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Pregnant Women's Energy Consumption and Weight Gain: The Perspective of a Rural Community at Rongo District Kenya

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Abstract

Women in poor rural communities often consume diets that are deficient in energy. Maternal malnutrition continues to be a global problem. Population studies indicate that kilocalorie intake is usually less than recommended and pregnant women often do not show a significant augmentation in energy intake. The prevalence of chronic malnutrition is reflected in the high incidences of maternal deaths, increased risk of disease, and lower pregnancy weight gain. Low rates of gestational weight gain increase the risk of low birth weight infants and shorter gestations and from an international health perspective, birth weight is the most readily available index of pregnancy outcomes. This study investigated women's socio-demographic factors, energy intake, and and their influence on gestational weight gain among pregnant women attending Rongo Sub-District Hospital. Objectives of the study included determining socio-demographic factors, energy intake, assessing weight gain, and testing for relationships between energy intake, maternal variables and weight gain. The study adopted longitudinal design and comprehensive sampling was used to select a sample of 100 pregnant women. Data was collected by use of structured questionnaires, observation, 24- hour recall and food weighing techniques. Data was analyzed by SPSS and dietary data by use of Nutri-survey. Pearson's Correlation Coefficient was used to test for significant relationships and t test for significant difference between mean of nutrients. Daily energy intake was found to be 1436.42 ± 421 Kcal/ day. Mean weight gain was 245.9±201std g/week and was higher for women with lower weight. The study found a significant relationship between energy intake and gestational weight gain (P≤ 0.05) and suggested possible confounding with certain socio-demographic factors. The pregnant women consumed fewer calories than the recommended levels. The study fills the knowledge gap, benefits future research work, government departments, NGOs, the community and pregnant women. The government and NGOs need to monitor gestational weight gain more closely in order to provide counselling as well as nutritional support to pregnant women.

Key words: Energy Intake, Gestational Weight Gain, Socio-demographic factors

INTRODUCTION

Every year more than 500,000 women worldwide die from complications arising from pregnancy and childbirth (Sub-Committee on Nutrition, 2004). Childhood and maternal underweight alone are responsible for 138 million disability adjusted life years or 9.5 % of the global burden of disease mostly in developing countries (SCN, 2004). In many countries in Africa, the prevalence of underweight women ranges from 10-15% (SCN, 2000). A third of the maternal deaths occur in sub-Saharan Africa where an alarming number of babies are born underweight and 40% of children are

stunted (Mwadime, 2001). According to SCN (2000), 11- 17 million infants with low birth weight are born each year. Complications related to pregnancy and child birth is a leading cause of morbidity and mortality among Kenyan women (Ministry for Planning National Development and Vision 2030, 2008).

Despite strategies put in place to achieve the 5th millennium goal of improving maternal health, maternal malnutrition continues to be a global problem. Population studies indicate that kilocalorie intake is usually less than recommended and pregnant women often do not show a significant augmentation in energy intake (Shaw, 2003). Approximately 826 million people in the world are undernourished or chronically food insecure facing a shortfall in the energy requirement by between 100-400 kilocalories (FAO, 2001) while 790 million people in developing countries subsist on diets that are deficient in energy (FAO, 2001). In Kenya 50% of the rural population is food insecure (Barasa, 2006).

The prevalence of chronic malnutrition is reflected in the high incidences of maternal deaths, increased risk of disease, and lower pregnancy weight gain. Low rates of gestational weight gain increase the risk of low birth weight infants and shorter gestations and from an international health perspective, birth weight is the most readily available index of pregnancy outcomes including intrauterine growth retardation, spontaneous abortion, fecundity and congenital abnormalities (Willis, 2003). Low birth weight infants are 4 times more likely to die from infections such as diarrhoea and pneumonia (Garza and Motel, 2000).

A recent Lake Victoria region study found that Kenyan women consume 1506 ± 533 kilocalories daily, only 15.6 % met the recommended daily allowance (RDA) (Waudo, kikafunda, Tuitoek, and Msuya, 2005). Pregnant women in this region may be at nutritional risk because of inadequate energy intake that may fail to meet the high-energy demands of their daily physical activity, and gestation.

