

A questionnaire to collect sociodemographic and health characteristics was developed in collaboration with Malawian health care professionals. After pre-testing the questionnaire on individuals not included in the study, minor adjustments were made prior to data collection. Demographic data collected included age, marital status, household size, highest level of education, employment status, health history (including diagnoses of goiter, night blindness and malaria), prior pregnancies, and health behavior information including antenatal visits, antenatal supplements and nutrition advice received, if any.

Foods and beverages consumed by the participant inside and outside of the home during the previous day were recorded using the Food and Agriculture Organization (FAO) food frequency questionnaire [11]. During analysis, sixteen food groups were aggregated into ten groups to calculate the Minimum Dietary Diversity Score for Women (MDD-W) [11] and into nine groups to calculate the Women's Dietary Diversity Score (WDDS) [12].

Hemoglobin was measured on a drop of blood from the fingertip using a HemoCue instrument and recorded to the nearest 0.1 g/dL [13]. A Charder scale with a measuring rod was used to measure height to the nearest 0.1 cm. MUAC was recorded to the nearest 0.1 cm using a non-stretchable tape measure at the midpoint of the upper arm, halfway between the olecranon and the acromion process.

Statistical Analysis

For descriptive data, percentages of the sample or mean (SD) were calculated using the statistical software SAS, v. 9.4. Plausible explanatory variables predicting hemoglobin were tested using multivariate linear regression. Additionally, logistic regression was conducted to test plausible explanatory variables with taking an iron supplement and receiving food advice. The odds ratios of variables that reached $p < 0.05$ significance level were identified.

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RESULTS AND DISCUSSION

Sociodemographic and health characteristics

Mean age of participants was 17.7 (1.2) years; ages ranged from 15-19 years, with 33% under 18 years (Table 1). Over 80% of the participants were married and the median number of individuals living in the household was three. Many had two living parents and 11% had lost at least one parent. The pregnancy was the first for most (87%) of the participants. Many (64%) were buying food from the market as their primary food source and approximately 25% relied on their farm for food.

According to the MDHS, 73% of adolescents in Malawi were not married, 22% were married, and 1.0% divorced [3]. These national statistics were very different from the participants in the current study, as 83% were married. The age of marriage appears to be younger in the rural areas of the central region, thus increasing the likelihood of pregnancy during adolescence. According to the WHO, the frequency of sexual activity is high in adolescents who are in stable relationships such as marriage compared to those who are not married [14].

Only one adolescent was enrolled in school at the time of the study. Most participants (72%) completed primary school as their highest level of education; 10% completed secondary school. In the MDHS report, the central region of Malawi had the lowest percentages of female adolescents completing secondary school or higher, compared to the northern and southern regions [3]. Maternal education is associated with nutritional status; undernutrition is strongly associated with stunting, less schooling and education, and lower infant birth weight [15]. One study in Malawi found that the prevalence of low adult height was higher among mothers with lower levels of formal education [16]. Encouraging young girls to stay in school and continue their education may be a key component of a strategy to reduce stunting in Malawi.

Antenatal Care and Supplementation

Each participant had attended at least one antenatal visit at the time of the study, 50% had only one antenatal visit and 30% had at least two visits (Figure 1). Despite attending at least one antenatal visit, only 48% reportedly received advice about what to eat during pregnancy and only 8% received advice about what to feed their newborn. Among those who received advice, the majority (80%) were advised by health care workers. Only 37% were taking any supplement, and the only reported supplement consumed was ferrous sulfate.

In 2016, WHO released new recommendations regarding antenatal care for a positive pregnancy experience. The WHO states that at least eight antenatal visits are recommended to reduce perinatal mortality, increasing overall quality of antenatal care and improving maternal satisfaction [17]. In the present study, data collection only occurred at healthcare facilities, so all the study participants had at least one antenatal visit; however, the participants may have been in various trimesters of pregnancy and may have had additional visits after the study. The MDHS reported that 50% of Malawian women received at least four antenatal visits, whereas only 8% of the participants had attended at least four antenatal visits at the time of this survey [3]. A

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review of adolescent health interventions points to the importance of delivery platforms in adolescent health care. The effective use of existing delivery platforms such as communities or schools may help adolescents overcome barriers to receiving antenatal care [18].

