

Detary Practices and Nutrient Intakes of Pregnant Women in Accra, Ghana

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Abstract: The aim of the study was to assess potential changes in dietary habits during pregnancy, nutrient intakes of pregnant women and the effect of socio-demographic factors on nutrient intakes of pregnant women. The research design was cross-sectional. A systematic random sampling technique was used to recruit 279 pregnant women from the antenatal clinic of the Korle-Bu Teaching Hospital and Osu Maternity Home in Accra. In-depth interviews were performed to assess perceptions and attitudes regarding food consumption and dietary habits during pregnancy. In addition, an interactive 24 h recall repeated for three days was used to obtain data on food and nutrient intakes of the women. Information on foods consumed was converted into quantitative data of nutrients using Ghana Food Composition Tables and FOOD PROCESSOR PLUS Software. Data were analyzed using the Statistical Package for Social Sciences (SPSS, 17). The mean energy, vitamin B₁₂, folate, iron and zinc intakes were found to be inadequate compared with the Recommended Intakes. There was also a significant difference ($p < 0.001$) in the mean intake of protein across the different trimesters. On the average protein, fat and carbohydrate contributed 13.2, 34.7 and 52.1%, respectively to total calories. Significant differences were observed between educational level and mean intake of protein ($p < 0.001$), as well as income levels and mean intake of protein ($p < 0.001$) and zinc ($p < 0.02$). Surprisingly women with larger household size had high intake of energy and nutrients. Most of the women (67.7%) reported food craving, 57.3% practiced pica and 48.8% reported dietary restrictions during pregnancy. However no significant difference was found in nutrient intakes between women who reported food craving, food avoidance and pica and women who did not. In conclusion, pregnant women in the study had lower intake of energy and nutrients compared with the RNI. Food craving and aversion as well as pica practice are common dietary practices among pregnant women in the study. Protein and zinc are associated with income and educational levels of the pregnant women in the study. It is recommended that more attention should be focused on nutrition education and intervention programs during pregnancy as well as dietary approaches such as fortification of foods to increase both macronutrient and micronutrient intakes.

Keywords: Dietary practice, maternal health, nutrition, nutrient needs, pregnancy, socio-demographics

INTRODUCTION

Nutrition during pregnancy plays a key role in the well-being of the mother and the newborn infant and further influences health during childhood and adulthood. Thus in the course of pregnancy, the quantity and quality of nourishment is of particular importance. Evidence suggest that inadequate nutrition during pregnancy, leads to spontaneous abortion, impaired fetal growth, learning impairment and behavioral problems of the offspring as well as poor pregnancy weight gain (Harding, 2001). Higgins (2003) identified dietary factors, overall diet quality and food habits as independent variables in determining pregnancy outcome and maternal weight gain. Assessment of dietary intake during pregnancy is important because it is well established that both nutrient

deficiencies and excesses can have adverse effects on pregnancy outcome (Worthington-Roberts *et al.*, 1996). Therefore an appropriate eating pattern is essential throughout pregnancy to ensure a healthy pregnancy and baby (Pickel *et al.*, 2005). Lack of dietary knowledge and the knowledge about consequences of malnutrition among future mothers may result in a lot of dietary indiscretions (Lingen, 2006). Accordingly, maternal dietary habits, poor dietary pattern and poor nutritional status of women before and during pregnancy is one of the major causes of malnutrition (Anderson, 2001).

The incidence of dietary inadequacies as a result of dietary habits and patterns in pregnancy is higher during pregnancy than at any other stage of the life cycle (Rao *et al.*, 2006). In light of this, a satisfactory nutritional status as a result of optimal food intake, before and during

pregnancy is important for a successful pregnancy. Factors such as beliefs and attitudes are also important influences in altering food habits of pregnant women. According to Admed *et al.* (2008) women, particularly in developing countries, are nutritionally at risk. Gender biases influence food consumption and distribution in families with women being the last recipient of food both in quality and quantity.