Purpose and objectives

The purpose of this study was to investigate the maternal energy intake and levels of physical activity and their influence on gestational weight gain among pregnant women at Rongo Sub-District Hospital. Specific Objectives of the Study were to: determine the daily dietary energy intake, assess gestational weight gain, and to determine the relationship between maternal energy intake and gestational weight gain of pregnant women.

The study was directed by the null hypotheses that: there was no significant relationship between energy intake and gestational weight gain among pregnant women at Rongo Sub- District Hospital.

METHODS

Research Design and Sampling

Longitudinal design was used for the study. Rongo Sub-District hospital was purposively selected for the study due to its credibility in offering antenatal services to the largest number of women in the Division (Migori District Medical Records, 2004). Comprehensive sampling was used to obtain the required sample. A population of approximately 120 pregnant women that visit the hospital in a month (Medical Records Migori District Hospital, 2004) constituted the study population.

The sample size was calculated as P1 = 0.7 +10% according to FANTA sampling guide (1997) recommendations to obtain a sample of 100 pregnant women. Because the same women were expected to visit the hospital the following month, one month was used as the right time frame to obtain the required sample. Each pregnant woman visiting the hospital was therefore selected for the study based on their consent.

Study Area

study area was Rongo, Migori District situated approximately 30 km from Lake Victoria. The area was selected for study because the researcher was likely to build trusting relations with the participants during the study and also because data quality and credibility were reasonably assured.

Target Population

This study targeted pregnant women visiting Rongo Sub-district hospital for ante-natal clinic in their 2nd and 3rd trimesters up to 38 weeks gestation during the period between March to August of the year 2006. Women in their first

trimester of pregnancy were not targeted because they do not present themselves for ante-natal checks and also because weight gain in the 2nd and 3rd trimesters is much more important to pregnancy outcome than weight gain in the 1st trimester (Garza andMotel, 2000). The study included pregnant women who suffered manageable chronic illnesses or who were on some form of medication or treatment but excluded those who did not give consent, were hospitalized or bedridden, did not visit the hospital and those resident in the locality for less than six months.

PROCEDURES

Research assistants were trained on data collection techniques and were instructed on conducting the interview. Researcher and assistants then visited the clinic daily for 30 working days to obtain the sample and collect data on 100 pregnant women.

A face-to-face interview with a standardized semi structured questionnaire was administered to collect data in the hospital counselling room. Weight measurements were taken at weekly intervals for 4 weeks for every woman to monitor weight gain once in the hospital and three times in their homes. Review of hospital records (outpatient cards) was done to obtain information on maternal morbidity. The women were given appointments to be visited at home exactly one week from the day of the recruitments. Each woman was coded and details of how to reach them in their homes were recorded. Each woman was weighed using a Bathroom Scale (RTZ – 98117) during each consecutive visit and measures recorded to the nearest 0.1 kg. Weight measurements were taken when the women wore no shoes with light clothing. Calibration of equipment was done before weighing each respondent.

A combination of 24-hour dietary recall and weighed food intake were used to measure food intake. The food and drink eaten by the woman the previous day were recalled by her as she was being interviewed by the researcher and assistants. The intakes were recorded on 24 hour recall sheets which were coded for every woman. Quantities were estimated through the use of common household measures. The 24 hour recall interview schedules were repeated during the home visitation. Each woman had three 24-hour recall data which were used for analysis.

Observers were later on present in the households of 10% of the respondents to carry out 2-4 days observations from 7.00 am to 6.00 pm. A measure of household food preparation and consumption was done using a Digital Salter scale UK REG. Design No. 1049111 that was purchased for the study. The sample for observation was obtained based on consent of the women who would also select a day that they would be present in their homes. During observation days all foods were weighed before cooking on digital display scales and results rounded to the nearest gram. After the food was prepared but before it was served the whole dish was weighed. Ingredients of mixed dishes were weighed at the time of preparation and portions consumed by the woman were directly measured and recorded. The weight of any food left at the completion of the meal was deducted from the weight of the original serving. Snacks and other foods such as fruits consumed by the subject but not included in the main dish were also weighed and results recorded to the nearest gram. Foods prepared while the observer was absent were obtained by questioning and observing the woman.

