European Journal of Nutrition & Food Safety

Volume 16, Issue 3, Page 94-106, 2024; Article no.EJNFS.114133
ISSN: 2347-5641

Understanding Maternal Nutrition Insights from Pregnant Women in Bamenda, Cameroon

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Authors' contributions

This work was carried out in collaboration among all authors. Author MCG carried out conceptualization, validation, managed literature searches and edited the manuscript. Author TNFR designed the study, carried out investigation, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript, author FEN managed the analyses of the study, performed statistical analysis and visualized the work and author ERA carried out investigations and visualized the work. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/EJNFS/2024/v16i31402

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/114133

Original Research Article

Received: 03/01/2024
Accepted: 09/03/2024
Published: 22/03/2024

ABSTRACT

The foundation for good physical health is good nutritional status. Nutritional status of pregnant women is directly affected by the foods they eat and their nutrient content. Nutritional knowledge is positively associated with diet quality. The aim of this study was to assess nutritional status and

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nutrition education knowledge of pregnant women attending antenatal clinics in Bamenda Health District (BHD).
Study Design: This study was carried conducted in BHD in the North West Region of Cameroon, with pregnant women aged 13 to 49 years recruited from public hospitals.
Place and Duration of Study: BHD including (Bamenda Regional Hospital, Azire Integrated Health centre, Atuakom Integrated Health Centre, Ntambag Integrated Health Centre) between April 2022 to September 2022.
Methodology: This was a cross sectional study carried out in four health facilities BHD. Random sampling technique was done to target the sample size of 354 pregnant women. A questionnaire was developed to collect socio-demographic information and clinical records of the pregnant women. Anthropometric parameters, biochemical and dietary assessments of the women were determined using standard techniques. Data collected was analysed by MS excel and SPSS Statistics version 20.0. Results were considered at significance level $P \leq 0.05$.
Results: The mean age of the study population was 26.4±5.5years and the average intake of servings of meals per day was suboptimal in the consumption of vegetables (2±1.9), fruits (0.6± 1.3) and milk (0.4 ±0.6) food groups. Women consumed diets that met less than 50% of energy needs. There exists a significant difference in mean energy requirements 1828.8 ± 152.9 Kcal compared to mean energy intake 1192.0 ± 344.6 Kcal which is below the Recommended Daily Allowances (RDA) of 2400 kcal for pregnant women. Ignorance still existed in dietary knowledge and 18.1% of the women were anaemic.
Conclusion: There was an overall suboptimal approach to dietary intake among the pregnant women, inadequate food intake, poor food choices and limited healthy dietary knowledge. Thus pregnant women in BHD still need more access to information on dietary information.

Keywords: Nutritional status; diet quality; food choices; knowledge; anaemic.

1. INTRODUCTION

Maternal nutrition is an important factor responsible not only for the health of the baby, but also for the long term growth [1]. Women have a distinct nutritional requirement throughout their life especially before and during pregnancy [2]. The nutritional requirements of the foetus, transient variations in blood volume and body mass, and the bioavailability of iron in a mostly vegetarian diet are all factors that can affect a pregnant woman's iron status [3]. Normal nutritional status is managed by balanced food consumption and normal utilization of nutrients [4]. Nutritional status refers to the health and wellbeing of individuals and populations as influenced by their intake and utilization of nutrients [5]. Too much or too little food intake may cause serious damage to the body system [6].

Nutrition knowledge has been reported to be positively associated with diet quality, which is regarded as a means of encouraging consumers to make a healthy choice of foods [4]. Maternal nutrition on antenatal care focus on; nutrition education and counselling, mild and little exercises, delivery of essential supplements to expectant mothers, like iron and folic acid supplementation [7]. Pregnant women are informed of the advantages of healthy eating habits for minimizing anaemia and are urged to adopt these habits and eat from a variety of food categories to get enough nutrients to support pregnancy [7,8].

Notwithstanding a marked increase in overweight and obesity in women of reproductive age, at present, most programmes are focused on under-nutrition and micronutrient deficiencies [9]. Protocols and guidance on managing excessive weight gain while managing micronutrient deficiencies, particularly in settings where inherited disorders of Red Blood Cell (RBC) exist [10].