One of the major factors determining dietary practices in the first trimester is morning sickness. During this time, the body is bombarded with hormonal changes especially in early pregnancy. Studies in USA have shown that at least 70% of mothers-to-be experience nausea, vomiting, fatigue, stress and/or other discomforts in the first trimester limiting diet options (ACOG, 2004). Tayie *et al.* (2000) reported that nausea and vomiting (morning sickness) during pregnancy are associated with a decrease in maternal weight gain and infant birth weight. Factors contributing to dietary changes during pregnancy which is more common are food craving, aversion and pica practice. Studies in developed countries have shown that between 76% and 90% of expectant mothers experience a craving for at least one food during pregnancy and between 50% and 85% have at least one food aversion (Pickel *et al.*, 2005). Perceptual food taboos often influence food avoidance during pregnancy. Kroskey (1990) reported a significant positive correlation between food avoidance and lower intakes of nutrients especially micronutrients. In Ghana, a study by Tayie and Lartey (1999) among 502 pregnant women showed that 48% of the women studied had pica habit. In a cross sectional study in an antenatal clinic at Kilfi District Hospital in Kenya, low iron status and anaemia were reported among 56% of pregnant women who practiced pica (Frii and Lowe, 1998). Socio-demographics such as age, education, social class and geographical location have also been found to correlate significantly with dietary habit and hence nutrient intake especially among pregnant women. Maneethorn *et al.* (2005) reported that pregnant women with higher family income and higher level of formal education tended to consume a nutritious diet with greater frequency than poorer groups.

In Ghana many studies have focused on dietary habits of pregnant women and the intake of specific nutrients especially micronutrient and the effect on pregnancy outcome and complication. Consistent evidence about Ghanaian women's dietary composition and habits during pregnancy and nutrient intake is lacking. Taking into consideration food habits and dietary changes that continue to occur throughout pregnancy, it will be informative to investigate and identify the dietary changes that occur among Ghanaian pregnant women and reasons associated with the dietary changes, to provide sufficient data for dietitians and nutritionists in advising pregnant women on dietary habits and food intake.

The objectives of the study were to evaluate the alteration in dietary habits among pregnant women and identify reasons for the alteration, compare the food and nutrient intakes of pregnant women with the Recommended Nutrient Intakes (RNI) and to determine the impact of socio-demographic factors on nutrient intake in pregnant women. A change in dietary practice has no significant effect on nutrient intakes in pregnancy was the hypothesis tested.

METHODOLOGY

Study design, site and population: The research was carried out in Accra (Osu and Korle-Bu) between October and November 2009.

The research design for the study was cross sectional. Data for the study was collected from the antenatal clinic of the Korle-Bu Teaching Hospital and the Osu Maternity Home. The Korle-Bu Teaching Hospital is a teaching hospital for the University of Ghana Medical School and also a referral hospital that serves Ghana and the West African Sub Region. The maternity unit which is the focus of the research provides antenatal services, has a labour ward, lying-in ward, family planning unit and postnatal clinic. The average daily attendance to the Korle-Bu maternity unit is 150. Osu Maternity Home provides antenatal services to pregnant women in and around Osu township in Accra. It has an antenatal clinic, labour ward, family planning unit and postnatal clinic. The average daily attendance is 56 pregnant women. The target population comprised all pregnant women who report to the antenatal clinic of the Korle-Bu Teaching Hospital and the Osu maternity home. The inclusion criteria were absence of chronic disease such as diabetes, hypertension and other pregnancy complication and being on no special diet. The study was carried out among pregnant women in different trimesters, who were of Ghanaian descent and resident in Accra.

Sample and sampling technique: The sample size was determined using the formula, $n = [z]^2 [p] [1-p] / E^2$; where n is estimated sample size; z is the critical z score based on the desired degree of confidence; p is the prevalence rate and E is the desired margin of error. A prevalence rate of 50% was chosen (for unknown prevalence), since there is no data on the prevalence of dietary changes among Ghanaian pregnant women. Based on this formula, a value of 385 was obtained. With an average daily attendance of 150 pregnant women at the Korle-Bu Teaching Hospital, the total attendance for five days was 750. Using systematic random sampling and an interval value of 3, every 3rd pregnant woman was selected from the antenatal care unit of the Korle-Bu Teaching Hospital

to obtain a sample size of 250. Similarly, the average daily attendance at the Osu maternity home was 56 pregnant women, the total attendance for five days was 280. Again using systematic random sampling, every 2nd pregnant woman was selected from the antenatal care unit of the Osu maternity home to obtain 140. Unfortunately due to time factor and limited resources 279 pregnant women participated in the study.