Data Analysis

Data for 100 pregnant women was available for analysis. All weights of foods consumed by the subjects from 24 hour recall and weighing method were converted from household measures into grams and then into intake values for energy, protein, fat, iron, zinc, fibre and vitamin C. Local measuring utensils were identified and their weights and volumes determined by use of a variety of foods and beverages to ease analysis. After the estimation of the quantities of food recalled and weighed, they were converted into energy intakes by using Nutri-Survey package for windows.

Regression analysis was used to estimate women's pre-pregnancy weights for those in their 2nd trimester of pregnancy taken as the intercept at 14 weeks because there is little gain before hand and a constant weight gain from 14 weeks (Subcommittee on Nutritional Status and Weight Gain during pregnancy, 1990). The mean of four measures was used as the weekly weight gain for every woman. Paired t-test was used to test for significant relationships between the means of nutrient intakes from recall and weighed intakes at $P < 0.05$. Pearson's product moment correlation coefficient (r) was used to measure correlations between variables at $P < 0.05$.

RESULTS

Respondents households from were made up of averagely 5 people. Houses had an average of 2.5 rooms. Roofs were mainly constructed of corrugated iron sheets (88%) and grass (12%). Floors were mostly mud (64%) and some were cemented (36%). Walls were constructed of brick (30%), mud/cement (6%), but mostly of mud only (63%). Most homes

had pit latrines (90%) and only one had a flash toilet while others (9%) had no latrine at all and used nearby bushes. Majority (88%) had at least a radio and a few (17%) had a television set. None of the homes had refrigerators or piped water. Majority (55%) hauled water from locally dug out wells while some (45%) collected water from nearby streams. Most women (50%) used firewood as fuel for cooking, some (23%) used charcoal, few (7%) used both charcoal and firewood and only a few (18%) used a combination of charcoal, paraffin and cooking gas.

DISCUSSION

Housing Characteristics

The housing characteristics included the type of dwelling occupied by the household, and type of roof, wall and floor, information on main water sources, toilet facilities and type of fuel used by the households for both lighting and cooking\. Household possessions were also covered in the study. Information on these characteristics is useful in that it reflects on the household's socioeconomic status from a public health point of view (Ministry of Medical Services and Ministry of Public Health and Sanitation, 2009).

Socio-Demographic and Health Factors

The social, economic and health factors that were considered include, age, marital status education level, employment status, wealth index, source of food, main provider of food and morbidity. Each of the factors has been discussed below.

The Women's Age and Marital Status

The average age of the women was 23.4 at the time of the study (Table 1). Majority (64%) of the women had their first pregnancy at below 19 years while 36% had their first pregnancies at over 19 year. Women in this study population got their first child at less than 19 years of age. Most (86%) of the respondents were married, some (12%) were single while 2% were widowed (figure 1).

Educational Level of the Women and Husbands' Educational Level

Most of the women had only a primary education (72%) followed by those who had not completed secondary school (10%)while just a few had no education at all (2%) (figure 2). If compared with the national, standards, these figures would be considered low. For instance 29% of women in Kenya have some secondary education while 12% have completed secondary school (CBS, 2003) compared to only 10% and 9%, respectively, from this study. The findings suggest that illiteracy levels are high among this study sample. The husbands generally had higher levels of education than the women. Only 1% had no education at all, 10% had tertiary education, most (57.5%) of the men had only full or incomplete primary education (figure 2). The figures obtained from this study correspond with the national figures (10% and 16%) (CBS, 2004) for complete tertiary and complete secondary education respectively and is a confirmation of the status of men's education in Kenya.

Education is a human right and one of the major factors that contribute to better living standards, its importance cannot be overemphasised. Education insufficient to achieve basic literacy is however unlikely to bring much benefit (Ministry of Medical Services and Ministry of Public Health and Sanitation, 2009).

Employment Status of Women and Husbands

Most of the women (66%) were not employed while some were (23%) self-employed with most of them involved in small businesses like hawking and selling in the market. Only a small proportion (8%) had some employment where they obtained wages at the end of the month (figure 3). More men than the women tended to be involved in some income generating activity. Fewer men (21.8%) than women (66%) were un-employed; (26.4%) were employed (Figure 3). Households where husbands have some form of income may not lack food even if the wife is not employed. Traditionally men are supposed to be the household provider.

Table 1. Age distribution of the pregnant women

Age (in years)	Frequency (N = 98)	Percent
≤ 19	35	36
20 – 24	31	32
25 – 29	17	17
30 – 34	7	7
35 – 39	5	5
40 – 44	2	2
≥ 45	1	1
Total	98	100

Table 2. Main source of food and main provider of food of the women's households.