Globally, the prevalence of maternal malnutrition is higher in Less Middle Income Countries (LMICs), when compared to high - income countries [11]. Also, maternal under nutrition and its consequences is estimated to account for 3.1 million child deaths annually [12]. The prevalence of obesity among pregnant women is higher in the Americas and the Caribbean when compared to Africa, but overall, rates of overweight and obesity are rising globally, a situation that mimics that in high - income countries and may be reflective of changing food environments [11,8]. In a methodical review of African studies, maternal obesity based on pre-

pregnancy or first semester of pregnancies is associated with increases risk of caesarean section birth deliveries, gestational diabetes, pregnancy induced hypertension, and preeclampsia [13].

In Cameroon, pre-pregnancy under nutrition and over nutrition, has been stated to lead to an increased risk of foetal complications including anaemia, infections, Foetal Growth Restrictions (FGR), low birth weight [14]. The maternal health programmes in Cameroon report maternal death, iron deficiencies, preterm labour in pregnant women [14,15]. Nevertheless, despite the increasing prevalence of obesity among women in urban areas and increasing prevalence of underweight in rural areas, according to standards for nutritional assessment of pregnant women is a call for concern [15].

The principal intention of this study is to assess the nutritional status and nutrition education knowledge, among pregnant women in Bamenda health district. Discoveries from this study will help health authorities to intensify their campaign in the fight against malnutrition in Bamenda and beyond.

2. METHODOLOGY

2.1 Study Design

The research was a descriptive cross-sectional study which consisted of 354 interviews of pregnant mothers aged 13 to 49 years old. This research was carried out in Bamenda Health District (BHD) located in Mezam division of the North West Region of Cameroon.

2.2 Setting

The BHD is comprised of 17 health areas (public, private and confessional). BHD is bounded to the north by Bafut health district, to the west by Mbengwi health district, to the south by Bali and Santa health district and to the east by Tubah health district as shown on the map below.

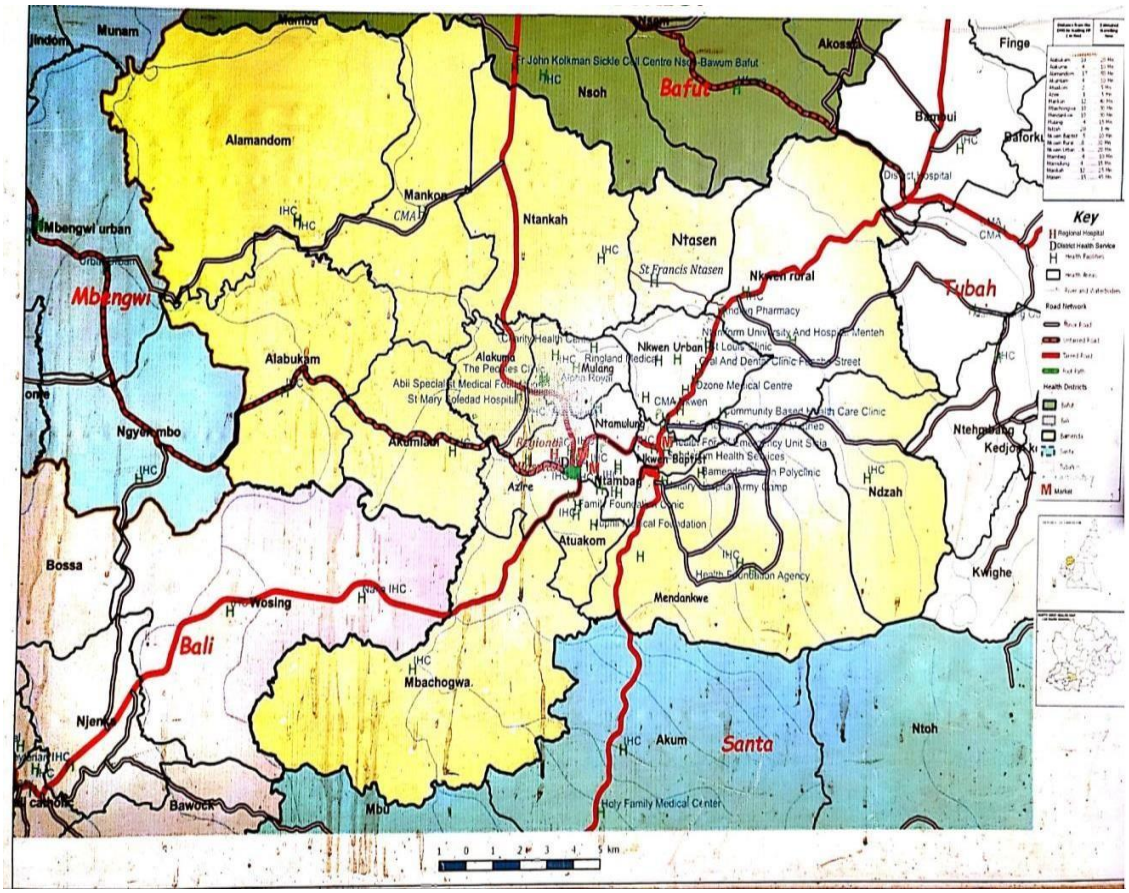

Fig. 1. Bamenda health district

The study was conducted over a five-month period from April 2022 to September 2022.