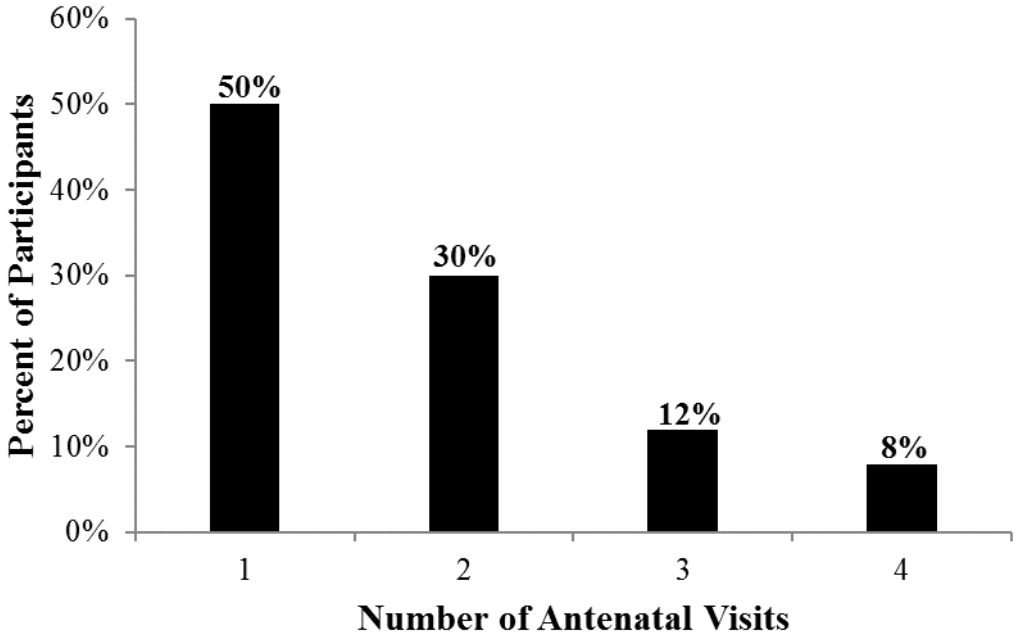

Figure 1: The number of antenatal visits attended by participants at the time of the study (N=62)

According to the MDHS, nearly 90.2% of mothers younger than 20 years old received information about foods to eat during pregnancy [3]. However, less than half of the study participants received advice about what to eat during pregnancy, despite all having at least one antenatal visit at the time of the study. Among those who received advice, 80% came from health care workers with a few receiving nutrition information from school teachers, mothers, and churches. This reveals poor nutrition education in the area where the participants are living and indicates the need for education regarding healthy food choices and dietary diversity to be included during antenatal care.

The number of antenatal visits was associated with a greater likelihood of a participant taking a supplement and the likelihood of having received advice about what to eat during pregnancy. As the number of antenatal visits increased, the participants were more likely to receive food advice [OR=19.33 (4.72-79.22) p<0.0001]. The results emphasize the relevance and importance of antenatal care. Less than half of the participants had received nutrition advice at the time of data collection, hence the importance of emphasizing nutrition education early and repeatedly during antenatal care.

Approximately 63% of the participants were not taking any iron supplements, in contrast to the MDHS, which reported only 10% of adolescents were not taking iron supplements

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during pregnancy [3]. This indicates a need for awareness and education on importance of iron supplementation during pregnancy in this area of rural Malawi. A few factors were associated with consuming supplements during pregnancy. Those who received nutrition advice were more likely to take a supplement [OR=4.19 (1.82-9.68), p=0.0008] than those who did not receive advice. As the number of visits increased, the participants were more likely to take a supplement [OR=11.88 (3.40-41.49) p=0.001].