Maternal Variable		Percentage
Main source of food	Production	85
	Purchase	15
Main provider of food	Both husband and woman	26
	Husband	61
	Other relatives	07
	Parents	06

Employment status of members of a household is vital because it is an important indicator of the economic status of the household (Ministry of Medical Services and Ministry of Public Health and Sanitation, 2009) and hence a key determinant of the dietary energy intake of the household. Employment is a means by which money comes into the household which in turn is used to obtain food which may be adequate or inadequate depending on the type of employment.

Household Size, Main Provider of Food and Main Source of Food

household size for the study households was 5 persons. Most (61%) of the households were provided for by the husbands, less than half (26%) of the households were provided for by both the husband and wife, a few of the households were either provided for by parents (6%) or other relatives (7%) (Table 2). The single women were young adolescents who lived with either a relative or parent. Widowed women were also supported by a relative. Almost all the households (85%) obtained their food mainly by subsistence farming; a few (15%) however obtained their food through purchase. This finding suggests that most women obtained their food through subsistence farming and that most women did not have much financial capability to provide for themselves. This is because most women were not employed but more husbands than wives had some form of employment (Figure 3).

Wealth Index of the Women

The wealth index was a composite measure of the living standard of the pregnant women's household's ownership of selected assets, materials used for housing construction, and water and sanitation facilities. The wealth index placed the pregnant women's households on a continuous scale of relative wealth using principal components analysis. The pregnant women were ranked according to the score of the household in which they resided. The index categorised the women into four quintiles: Poorest, Second poorest, Middle and Slightly rich. Only 5% of the women fell within the slightly rich wealth index and 17% fell within the middle wealth index. Majority fell within either second poorest (36%) or poorest (42%) wealth indices (figure 4). This finding suggests that this study sample was made up mostly of women from poor households. This finding may be in agreement with a 2006 FAO report that found a proportion of Kenyans to be suffering from food poverty and further reported that Nyanza, Rift valley and Eastern provinces contributed 66% of the total rural food poverty. The report further states that there is an intricate relationship between food poverty and absolute poverty (Barasa, 2006).

Morbidity

Ailments that are commonest causes of illness among pregnant women in Kenya are malaria, respiratory disease, diarrheal disease, skin infection and intestinal worms (Ministry of medical services and ministry of Public Health and Sanitation, 2009). Ailments that were observed among the women were selected based on this report. The study found the women to have reported the following illnesses in the order of their frequencies, malaria followed by respiratory conditions such as coughs, chest pain and flu. Twenty nine percent of the women had suffered one or more incidences of malaria during the pregnancy, 26% had suffered from malaria once during the pregnancy, 5% had suffered from respiratory conditions and 39% had not suffered from any disease condition during the four weeks preceding the study (figure 5). About 10% of the women were actually found to be suffering from malaria related symptoms during the periods of visitation as observed in hospital records. This implies that malaria continues to be a major problem within the region. Malaria may therefore be a major contributing factor towards the low weight gains observed, working through the malnutrition–infection complex to create a multi related conditions such as compromised body defence due to lack of several other nutrients.

The deficiencies may be initiated by low calorie intake and continued under-nutrition due to food intolerance and lack of satiety caused by illness as observed among several women. In an effort to prevent malaria, 74%, of the women slept under mosquito nets This is in contrast to the figure of mosquito net use obtained by the 2003 Kenya Demographic Health Survey (CBS, 2004) of 17% by pregnant women and may imply that the malaria prevention campaign by the government and UNICEF has made tremendous achievement. Morbidity may influence dietary intake, activity levels and therefore maternal nutritional status.

This study highlights the plight of pregnant women attending ante-natal clinic at Rongo Sub-District Hospital; the high proportion of poor women, the high illiteracy levels, harsh living conditions, women's unemployment and a struggle by pregnant women to survive despite constraints paused by the women's environment. The government and other organizations would do well to introduce interventions that improve the socio-economic status of women in this community. This study also presents a highlight into other problem areas affecting maternal health that would be worth investigating further.