2.3 Study Population

Bamenda has a population of about 1,728,953 inhabitants, with Bamenda as its capital city. 354 pregnant women, aged 13 – 49 years were selected using random sampling techniques. A convenient sample size was obtained by taking a suitable fraction of the total number of pregnant women in the various health districts; that is 139 from the Regional Hospital Bamenda, 183 from Azire Intergrated Health Centre, 18 from Atuakom, 14 from Ntankah Integrated Health Centre.

2.4 Sampling Techniques

Multi stage sample techniques was employed in the selection of participants. The number of pregnant women sampled from each hospital was determined using the Cochran equation (Cochran, 2020) at 95% confidence interval and the subjects were chosen randomly.

Cochran equation:

$$n^0 = \frac{\mathrm{Z}^2\mathrm{pq}}{e^2}$$

where n_0 is the sample size of the study (354); Z^2 is the abscissa of the normal curve that cuts off an area α at the tails; (1-α) equals the desired confidence level e.g. 95% e is the desired level of precision; p is the estimated proportion of an attribute that is present in the population and, q is 1-p. The value Z is found on the statistical tables which contain the area under the normal. e.g. Z= 1.96 for 95% level of confidence.

2.5 Selection of Subjects

Pregnant women were selected from renowned hospitals in BHD based in town for security purposes. The required number of women was picked randomly in the hospitals until the sample size was obtained.

2.6 Data Collection

Questionnaire was designed and pretested to obtain information from pregnant women on dietary practices. A HemoCue B-Hemoglobin analyzer was used to determine the haemoglobin levels of the pregnant women.

Structured questionnaires comprised of both open-ended and closed- ended questions was used in data collection.

Anthropometry measurements of Body Mass Index (BMI), were taken using the weight and height calibrated scale. This study had exclusion criteria including pregnant women who had chronic diseases such as COVID 19, tuberculosis, those who refused to give consent and women who needed emergency attention.

All Information was gotten from direct interviews from the pregnant women in order to get the best possible answers and her lived experienced.

2.7 Data Analysis

Data gotten from interviews were doubled entered and analysed using Microsoft Excel, and Statistical package for social sciences SPSS version 20.0 (IBM Corp, Atlanta, GA, USA). Data entry was performed using EPI INFO and Microsoft office Access software. Statistical significance of associations was ascertained using the one-way ANOVA, chi test, spearman's correlation and T test for categorical variables, with a p-value <0.05 and 95% confidence interval (95%CI). One-way ANOVA was used to evaluate strength of the linear association between quantitative variables like BMI and dietary intake. Descriptive statistics was carried out to measure percentages, averages, and relative frequencies of the variables. The analysed data was interpreted and the results were represented using tables, graphs and charts, where it was necessary.

To calculate the percentages, averages, and relative frequencies of the variables, descriptive statistics were used. Multivariate analysis was used to evaluate connections between quantitative factors such as anthropometric measurements and eating behaviours with statistical level of significance set at $P \leq 0.05$.

3. RESULTS AND DISCUSSION

3.1 Numerical Information

3.1.1 The socio demographics of the study's participants

Table 1 shows the sociodemographic characteristics of the study participants. The most represented age group was 25-34 (49.4%), followed by 15-24 (39.5%). Only 10.7% (>34) women were greater than 34 years and the least represented age group < 15 (0.3%). Most of the study participants, 255 (72%) were married, 95 (26.8%) were single, 4 (1.1%) were widows.

Most participants, 199 (56.2%) were in their third trimester of pregnancy, 142 (40.1%) were in their second trimester, and the least 13(3.7%) were in their first trimester. Investigations in this study indicate that majority of the pregnant women 215, (60.7%) had less than three pregnancies, and 130 (36.7%) had 3 to 5 pregnancies, and 9 (2.5%) had greater than 5 pregnancies and were considered grand para.