Procedure for data collection: An interview guide was designed, pretested and used as instrument for data collection. The interview guide was made up of eight sections. Sections 1, 2 and 3 were used to gather data on the socio-demographics of the respondents; respondents' nutrition knowledge and dietary behavior; and pica practice respectively. Sections 4, 5 and 6 elicited data on food craving; food avoidance and food habits respectively. Section 7 was a repeated 3 day 24h recall to measure food intake. The subjects were interviewed privately by the researchers in English language and the local languages (Twi, Ga and Dangbe) where appropriate. To capture food intake during pregnancy, a repeated 24h recall for 3 days per participant was performed on different visits to the antenatal clinics (dates for next visits were taken from respondents). The women were met on their next visit without prior notification and asked to describe what they had eaten and drunk during the preceding 24h. To assist the women to recall accurately, portion sizes based on household utensils and measures were used in collecting data and later converted to grams for analysis. Food craving, aversion and pica practice were also recorded. In a period of 15 weeks 279 pregnant women attending the antenatal clinics of the Korle-Bu Teaching Hospital and the Osu Maternity Home participated in the study.

Data analysis: Dietary data from the repeated 24-hr recall was converted into grams of individual dishes and nutrient intakes were analyzed using the Ghana Food Composition Tables and Food Processor Plus Software. The mean intakes were calculated for each trimester. Calculations were done without nutrient supplementation. Statistical Package for Social Sciences (SPSS, version 17) was used to analyse the data. Descriptive statistics (means, standard deviations and ranges) were generated for variables. ANOVA was used to assess the difference between nutrient intakes and socio-demographic factors of pregnant women as well as nutrient intakes across the different trimesters. Independent t-test was used to determine if there is a difference between dietary practices and nutrient intake of pregnant women. p-value of less than 0.05 was considered significant.

Ethical consideration: The study was given approval by the Ethics and Review Board of the School of Allied

Table 1: Characteristics of pregnant women (N = 279)

Characteristics	N	%
Trimester		
- First	18	6.0
- Second	97	35.0
- Third	164	59.0
Age		
- under19	9	3.2
- 20-29	142	50.9
- 30-39	120	43.0
- 40and above	8	2.9
Educational level		
- Low	127	45.5
- Middle	78	28.0
- High	74	26.5
Marital status		
- Married	246	88.2
- Single	33	11.8
Household size		
- 1 to 2	137	49.1
- 3 to 5	109	39.1
- 6 or more	33	11.8
Income		
- Less than GH 100	48	17.2
- Between GH 101-300	59	21.1
- Between GH 301-600	65	23.4
- Between GH 601-1000	59	21.1
- GH 1000 or more	48	17.2

Table 2: Meal frequency before and during pregnancy

Meal Frequency	Before pregnancy		During pregnancy	
	N	%	N	%
< 3 times	75	26.9	35	12.5
3 times	172	61.6	139	49.8
> 3 times	32	11.5	105	37.7
Total	279	100	279	100

Table 3: Dietary change among pregnant women with reasons associated

Dietary change/Reasons	N	%
Reasons	-	-
Dietary change		
Increase in amount of food	66	23.7
Increase in frequency of meals	31	11.1
Increase in amount and frequency of meals	59	21.1
Increase in quality of food	19	6.8
Decrease in amount or frequency of meals	50	17.9
Maintained amount or frequency of meals	54	19.4
Total	279	100
Reason for dietary change		
To increase maternal weight	7	3.2
For better fetal development	63	28.0
For better maternal health	49	21.7
To produce enough breast milk for unborn baby	21	9.3
Eating for two	85	37.8
Total	225	100

Table 4: Pica practice, food craving and avoidance among pregnant women

Practices		Trimester			
		First (%)	Second (%)	Third (%)	Total (%)
Dietary practice					
Pica	Yes	50	42.3	42.1	42.7
	No	50	57.7	57.9	57.3
Food craving	Yes	66.7	74.2	67.7	67.7
	No	33.3	25.8	32.3	32.3
Food avoidance	Yes	66.7	36.1	47.6	44.8
	No	33.3	63.9	52.4	55.2

Health Sciences (Ethical Identification Number SAHS-Et./10102853/AA/26A/2010-2011). Introductory letters were sent to the Korle-Bu maternity unit and Osu maternity home to seek permission prior to the commencement of data collection. All pregnant women who were eligible were orally informed about the purpose of the study and those who agreed to participate signed a consent form.