Energy Intake

Most of the women's diets consisted of three meals a day and majority did not snack in between the meals. Energy intake among the pregnant women was 1436.42 Kcal/day and 1515.602 Kcal/day from recall data and weighed intakes respectively. (Table 3). All the nutrients measured by the two methods varied only slightly. Intakes of energy, carbohydrates and proteins, vitamin C, folic acid and zinc tended to be slightly underestimated by the 24-hr recall method but the differences were not significant ($P< 0.05$). The 24 hour recall method has been reported to be cheaper and easier than other techniques and has been found to yield reliable information if carefully planned and well executed (Ferguson *et al,* 1989). Data from this study supports this observation.

The lack of significant differences in intake of all nutrients assessed by the weighed food method and the recall technique in this study group show that 24 hour recalls can produce reliable data. Laboratory analysis results did not also vary much from the other two results for the nutrients analysed although they tended to be closer to the weighed intakes than the recalled intakes. This may imply that the weighed method had more precision than the recall data.

The three data sources serve to validate the intakes obtained because of the closeness of the results although no significant testing was done for laboratory assessment and other outcomes. It is possible that the difference in the intakes of some nutrients obtained by the recall and weighed intakes in this study may have been reflections of actual variations because they represented mean values for intakes on different days of the week and differences in the sample sizes for the two methods. The comparability of data collected by the two methods may have been due to the use of local utensils and similar ingredients during recall interview and observation in which the amounts of food ingredients used during preparation and serving of the previous day's meals were estimated. The meals in this study sample were simple and varied little from day to (Table 5) and this may also have contributed to the insignificant differences.

Most of the food nutrients presented in table 3 did not meet the recommended daily values. Only vitamin C and fibre were taken in excess of the recommended values. The quantity of protein consumed was not very low although it did not reach 100% adequacy. The nutrient intakes for most nutrients among this study sample were inadequate except for vitamin C and fibre. High intake of fibre foods is good for these pregnant women because it provides a variety of beneficial phytochemicals and a hefty measure of protection against constipation (Brown et al, 2005). These findings compare with a 2006 Nakuru study of dietary quality of pregnant women (Mbuthia and Elmadfa, 2007) in which there was inadequate intake for energy, folic acid, calcium, iron and zinc but adequacy was obtained for fibre and vitamin C.

Table 3. Mean daily intakes of selected nutrients from recall, observed and analysed intakes compared with RDA

Nutrient/day	RDA	Recall	% RDA	P value t- test	Observed intakes	% of RDA	Lab Analysis
Energy (Kcal)	2500	1436.42	57.55	0.201	1515.60	60.6	1533.75
Protein (gm)	60	54.74	91.2	0.544	59.40	99.0	58.36
Fat(gm)	83374	38.6	21.5	0.624	38.20	46.0	38.47
CHO (gm)	27	237.00	63.4	0.835	247.44	66.2	247.10
Iron (mg)	100	13.35	49.	0.189	10.35	38.3	
Vitamin C (g)	400	122.73	122	0.848	137.73	137.7	
Folic acid (µ)	20	85.75	21.4	0.638	88.62	22.15	
Zinc (mg)	30	9.02	45.0	0.732	10.30	51.5	
Fibre (mg)		31.96	106	0.690	30.00	100.0	

Analysis done at the MIT/Moi University

Table 4. Nutrient Intake as percentage of RDA of rural pregnant women compared with intakes of pregnant women at Rongo Sub-District Hospital.

Nutrient	*2nd trimester	*3rd trimester	Rongo women intakes
(N – 61)	(N – 80)	(N- 100)	
Calories	59	49	56.3
Protein	6o	46	91.2
Iron	79	72	49
Vitamin C	399	187	122

*(Sehmi, 1993)

Dietary iron and folic acid intakes were well below adequacy levels i.e. 49% and 21.4% respectively. Body requirements for these nutrients may have been boosted by supplements given at the hospital as a government's intervention program for these nutrients (MOH,2000) although this study did not investigate whether the women were actually taking the supplements or not. Another study by Steyn and Nel (2006) on dietary intake of adult women in South Africa, Nigeria and Kenya found Kenyan women's dietary intake of carbohydrate and fat to be almost similar to findings from this study. Diets of pregnant women in Kenya is insufficient in many aspects in that it fails to supply the nutrients in the required amounts as indicated by findings from the two studies compared in table 4 (Sehmi, 1993).