Majority 250 (70.6%), of the women had started their first Antenatal Clinic (ANC) visit in their second trimester of pregnancy, followed by those in their first trimester, 76 (21.5%), then to those in their third trimester 24 (6.8%) and finally 4 (1.3%) those who never knew their trimester when they started ANC visit. Majority of the participants, 183 (51.7%) had attained secondary school education, 72 (20.3%) had

Table 1. Sociodemographic characteristics of pregnant mothers who participated in this study

Variable	Category	Frequency	Percent frequency
Age group	< 15	1	0.3%
	15 – 24	140	39.5%
	25 -34	175	49.4%
	>34	38	10.7%
Marital status	Married	255	72%
	Single	95	26.8%
	Widow	4	1.1%
Gestation in weeks	First trimester	13	3.7%
	Second trimester	142	40.1%
	Third trimester	199	56.2%
Number of pregnancies	<3	215	60.7%
	3 -5	130	36.7%
	>5	9	2.5%
First Antenatal Clinic visit	First trimester	76	21.5%
	Second trimester	250	70.6%
	Third trimester	24	6.8%
	Unknown	4	1.3%
Level of education	No formal education	4	1.1%
	Primary	33	9.3%
	Secondary	183	51.7%
	Post-secondary	62	17.5%
	University	72	20.3%
Occupation	Student	77	21.8%
	Business	68	19.2%
	Teacher	36	10.2%
Variable	**Category**	**Frequency**	**Percent frequency**
	Handicraft	73	20.9%
	Housewife	24	6.8%
	Others	76	21.5%
Monthly income	< 100000	272	76.8%
	100000 – 250000	65	18.4%
	>250000	15	4.8%

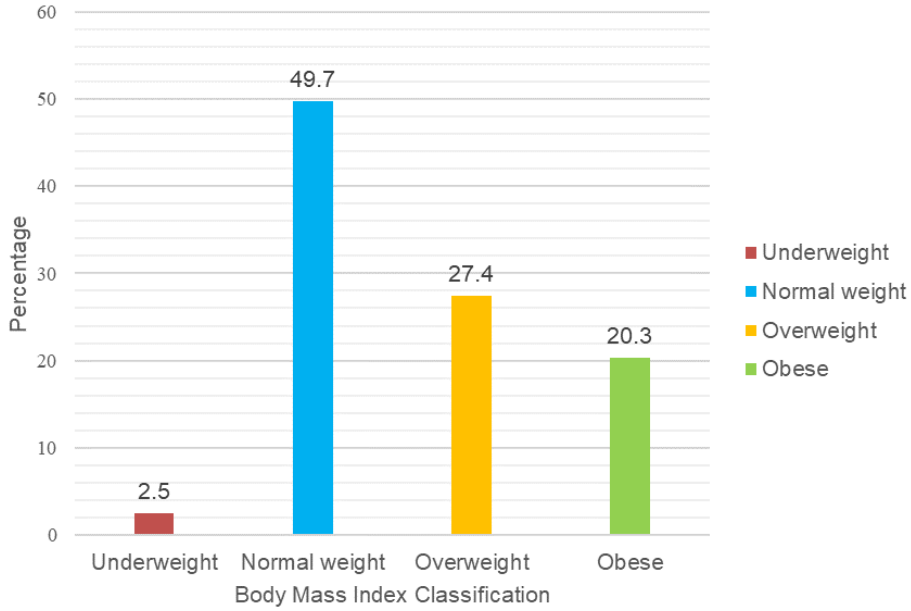

Fig. 2. Pre-pregnancy body mass index

attained university education, 62 (17.5%) had attained post-secondary institutions, 33 (9.3%) had attained primary and 4 (1.1%) had no formal education. According to the level of education, majority were students 77 (21.8%), others 76 (21.5%), business 68 (19.2%), seamstress 38 (10.7%), teacher 36 (10.2%), hairdresser 35 (9.9%) and housewife 24 (6.8%).

Most of the participants according to the Table 1, most 272 (76.8%) earned < 100000 FCFA per month, 65 (18.4%) earned 100000- 250000 FCFA per month, and 17 (4.8%) earned >250000FCFA per month.