RESULTS

Majority of the women were between the ages of 20 and 39 years (93.9%). A few were teenagers. Pregnant women in the study generally had low to middle level of education (73.5%) and most of them were married (88%). Income levels were evenly distributed among the pregnant women. About half (49.1%) of the women had household size of 1-2 with 11.8% living in households larger than six. About 50% of the pregnant women were in the third trimester with 35 and 6% in the second and first trimester, respectively (Table 1).

Dietary habits of the pregnant women:

Meal frequency and snacking pattern: The frequency of meal consumption was different before and during pregnancy among the pregnant women. Before pregnancy 26.9% of the women ate less than three times a day as compared to 12.5% during pregnancy, an improvement of 14.4%. Again a greater proportion (37.7%) of the women ate more than three times during pregnancy as compared to only 11.5% before pregnancy (Table 2). The frequency of snack consumption per day also increased during pregnancy. Different types of snacks were consumed before and during pregnancy (data not shown). Snacks consumed included pastries, fruits, fruit juices or fizzy drinks, roasted plantain and groundnut and ice cream. Apart from consumption of pastries which reduced during pregnancy and fruit consumption which increased during

pregnancy, not much difference was observed in the consumption of snack types (data not shown).

Change in dietary pattern: Out of the 279 women studied, 80.6% reported a change in their dietary habit while 19.4% maintained their dietary habit. Table 3 presents self reported dietary change among the pregnant women in the study. A few (23.7%) of the pregnant women increased the amount of food consumed, 11.1% increased their frequency of food intake while 17.9% decreased the frequency or amount of food consumed. Only 6.8% of the pregnant women increased the quality of food consumed. In terms of reasons associated with dietary change among pregnant women, about a third (37.8%) did so because of the notion of eating for two, to increase maternal weight (3.2%) and 28% for better fetal development. Other reasons given were for better maternal health (21.7%) and to be able to produce enough breast milk for unborn baby (9.3%) (Table 3).

Pica practice, food craving and avoidance: Table 4 presents dietary behaviors among the pregnant women in terms of pica practice, food craving and avoidance in each trimester. Half of the women practiced pica in the first trimester, 42.3% in the second trimester while 42.1% practiced pica in the third trimester. Common forms of pica practiced were sponge/stick chewing (13.6%), clay eating (11.1%), ice cubes (3.3%), chewing gum (4.3%), toffee (6.3%) and cola nut (3.6%). Reasons associated with the pica practice included prevention of salivation (44%), nausea (28%) and vomiting (15%). Thirteen percent of the women could not explain why they practiced pica (data not shown).

Food craving was also a common practice among the pregnant women, with a greater number of the pregnant women (67.7%) craving for at least one food item during pregnancy. Foods commonly craved for included chocolate (17.9%), candies (10.8%), fizzy beverages

Table 5: Mean energy and nutrient intakes as percentage RNI and women 100% RNI

Nutrient	Trimester			Mean	Range	100 intake as % RNI	Mean % RNI
	First	Second	Third				
Vitamin A (R.E)	2370.7	2093.9	1783.3	1929.2	25.9-13597.5	241.2	28.3
Riboflavin (mg)	1.4	1.3	1.5	1.5	0.2-19.1	91.1	70.3
Vitamin B (µg)	0.7	0.4	2.5	1.7	0-32.5	74.8	83.5
Folate (µg)	73	73.2	114.2	97.3	0-532.7	24.3	99.6
Iron (mg)	24.1	23.6	26.6	25.4	5.8-215.5	84.6	73.5
Zinc (mg)	9.11	0.2	9.9	9.9	0.07-58.5	66.3	87.8
Total calories (Kcal)	1925.8	2023	2243.9	2146.6	306-3695.5	89.4	72.8
Protein (g)	72.4	69.7	71.3	70.8	14.2-133.5	118	40.1
% Total calories	-	-	-	13.2	-	-	-
Carbohydrate (g)	268.5	282.8	286.7	279.4	58-790	-	-
% Total calories	-	-	-	52.1	-	-	-
Fat (g)	72.7	80.4	95.5	82.8	16.5-171.5	-	-
% Total calories	-	-	-	34.7	-	-	-

(10.8%) and ice cream (10.3%). Surprisingly quite a larger number of the women (17.9%) craved for cereal products or foods belonging to starchy roots and plantain group. Reasons expressed by the pregnant women for food craving were for satisfaction (45%) and to prevent either nausea or salivation (4%). Almost half of the women (51%) who craved could not associate any reason to their strong desire for a particular food (data not shown).