A list of the frequency of all foods consumed in one week was generated from 10% of the sample reports. Most of the foods consumed by the women were carbohydrates which accounted for 57.5% of the weekly diet, followed by vegetables 19.2%, proteins 12.2 %, fruits 5.8% and lastly beverages (5.2 %) (Table 5). Consumption of proteins was relatively low but the strong point is that they were mostly of animal sources enabling the women to obtain superior quality protein as single source foods in terms of meeting essential amino acid requirements. The relatively high consumption of animal proteins was due to the high intake of small fish and other fish types which are easily available in the area of study. There was high consumption of tea and this may be a disadvantage because it may have taken the place of more nutritious food items yet it is limited in calories. Beliefs about food cravings and food aversions may have influenced the food choices of these women so that the frequency of consumption of certain foods as observed in table 5 may not be necessarily a result of types of food available in the locality.

Women's diets had little variety (table 5) with high repeatability of certain food items through the week. A large proportion of food consumed were home produced or purchased locally, diets were therefore monotonous and simple because they may have been dictated by what was available in the home or local markets and the prices of these foods. The pregnant women may also have consciously chosen not to consume certain foods for personal reasons (food avoidances), hence the high frequency of consumption of certain foods and the low frequency of others. Majority of the food items consumed were home prepared mixed dishes. Frequently consumed dishes were selected for analysis and the analysed values compared with calculated values from food composition tables (table 6). Calorie, protein, fat and carbohydrate values are comparable for most foods, therefore values for these nutrients agree well for most of the mixed dishes consumed. Drop scones (*Mandazi*) had the highest amount of calories (305Kcal/100g) and

Table 5. Frequency of consumption of foods by food groups in one week by 10% of the women

Category	Food Item	Frequency (week)	Food Item	Frequency (week)	% (week)
Carbohydrates	Ugali	140	English potatoes	4	
	Rice	18	Sugarcane	11	57.5
	Bread (white)	3	Chapati	4	
	Porridge	58	Mandazi	9	
	Sweet potatoes	6	Cake	1	
	Nyoyo (maize and beans)	9			
Proteins	Fish	9	Eggs	5	
	Small fish	20	Beans	7	12.2
	Meat	8	Ground nuts	1	
	Chicken	3	Liver	1	
Vegetables	Local vegetables	31	Cabbage	5	
	Kales	49			19.2
Fruits	Bananas	6	Pears	2	
	Citrus fruits	13	Mangoes	3	5.8
	Avocado	05	Guavas	4	
	Pawpaw	02	Pineapple	1	
Beverages	Tea (with milk)	72	Sour milk	4	19.5
	Black tea	8	Soda	2	

NB: Multiple responses were provided by the subjects.

Table 6. Analysed and calculated nutrient values of selected mixed dishes consumed by the women.

Dish Name	N	Calorie Kcal/100g		Protein g/100g		Fat g/100g		Carbohydrates g/100g	
		A*	C	A	C	A	C	A	C
Maize Meal(*Ugali*)	140	134	144	3.5	3.3	1.5	1.7	30	27.6
Porridge	58	47	46	1.0	1.1	0.11	0.7	8.4	8.9
Tea	72	28	26	0.5	0.7	1.0	1.3	0.5	0.7
Rice	18	105	110	5.6	6.5	0.5	0.5	33.0	31.4
Sweet potatoes	06	133	133	1.0	1.2	0.1	0.1	20.1	17.5
Maize and Beans	09	135	147	4.5	5.1	1	1.6	30	29.6
Drop Scones	09	300	305	7.0	6.7	6.75	6.7	3	54.4
Kales	49	53	36	1.8	1.6	2	2.1	3.0	3.4

N- Number of times dishes were reported.
A – Analysed values
C - Calculated values: Nutrient values were calculated from nutrient values of each ingredient and are based on a standard composition by FAO/WHO food composition tables.
* Calculated using specific energy factors (Nielsen, 2006)

tea had the least (26/Kcal/100g).

Kilocalorie intake among the women was disaggregated according to various characteristics of the pregnant women (table 7). According to education status intake appeared highest (1634.2 Kcal/day) among women with tertiary education, and least among women with secondary education (1362.8 Kcal/day).