3.1.2 Anthropometric parameters

Pre-pregnancy body mass index classification: In accordance to Fig. 2 as shown, results disclosed that 2.5% of the pregnant women were underweight, 49.7% were normal weight, 27.4% overweight and 20.3% were obese**.** Similar findings were in consistence to a study carried out by Aji et al., [16], were 43.1% obese and overweight, 10.2% underweight. These findings are contradicted by that of Gondwe et al., [17] in Malawi who had 10.9% overweight, 5.9% underweight, 5.2% obese in their study. This would imply that women should know the importance of weight management before pregnancy as reported by Fair et al., [18], who suggested weight management is likely to reduce the risk of pregnancy and birth complications (such as miscarriage, stillbirth and birth defects such as spina bifida), as well as to minimize the risk of obesity development and metabolic disease such as type 2 diabetes in the long term.

3.1.3 By biochemical parameters

Determining the level of Hb in the pregnant women's blood: Most women, 16.7%, had mild anemia; that is, their haemoglobin (Hb) levels of 7.0 – 8.9 g/dl. About 1.1% had moderate anemia (7.0 -8.9 g/dl) and 0.3% had severe anaemia (<7.0 g/dL). Accountably, the prevalence of anaemia in this study was recorded at 18.1% which was low, while 0.3% of the women had severe anaemia. See Fig. 3, for comprehensive image analysis. Other studies have shown a higher degree of anaemia in pregnancy such as 73.6% in Kenya [3], 87% in India [19] and 41.82% in East Africa [20]. The low prevalence of anaemia in the present study may be related to more frequent iron supplementation intake. Since the women had more visits for prenatal care, they were encouraged in each visit to take their supplements. Therefore, it seems that iron deficiency anaemia is relatively lower in this study as compared to other studies. This low haemoglobin results are linked to a study carried out by Tabrizi et al. [19] among Iranian Women, who had just 20.2% prevalence of anaemia.

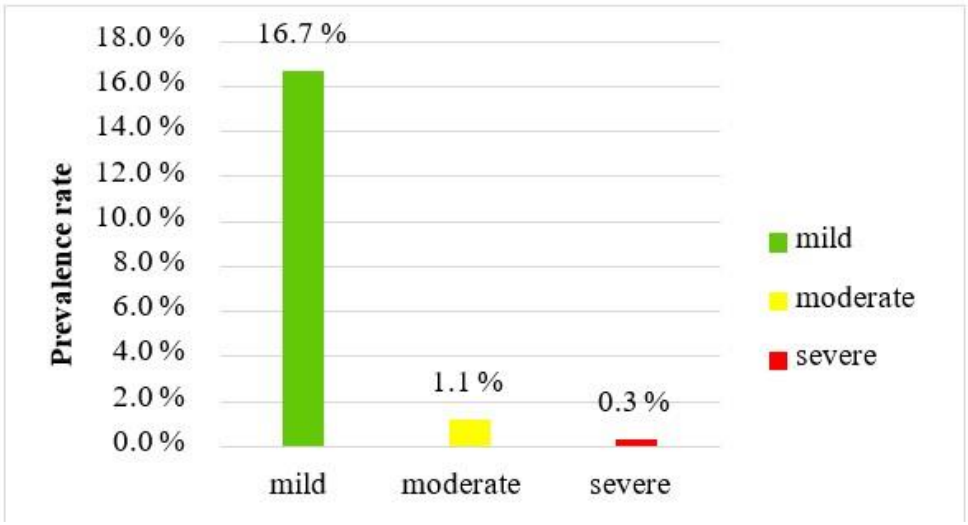

Fig. 3. Anaemia in pregnancy

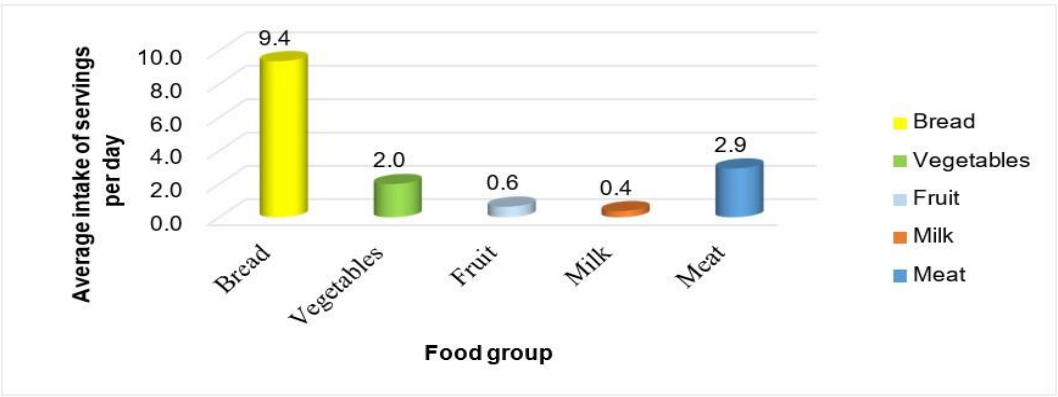

Fig. 4. Average intake of servings per day of the pregnant women

Table 2. Sample diet for a three calorie level

Food group servings	United States Department of Agriculture Lower Boundary	Average Pregnant Women Intake	United States Department of Agriculture Upper Boundary
Bread	6	9.4	11
Vegetable	3	2	5
Fruit	2	0.6	4
Milk	2	0.4	3