Nearly half (44.8%) of the pregnant women in the study avoided at least one kind of food. Food avoidance in the first trimester was reported by 66.7% of the women. In the second trimester, food avoidance was reported among 36.1% while 47.6% avoided certain foods in the third trimester. Foods avoided included meat and fish (10.8%), eggs and milk (4.3%), green leafy vegetables and cereals (23.3%) and fruits (2.2%). Reasons associated with food avoidance were taste /smell of food (27%),

Table 6: Socio-demographic distribution and mean nutrient intakes

Socio demographics	Mean nutrient intake							
	Energy(Kcal)	Protein (g)	Vitamin A(R.E)	Rboflavin (mg)	Vitamin B ₁₂ (µg)	Folate (µg)	Iron (mg)	Zinc (mg)
Education								
Low	2087.7	65.3 ^a	2039.8	1.5	1.6	470.5	19.7	9.7
middle	2010.6	65.7 ^{b,a}	1848.6	1.4	1.4	62.6	8.9	9.0
High	2391	85.6 ^{*,c}	1824.4	1.6	2.0	65.8	11.8	11.4
p-value	0.32	0.001	0.63	0.51	0.57	0.76	0.10	0.06
Income								
< GHC 100	2282.8	64.5 ^{a,b,c}	1699.3	1.4	1.3	179.9	25.3	11.3 ^a
GHC101-300	1900.6	60.8 ^{b,a,c}	2003.9	1.3	1.5	68	22.6	7.9 ^b
GHC301-600	2031.5	68.9 ^{c,a,b}	1681.3	1.6	1.6	79.8	24.2	9.1 ^{c,a,b}
GHC601-1000	2202.8	77 ^{d,a,c}	2290.8	1.5	1.9	79.9	26.9	10.9 ^{d,a}
GHC1000 and above	2398.9	84.3 ^{*,e}	1981.3	1.6	1.9	99.2	28.6	11.1 ^{e,a}
p-value	0.55	0.001	0.32	0.79	0.87	0.41	0.29	0.02
Household size								
1 to 2	2214.6 ^{a,b}	76.3 ^a	2282.6 ^{a,c}	1.5 ^{a,b,c}	1.7	88.2 ^{a,b}	26.5 ^{a,c}	10.5 ^{a,c}
3 to 5	1843.7 ^{b,a}	61.5 ^b	1510.4 ^{b,c}	1.2 ^b	1.2	66.6 ^{b,a}	22.4 ^b	8.6 ^b
6 and more	2864.6 ^c	78.9 ^{c,a}	1845.5 ^c	1.8 ^c	2.7	236.6 ^c	30.8 ^{c,a}	12.2 ^{c,a}
p-value	0.01	0.001	0.001	0.05	0.06	0.02	0.01	0.001
Marital status								
Married	2059.5	70.5	1841.6	1.4	1.7	78.3	24.8	9.6
Single	2795.9	73.6	2582.6	1.8	1.3	238.9	29.6	12.5
p-value	0.34	0.64	0.10	0.13	0.57	0.32	0.96	0.14
Age								
< 19	2028	69.5	1545.7	1.1	0.4	65.5	23.8	9.7
20-29	2195.1	70.3	2088.1	1.6	1.9	119.7	25.7	10.2
30-39	2125.9	71.9	1751.3	1.4	1.5	76	25.3	9.7
40 and above	1729.5	64.7	2209.2	1.0	0.5	54.3	23.7	9.3
p-value	0.88	0.94	0.39	0.35	0.36	0.69	0.97	0.94

*: The mean difference is significant at p<0.05; **: Mean values with different superscripts are significantly different at p<0.05; ***: Mean values with same superscripts are not significantly different at p<0.05