However, as the number of individuals in the household increased, individuals were less likely to take a supplement [OR=0.69 (0.49-0.97, p=0.0344]. Perhaps dividing resources amongst more individuals in the household was a limiting factor. In Bangladesh, larger households had an increased risk of food insecurity (adjusted RR 1.47 (1.02, 2.09) [19].

Nutritional Indicators

The occurrence of anemia was high (66%). Many with anemia had moderate anemia (51%) compared to mild (13%) or severe (2%) (Table 2). According to the MDHS, 45.1% of pregnant females were anemic; mild (22.7%), moderate (20.8%), and severe (1.6%) [3]. A systematic review on adolescent nutrition interventions found that micronutrient supplementation has the potential to decrease the prevalence of anemia. The high percentage of participants not consuming supplements combined with the high occurrence of anemia suggests that micronutrient supplementation may be an effective intervention for decreasing anemia in these pregnant adolescents [20].

Low height-for-age occurred among 19% of participants (table 2) and 21% had a measured height ≤ 150 cm (data not shown). Stunting and short height have been associated with restriction of uterine blood flow and poor growth of the uterus and placenta, and ultimately are strong predictors for infant birth weight [21]. Maternal stunting is also associated with perinatal mortality. Early interventions that combat stunting are important for the eventual improvement of reproductive health and birth outcomes in Malawi.

Dietary Diversity

The mean minimum dietary diversity-women (MDD-W) score was 4.0 (1.2) and the mean women's dietary diversity score (WDDS) was 3.9 (1.0). The score range for MDD-W is 0-10 and WDDS is 0-9. Many of the participants (69%) did not meet the minimum dietary diversity (≥ 5 of the 10 recommended food groups). None of the participants consumed milk or other dairy products (Figure 2). Milk consumption in Africa is not common, especially in low-income areas [22]. However, milk and other dairy products were not among the foods restricted during pregnancy and are not a known taboo in Malawi [23]. Consumption of milk, which contains protein and fat, is important for maintaining good nutrition during pregnancy [24]. Maternal frequency of milk intake has been shown to be positively associated with birth weight among pregnant Malawians [26]. Consuming milk during pregnancy is especially important for pregnant adolescents who are at a high risk for delivering a low birth weight baby. Understanding the barriers to milk consumption among pregnant adolescents in Malawi is an important step to promote its consumption during pregnancy.

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Very few (7%) participants consumed eggs, which are a good source of protein for pregnant women. One of the barriers to consumption was the avoidance of eggs during pregnancy for cultural reasons. All participants ate foods from the grains, white roots, and tubers group. Many participants consumed dark green leafy vegetables (62%), other vitamin A rich fruits and vegetables (61%), and other vegetables (77%). However, less than half (39%) reported consuming meat, poultry, or fish.

Some of the participants reported receiving education about nutrition during their antenatal care; however, it is imperative for all adolescents to receive advice about consuming a diverse diet especially during pregnancy. Education about the importance of dietary diversity in antenatal care may improve maternal nutritional status during pregnancy. All participants consumed carbohydrates, primarily in the form of *nsima*, a thick porridge made from maize, the staple crop in Malawi [11]. A previous study in Malawi found similar results among pregnant women who all ate maize, wheat, rice, or sorghum every day of the week over a seven-day period [26].