3.1.4 By dietary assessment

Assessing the qualitative and quantitative food intake of pregnant women using 24-hour dietary recall: The 24-hour recall revealed that the respondents consumed an average of 9.4 ±3.1 servings of bread and cereals per day, that met the expected servings 6 to 11. For the vegetables, the average number of serving is 2±1.9, which did not meet the expected which is 3 to 5 servings per day. For fruits, the recommended serving is 2 to 4, and the average serving was 0.6± 1.3 which did not meet the expected. For milk, the recommended serving is 2 to 3 servings, and the average was 0.4 ±0.6 and did not meet the recommended. For meat, it is 2 to 3, and the average was 2.9± 1.9, which met the expected. See Fig. 4 for comprehensive image analysis.

The Table 2 shows the average intake of servings per day when compared to the United States Department of Agriculture (USDA) recommended upper and lower boundary intake

per day. The results of consumption within 24 hours of the 5 food groups had total energy intake 1171.8 Kcal. The standard deviation had; bread (3.1), vegetable (1.9), fruit (1.3), milk (0.6) and meat (1.9), with energy intake (374.8). The range had; bread (24.0), vegetable (8.0), fruit (6.0), milk (4.0), meat (9.0), with energy intake 2940.0 kcal.

3.1.5 Energy requirement and energy intake of the pregnant women

There exists a significant difference in mean energy intake 1192.0 kcal compared to mean energy requirements, 1828.8 kcal. It was calculated using the Harris benedict equation, as recorded by Most et al. [21] energy intake requirements model, which estimates surplus energy requirements to be 400–600 kcal/d for underweight and normal-weight women, and 220–350 kcal per day for overweight or obese pregnant women.

Just Bread/Cereals and meat/fish group met the recommended daily servings according to the USDA dietary guidelines. Consumption of cereals/bread group is reported in the study carried out by Tayyem et al. [22] in Jordan. The authors of this study reported the mean intake of cereals to be higher and that of meat/fish to meet the required daily servings.

They also attributed the increase in cereal intake to higher energy consumption. This is because carbohydrate forms the basis of a meal. The required consumption of meat/fish in this group is comparable to a study carried out by Ibanez et al. [23], in Spain, who reported pregnant women had a high intake of protein from meat sources. The association between meat intake and Small for Gestational Age (SGA), has been investigated showing controversial results. The most frequent advice in pregnancy diet is to avoid raw or undercooked meat products in order to prevent infectious food borne diseases [23].

Contrary, the Vegetable, fruit and milk groups did not meet the daily requirements, following the USDA dietary guidelines. This was possibly due to increase in food prices rendering these food items unaffordable. The findings of this study also agree with another study reported by Tayyem et al. [22] done in Jordan in 2020, who reported the consumption of some food groups; for example, fruit 1.7 and vegetables 1.3, dairy products 0.7, was below the recommended amounts. Furthermore, Maternal factors such as social class, and education strongly influenced dietary practice [22]. More so, generalized chemosensivity in pregnancy made it possible for the women not to have appealing appetite or dislikes for some foods, accounting to little or no consumption of some of the food groups concerned. This is similar to a study carried out by Yalew et al. [24] in Ethiopia, who reported a change in olfactory and taste sensitivity. Suh et al. [25] reported some discordance exists between maternal nutrition knowledge and their dietary practices.

In this study, a significant difference existed between the mean energy intake of 1192.0 kcal compared to the mean energy requirements of 1828.8 kcal. This is comparable to a study carried out by Lundqvist et al., [26], in Sweden who reported energy intake in pregnant women to be low but not significant, a reflection of that they reported consuming significantly less of rice/potatoes/pasta and vegetables (grams per day).

Likely, women with low socioeconomic status were particularly prone to low intake levels of energy [26]. This finding was in contrast to a study carried out by Shommo [27] in Sudan where the daily mean intakes of energy for all pregnant women was 2149 kcal total calorie intake, which is higher than the results of this study and its significantly lower than the FAO/WHO guidelines. The reason for low energy intake might be due to economic factors, nausea and other disturbances that might occur during pregnancy such as gestational diabetes.