Table 7: Dietary practices and mean nutrient intakes

Dietary practice	Mean nutrient intake							
	Energy (Kcal)	Prot (g)	Vitamin A (R.E)	Riboflavin (mg)	Vitamin B ₁₂ (µg)	Folate (µg)	Iron (mg)	Zinc (mg)
Meal frequency								
< Three times	1692.6	55.9 ^{a,b}	1686.8	1.1	0.7	60.9	20	8.1 ^{a,b}
Three times	2154.6	67.3 ^{b,a}	1917.4	1.5	1.8	115	25	9.7 ^{b,a,c}
> Three times	2287.4	80.4 ^c	2025.7	1.5	1.8	85.6	27	11 ^c
p-value	0.18	0.001	0.61	0.33	0.16	0.59	0.06	0.001
Food craving								
Yes	2254.7	73.6	1946.7	1.5	1.5	107	26	10
No	1919.5	65.1	1892.6	1.3	2.1	78.1	25	8.9
p-value	0.11	0.65	0.81	0.18	0.15	0.49	0.10	0.10
Food avoidance								
Yes	2237.1	71.3	1958.8	1.5	1.6	116	26	9.9
No	2073.1	70.4	1905.2	1.4	1.7	81.9	25	10
p-value	0.41	0.83	0.80	0.59	0.91	0.37	0.10	0.70
Pica practice								
Yes	2237.1	71.3	1958.8	1.5	1.6	116	26	9.9
No	2073.1	70.4	1905.2	1.4	1.78	1.9	25	9.9
p-value	0.34	0.51	0.37	0.24	0.22	0.34	0.10	0.70

*: The mean difference is significant at p<0.05; **: Mean values with different superscripts are significantly different at p<0.05; ***: Mean values with same superscripts are not significantly different at p<0.05

texture of food (26%) and feeling of nausea or vomiting (2.2%). Forty five percent of the women avoided certain foods with no associated reason (data not shown).

Nutrient intakes: Energy and nutrients intakes were generally low among the pregnant women. The mean energy intake was 2146.6 Kcal which is lower than the recommended RNI. Seventy two percent of the women had energy intakes below the recommended. Though the mean protein intake was adequate (70.8g), 40.1% of the women had intake below the recommended. Vitamin A intake was also adequate. Intake of other minerals and vitamins were low particularly that of folate. Almost all the women in the study (99.6%) did not meet the RNI for folate. With the exception of the intake of Vitamin B₁₂, no significant differences were observed among the women across the three trimesters in terms of energy and nutrient intakes. The mean percentage contribution to total calories from fat, protein and carbohydrate were within recommended values (Table 5).

Socio-demographic characteristics and nutrient intake: Table 6 shows the relationship between socio-demographic characteristics and mean nutrient and energy intakes of the pregnant women. There was no significant difference between educational level and mean intake of energy and selected nutrient except for protein. The higher the educational level the higher the amount of protein consumed. There was also a significant difference between income levels and mean intake of protein ($p<0.001$) and zinc ($p<0.02$). However no difference was observed between income levels and the intake of energy as well as other nutrients. In terms of household size, there was a significant difference between household size and the intake of energy and all nutrients except vitamin B₁₂. Women with larger household tended to have higher intake of nutrients. There was no significant difference between marital status and mean intake of energy and selected nutrient as well as age of the pregnant women.

Dietary practices and mean nutrient intake: The results show a significant difference between meal frequency and mean intake of protein ($p<0.001$) and zinc ($p<0.001$). However no significant differences were observed in nutrient intakes between women who reported food craving, food avoidance and pica and women who did not (Table 7).

DISCUSSION

This present study demonstrates differences between dietary practices and nutrient intakes as well as the influence of socio-demographic factors on nutrient intakes. In this study 42.7% of the women practiced pica and the most common form was sponge or stick chewing

which is contrary to the findings by Tayie and Lartey (1999) in Ghana. In their study, 48% of their subjects practiced pica with the common form being clay eating. Compared to the study by Tayie and Lartey (1999), this study had a smaller sample size. Pica practice normally occurred in the first trimester to prevent salivation, nausea or vomiting as reported by the pregnant women. In Kenya, Frii and Lowe (1998) reported pica practice in 56% of their subjects and again the study had quite a larger sample size.