Association between Dietary Diversity and Hemoglobin

Adequate maternal hemoglobin promotes healthy pregnancy and childbirth [24]. The participants' total dietary diversity scores showed no correlation with hemoglobin status. However, two individual MDD-W food groups were significant predictors of hemoglobin. Consumption of meat and poultry predicted a 1.31 g/dL (p-value = 0.0306) increase in hemoglobin level and consumption of dark green leafy vegetables predicted a 1.08 g/dL (p-value = 0.0331) increase in hemoglobin level (R^2=0.15). These results reveal potential factors that would be important in increasing hemoglobin levels and decreasing the occurrence of anemia. During antenatal care, encouraging consumption of food sources of iron as well as antenatal supplementation with ferrous sulfate are expected to promote an increase in hemoglobin levels. Higher hemoglobin levels between early and mid or late pregnancy have been found to be positively associated with birth weight [27].

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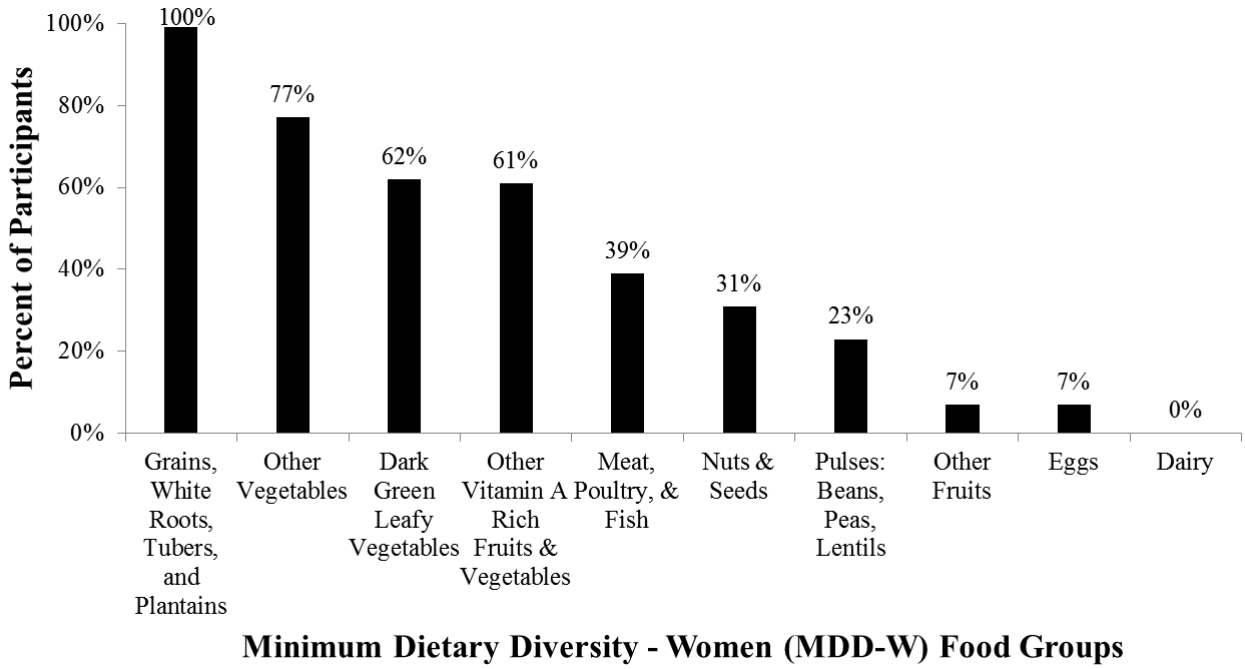

Figure 2: The percentage of participants consuming from each MDD-W food group (N=61)

Food Taboos

Food restrictions during pregnancy were common, but some were unexplained. Approximately 35% of the participants were avoiding at least one food or beverage (Table 1). Eggs and leftovers were the most commonly avoided foods (data not shown). Among those avoiding eggs, 87% reported that egg consumption would lead to an infant being born bald. The avoidance of certain foods during pregnancy in Malawi appears to be widespread. Another study conducted among Malawian women discovered similar food taboos during pregnancy, including avoidance of eggs, red chili, and sugarcane [28]. Reasons for avoiding most foods were beliefs about potential harmful effects on mother, baby, or childbirth. Following cultural advice during pregnancy is common in rural areas in low-income countries. Cultural food taboos traditionally affect women and involve the avoidance of animal source foods [22]. Although, certain traditional food beliefs may protect mother and fetus during pregnancy, some traditional food restrictions lack scientific basis and can be harmful.