3.2 Nutrition Knowledge and Dietary Practices of Pregnant Women

According to the Table 3 as depicted above, dietary knowledge and practices of participants in this study revealed that 10.2 % had a convincing notion of what a balance diet was. Wrong idea of what a balance diet is due to very little or no education about nutrition. Results of dietary knowledge and practices was synonymous to a study carried out in Yaoundé, Cameroon by Suh et al. [25], who proved a satisfactory level of nutritional knowledge of pregnant mothers in Yaoundé. In another study of dietary knowledge, carried out by Nana and Zema [28] in Ethiopia, 61.4% of the study participants had good dietary knowledge and 38.6% had poor dietary knowledge due to low

levels of dietary exposure. Likewise, in another study done by Soederberg and Cassady [29], nutritional knowledge supports healthy food choices. Knowledge plays a broader role in food choices by supporting dietary intake. Motivation may be an important factor in encouraging pregnant women to think about the importance of nutrition in food choices [29].

In terms of the quality of the majority of foods consumed, participants had limited knowledge on the quality of food, 28.0% participants had wrong knowledge on quality of foods, and few 26.6% had knowledge on good quality of foods. Apparently, a study carried out by [30] on the quality of foods in Ethiopia, reported maternal nutritional knowledge (49%) to be limited about food sources and misconceptions. This study found that 48.6% of the pregnant women avoided certain meals due to common pregnancy discomforts, financial unaffordability and natural dislikes of some food items. Similarly, a study in Ethiopia carried out by [28,30] reported pregnant women avoiding certain foods because it induced nausea and other pregnancy discomforts. In this study, mothers with greater financial means had higher levels of education; additionally, they may have been exposed to additional nutrition information at work or through other media (such as the internet, books, and magazines used as sources of information in the workplace), which would account for their greater nutrition knowledge. Differences in diet and nutrition information exposure during pregnancy may also be a contributing factor to the variance, Despite the respondents' high literacy rates, there was some misunderstanding and misinformation regarding mothers' knowledge of proper eating practices during pregnancy and identification of potentially dangerous foods. According to a study carried out by Zerfu and Biadgilign [30], in Ethiopia reported a common misunderstanding and lack of information regarding the primary nutrient sources in meals during pregnancy. 15% of the women in this study and 15% of all women reported desires for non-food items like clay (calabash/calabar chalk). This study resembled one on maternal nutritional intake during pregnancy that was conducted in Riyadh, Saudi Arabia, and published by Suh et al. [25]. The percentage of pregnant women who had distinct cravings for particular foods, pica and aversion was 28.1%, 13.2% and 47.4%, according to the authors. These pregnant women craved for non-food items to alleviate nausea and some consumed ice to cold down their body temperature.

Table 3. Nutrition knowledge and dietary practices of pregnant women

Parameter	Frequency (cies)	Percent (ages)
Idea of a balanced diet		
1 = Right	318	89.8%
2 = Convinced	36	10.2%
Number of times you eat per day		
4 = Anytime	140	39.5%
3 = thrice	167	47.2%
2 = Twice	39	11.0%
1 = Once	6	1.7%
0 = Unknown	2	0.6%
Quality of foods		
1 = Good	94	26.6%
2 = Limited	161	45.5%
3 = Wrong	99	28.0%
Meals avoided		
Did not avoid	182	51.4%
Avoided	172	48.6%
Pica		
Did not Crave	301	85.0%
Crave	53	15.0%
	354	100%

Table 4. Relationship between dietary knowledge and socio demographic characteristics

Parameter (n=354)			Marital status	Education	Number of pregnancies	Income	Occupation
Idea of a balanced diet	**Frequency (cies)**	**Percent (ages)**	**P value***	**P value***	**P value***	**P value***	**P value***
1 = Right	318	89.8%	0.537	0.732	0.919	0.664	0.516
2 = Convinced	36	10.2%					
Number of times you eat per day							
4 = Anytime	140	39.5%	0.916	0.339	0.434	0.075	0.901
3 = thrice	167	47.2%					
2 = Twice	39	11.0%					
1 = Once	6	1.7%					
0 = Unknown	2	0.6%					
Quality of foods							
1 = Good	94	26.6%	**<0.05**	0.230	**<0.05**	0.157	0.259
2 = Limited	161	45.5%					
3 = Wrong	99	28.0%					
Meals avoided							
Did not avoid	182	51.4%	0.259	0.210	**<0.05**	0.390	0.223
Avoided	172	48.6%					
Pica							
Did not Crave	301	85.0%	0.334	0.945	0.688	**<0.05**	0.969
Crave	53	15.0%					

3.3 The Relationship between Sociodemographic Factors and Dietary Knowledge

The Table 4, shows there was no statistically significant correlation between the notion of a balance diet and number of times of food consumption per day with respect to sociodemographic factors. Marital status, number of pregnancies and income are significantly related to quality of foods, meals and cravings, *P<0.05*.