Food craving and avoidance was reported by 67.7% and 44.8% of the women respectively. The most avoided food in this study was meat and fish, this accounted for the lower intake of Vitamin B₁₂ observed in the first trimester as most women in this group reported food avoidance. This is not surprising because the rich source of Vitamin B₁₂ is meat

Mean energy and nutrient intakes in this study in comparison with RNI, showed intake of energy, vitamin B₁₂, folate, iron and zinc to be inadequate. This finding is in line with Huybregts *et al.* (2009) in Burkina Faso where mean energy and nutrient intakes were found to be insufficient compared with the recommended daily allowances, especially for pregnant women. Protein and vitamin A intake was however adequate and above the recommended RNI while riboflavin was adequate as the recommended intake. The mean intake of protein and vitamin A was adequate across the different trimesters as well. Research by Kamau-Mbuthia and Elmadfa (2007) in Kenya shows a similar trend where adequate intake was found for protein among pregnant women in their study. Vitamin A deficiency may not be a major problem due to the higher intake of palm oil. Only a few women had intakes below the recommended. The mean intake of folate was alarmingly low, similar to studies in Sweden by Andersen *et al.* (2008). The lower intake of folate in the study is probably due to low intake of vegetables. Since the recommended intake for folate is increased during pregnancy, increased consumption of dark green vegetables by pregnant women should be encouraged. Currently, at least three servings of vegetables and two servings of fruits are recommended for the general population. Pregnant women should consume additional serving of vegetables and fruits to help meet their energy and nutrient needs.

Mean energy intake in this study was much lower than those reported for pregnant women in other studies by Esmailzadeh *et al.* (2008) in Iran and Cuco *et al.* (2006) in Europe. About 72.8% of the pregnant women in this study did not meet the RNI for energy. In a similar study in Nigeria, Ojofeitimi *et al.* (2008) reported that more than 60% of their sample did not meet the requirement for energy. Mean energy intake for this study group was 2146.6Kcal compared to the RNI of 2400Kcal. There was no significant difference ($p<0.49$) in the mean

intake of energy across the different trimesters. Inadequate energy intake will result in low birth weight, poor maternal weight gain and low fat stores. It is therefore of great importance to ensure adequate intake of energy especially in pregnancy, when the woman needs sufficient energy for herself and the developing fetus.

Although protein intake was much higher in this study than those reported by Andersen *et al.* (2008) and Ojofeitimi *et al.* (2008), the protein sources are from plant and are limited in essential amino acids. On the average protein, fats and carbohydrate contributed 13.2, 34.7 and 52.1%, respectively to the total calories of respondents. Further interpretation of the energy and nutrient intake determined in the study is limited by the lack of published data on dietary intakes of Ghanaian pregnant women, which could serve as a basis for comparison. Inadequate nutrient intake might be due to poverty, low purchasing power, lack of nutrition knowledge, ignorance and illiteracy.

Socio-demographic factors such as age, educational level, marital status and income have been found to influence the amount of nutrient intake. Determinant of health and nutritional status are socio-demographic. In this study, pregnant women with higher education level consumed higher amount of protein compared to women with low and middle level of education. This might be due to access to nutrition information and knowledge about quality sources of protein. Again increased family income increased the intake of protein and zinc. Pregnant women with higher family income had higher protein intake due to affordability. This finding is in line with studies by Maneethorn *et al.* (2005) in Thailand where pregnant women with higher family income and formal education tended to consume a nutritious diet with greater frequency than poorer group. In addition, studies by Rogers *et al.* (1998) reported lower intake of protein, iron and zinc among pregnant women of low socioeconomic status. By statistical evidence investing in education and increasing economic power would be of much importance. Surprisingly in this study pregnant women with larger household size had higher intake of energy and all other nutrients compared to women with smaller household size. No significant differences were observed in the intake of energy and nutrients between marital status as well as the age of the women.

CONCLUSION

The study shows an improvement in dietary habit during pregnancy compared to periods before pregnancy. There was an increase in meal frequency as well as the amount of meals consumed. Dietary practices such as pica, food craving and aversion were common dietary behaviors in pregnancy.

Energy and nutrient intakes were low compared with the recommended intakes except for protein and vitamin A. Dietary practices such as pica, food craving and aversion did not affect the intake of energy and other selected nutrients.

Educational level, family income and household size were predictors of nutrient intake in pregnant women in this study.

It is recommended that more attention should be focused on dietary approaches, including fortification of foods with micronutrients, which may prove to be more beneficial and sustainable than provision of supplements during pregnancy. Such approaches would encompass increasing energy and macronutrient intakes, as well as micronutrient intakes, which may be more advantageous.

Nutrition education programs and interventions should be designed to improve knowledge of food and nutrition as well as to enhance dietary diversification to encourage appropriate food choices. This program could increase the awareness of health in order to prepare women for better or appropriate health during pregnancy.

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