Other foods avoided by one or more adolescents included: eggs, leftovers, Coca-Cola, cabbage, okra, pork, catfish, mice, attached bananas, red chili, sugarcane and groundnuts. While not all food restrictions create risks of nutritional deficiencies, some of the foods being restricted such as eggs, meat, bananas, and groundnuts are very nutritious. Avoiding these foods during pregnancy may decrease the likelihood of a pregnant adolescent meeting her nutritional needs. Restricting nutritious foods during pregnancy also has been studied in Nigeria where pregnant women restricted foods rich in carbohydrates, protein, and fats/oils that are necessary for a healthy pregnancy [29].

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Previous research has found that pregnant Malawians avoided cooked food sold in the market [28]. Such food avoidances may protect from potential foodborne illnesses. They also found women avoided eating fish and salt during pregnancy. Avoiding fish could be a protective mechanism against ingesting heavy metals but might limit animal source food intake [29]. Lower intakes of salt during pregnancy might reduce the risk of hypertension [30]. However, evidence that pregnant adolescents in Malawi avoid several nutritious foods during pregnancy reveals a need to address food taboos during antenatal care. Nutrition education during antenatal care should address the nutritional benefits of the taboo foods to discourage their restriction during pregnancy.

Eating Patterns

According to the recommendations made by the Malawi National Nutrition Guidelines (2014), pregnant females should eat from each of the six food groups and eat two extra meals in between main meals each day [31]. Only 13% of participants were consuming foods from each of the six food groups designated by the Malawi National Nutrition Guidelines. All participants ate foods from the staples group. Many participants consumed foods from the vegetable (93%), fats (82%), and fruit (62%) groups. However, less than half of participants consumed foods from legumes/nuts and animal food groups.

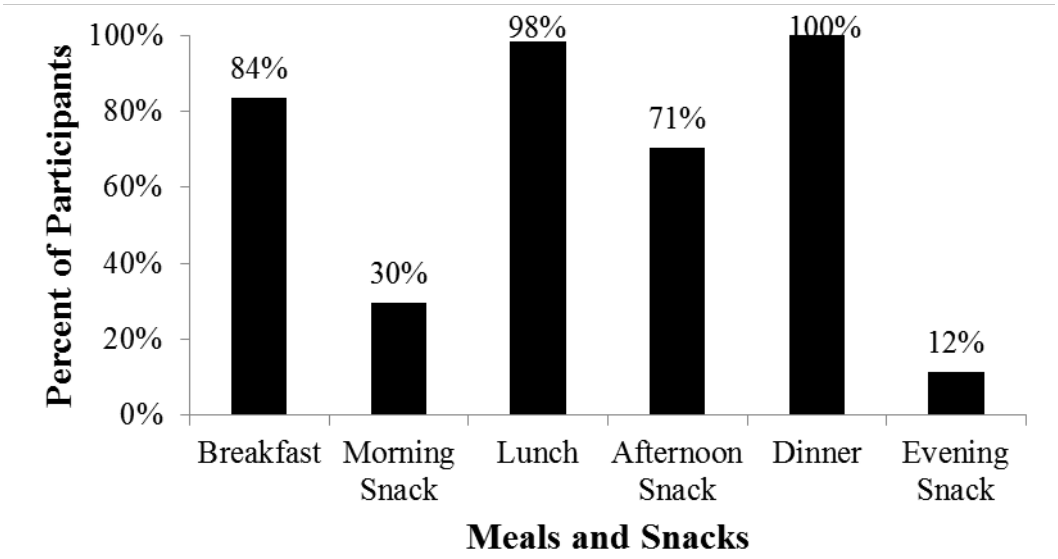

Figure 3: The percentage of participants consuming meals and snacks (N=61)