3.4 Relationship between Dietary Knowledge and Socio Demographic Factors

Based on factors like gestational age, income, occupation, and educational attainment, a multiple linear regression was used to predict Hb. No significant regression equation was found. Based on educational level, income, occupation and gestational age a multiple linear regression was performed to predict pregnancy weight gain. There was identified a significant regression equation (F (2,351) = 49.740, p < 0.001), with an R^2 of 0.221. Pregnancy weight gain is equal to 4.033(Gestational age) + 1.061(Income) - 4.106, Income is coded as 1 = < 100,000F, 2 = 100,000 to 250,000F, 3 = > 250,000F. Gestational age is denoted by the codes 1 for the first trimester, 2 for the second trimester, and 3 for the third trimester. Pregnancy weight gain increased by 0.988 units for each 1 unit of gestational age and 1 unit of Income. Both gestational age and income were significant predictors of pregnancy weight gain at *P<0.001* and *P<0.05* levels accordingly.

Results revealed a substantial relationship between average haemoglobin levels and educational attainment. People with low levels of education are assumed to be ignorant, which results in poor eating decisions. The majority of those surveyed had mild anaemia. Among all the various educational classes, there was some mild anaemia.

This study is probably comparable to one done by Kemunto [3] in Kenya, whose research revealed considerable variations in pregnant women's haemoglobin levels depending on their educational attainment. While accounting for educational attainment, employment, and marital status, there was no statistically significant association between calorie intake and pregnant weight increase. There exists a negative significant correlation between energy intake and pregnancy weight gain while controlling for educational level, occupation and marital status. Report on this research will align to that carried out by Minami et al. [31] in Japan, who evaluated the generally underappreciated link between maternal energy consumption and birth weight, which is mediated by prenatal weight gain. In contrast, the group that consumed more energy had a higher percentage of pregnant women who gained too much weight [31].

The calculator suggests increasing daily caloric intake by 129 kcal in trimester 1, 249 kcal in trimester 2, and 108 kcal in trimester 3 in accordance with Gilmore et al. [32] recommendations in the Institute of Medicine (IOM), guidelines for energy intake and weight gain. Increased energy intake was found to be the cause of weight gain that exceeded the 2009 Institute of Medicine (IOM), gestational weight growth recommendations. Excess Gestational Weight Gain (GWG), which was more common in women with a BMI of 25 or higher, could help to explain the high gainers' increased caloric intake. It makes sense that these ladies would consume more calories to sustain their larger metabolism [32]. Income did not have any significant influence on pregnancy weight gain, haemoglobin and dietary energy intake. This was in contrast to a study carried out by Shommo [27] in Sudan, who described partial correlations between maternal dietary intake and income, and overall pattern for positive correlations between dietary intake.

4. CONCLUSION

Pregnant mothers in this study started antenatal clinic mostly in the second trimester.it should be noted that early prenatal care can be advantageous by identifying risk factors early and offering preventive and health promotion advice to promote healthy lifestyles, appropriate weight gain, and treatment of medical conditions like diabetes and pregnancy induced hypertension. To achieve the USDA recommendations for intake of these food groups, is should also be urged to eat a variety of fruits and vegetables that are low in calories and high in micronutrients. While the majority of expectant mothers had enough knowledge of nutrition during pregnancy, some still had gaps in their knowledge, had misconceptions about it, and had problems. About 45.5% of women had supplements cause nausea and vomiting to

some pregnant women. Health facilities should put in place programs that favour nutrition education in pregnancy. Nutrition services are underutilized in this region and mostly the nurses/midwives/ doctors play the role of the nutritionist.

CONSENT

As per international standards or university standards, patient(s) written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

This study included the use of human participants. Ethical approval was obtained from the Regional Delegation of the North West, Bamenda with authorization number 109/ATT/NWR/RDPH/BRIGAD.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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