Many (74%) participants did not eat the recommended meal frequency of three meals with two additional meals/snacks between main meals. The most common eating pattern was three meals with one snack, and 79% reported eating at least one snack between meals. Snacks were commonly eaten after lunch but before dinner (Figure 3). Mangoes were the most common snack (67%) (data not shown). Snacking between meals in Malawi is an important way for women to meet their energy and nutrient recommendations [32]. For example, one study found that snacks were the greatest contributors of fat and vitamin C in non-lactating and lactating Malawian women. While many participants chose a snack high in vitamin C, consuming snacks high in protein and fat was not common. Consuming snacks high in fat is linked to increased energy

intakes among Malawian women, so it is advisable to educate pregnant adolescents on selecting snacks that would encourage healthy weight gain.

Limitations

Limitations of the study were that dietary intake assessment only included foods consumed the day prior to data collection and the sample size was small. A thorough assessment of dietary diversity would include multiple days and seasons. The cross-sectional anthropometric data collected only reflect nutritional status at one point during the pregnancy and not by trimester. Because trimester of pregnancy was not known, BMI of the subjects was not reported. In a longitudinal design, weight gain of the participants should be tracked over time.

CONCLUSION

The nutritional status of pregnant adolescents living in this rural area of Malawi is compromised and should be addressed through nutrition education during antenatal care. Specific focus should be on improving dietary diversity, increasing consumption of iron-rich foods, promoting healthy meal frequency and snacking. Additionally, it is important that education should focus on the harmful effects of restricting the consumption of healthy foods. Education received during antenatal care is imperative. Evidence shows that pregnant adolescents who received adequate nutrition education and attended more antenatal care visits were more likely to take their supplements. Improving nutrition education and awareness during the pre-conception stage or as early in the pregnancy as possible will be essential to promoting healthy nutrition for pregnant adolescents. Future research may consider assessing food taboos among a non-adolescent sample and also conducting in-depth qualitative research to assess barriers in overcoming cultural food taboos during pregnancy.

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Table 1: Demographic, social, and health characteristics of participants (N=62)

Characteristic	n	%
Age (years)[a]		
15	3	5
16	10	16
17	7	12
18	22	36
19	19	31
Marital Status		
Married	52	83
Single	9	15
Divorced	1	2
Household		
Had lost one or both parents	7	11
Had both living parents	55	89
Education (highest level completed)		
Less than primary	1	2
Some primary	10	16
Primary	45	72
Secondary	6	10
Health		
First pregnancy	55	87
Received advice about food to eat during pregnancy	30	48
Received advice about food to feed infant	5	8
Restricted some food during pregnancy	22	35
Had been told she has a goiter	3	5
Had trouble seeing at night	1	2
Took ferrous sulfate supplement	23	37
Had malaria at least once during pregnancy	2	3

[a]Data on age were available for 61 participants

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Table 2: Anthropometrics and hemoglobin status of participants (N=62)

Indicator	Mean (+/-SD)	Number (Percentage)
MUAC (cm)	25.8 (2.00)	
Low MUAC[1]		19 (31%)
Height-for-Age Z-Score	-1.28 (0.82)	
Stunted[2]		11 (18%)
Hemoglobin (g/dL)[a]	10.37 (1.93)	
Anemia[a]		40 (66%)
Mild[3]		8 (13%)
Moderate[4]		31 (51%)
Severe[5]		1 (2%)

[a]Data on hemoglobin were available for 61 participants.

1. Mid-upper arm circumference (MUAC) ≤ 25.0 cm
2. Height-for-Age Z-Score <-2SD
3. Hemoglobin 10.0-10.9 g/dL
4. Hemoglobin 7.0-9.9 g/dL
5. Hemglobin < 7.0 g/dL

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