Apart from those with some secondary education, energy intake may be said to be proportionally related to education level so that the higher the education level the higher the energy intake. This may be because women with tertiary education are more food secure than other groups since these women have their own incomes. Women's cash income is comparatively more significant in terms of a family's standard of living as they spend it on the family (Wardlow, 2003)). According to women's employment status, energy intake was highest among women who were casual workers (2087.40 Kcal/day) and lowest among the wage earners (employed women)(1248.54 Kcal/day). Women who are employed may

Table 7. Energy intake categories by selected maternal variables

Maternal Variable	N	Energy intakes (Kcal/day)	Standard deviation
Subjects' Education Level			
None	2	1721.95	343.01
Primary	72	1409.33	438.01
Some secondary	10	1362.81	254.61
Completed secondary	9	1517.53	385.76
Tertiary	7	1634.27	497.94
Total	100	1436.42	421.84
Husbands' Education Level			
Primary	45	1386.70	426.30
Some secondary	10	1479.92	287.86
Completed secondary	13	1616..65	465.06
Tertiary	10	1375.54	500.76
none	1	1602.00	429.67
total	87	1440.90	
Husbands' employment status			
Unemployed	19	1316.36	449.80
Casual	20	1380.80	363.13
Self- employed	25	1603.01	448.44
Wage earner	23	1419.83	419.36
Total	87	1440.90	429.67
Subjects' Employment Status			
Unemployed	66	1424.52	360.82
Casual	3	2087.40	484.12
Self-employed	23	1451.01	533.77
Wage earner	8	1248.54	348.45
Total	100	1436.42	421.84
Main provider			
Both	26	1481.14	557.00
Husband	61	1427.82	373.55
Other relatives	7	1384.51	336.27
Parents	6	1390.69	379.98
Total	100	1436.42	421.84
Main method of obtaining food			
Self production	85	1424.56	415.93
Purchase	15	1503.62	463.34
Total	100	1436.42	421.84
Wealth Index			
Low	42	1382.10	444.45
Lower middle	17	1489.83	475.38
Medium low	36	1480.06	374.91
medium	5	1396.94	428.33
total	100	1436.42	421.84

be at risk of compromised diets because of reduced time for shopping and cooking and being away from home, it is also less likely that they ate three meals a day. This suggestion may explain why energy intake was lowest among women who were employed. According to husbands' level of education, energy intake appeared highest (1616.6 Kcal/day) among women whose husbands had completed secondary education and lowest among those with husbands with tertiary education (1375.5 Kcal/day).

According to husbands' employment status, energy intake was highest among women with self-employed husbands (1603 Kcal/day) and lowest among those with unemployed husbands (1316.3 Kcal/day). It may seem that self-

Table 8. Weekly weight gain categories by selected maternal variables

Maternal Variable	N	Mean weight gain (g)	Standard deviation	% RWWG
Mean Weekly Weight Gain	91	245.89	201.727	57.9
Subjects' education level				
None	2	262.50	159.09	61.8
Primary	64	230.39	225.30	54.2
Some secondary	9	339.44	208.87	79.9
completed secondary	9	327.77	183.90	77.1
Tertiary	7	157.31	234.60	36.9
Total	91	245.89	201.727	57.8
Husbands' education level				
Primary	64	400.00		94.1
Some secondary	19	173.33	283.44	40.9
Completed secondary	20	435.50	180.86	102.5
Tertiary	25	307.69	184.66	72.4
None	23	192.62	234.92	45.3
Total	87	233.93	275.84	55.0
Husbands' employment status				
Unemployed	19	198.61	218.32	46.7
Casual	20	315.25	204.02	74.2
Self- employed	25	288.50	157.28	67.9
Wage earner	23	134.81	214.93	31.7
Total	87	233.93	275.84	55.0
Subjects' employment status				
Unemployed	61	235.69	217.03	55.45
Casual	3	316.66	189.29	74.5
Self-employed	21	246.59	210.44	58.0
Wage earner	6	291.40	203.39	68.5
Total	91	245.89	201.72	57.8
Main provider				
Both	21	264.46	190.97	62.2
Husband	60	232.64	213.37	53.3
Other relatives	6	146.42	265.02	34.5
Parents	5	429.00	32.86	100.9
Total	91	245.89	201.72	57.8
Wealth Index				
Low	39	178.82	249.37	42.1
Lower middle	16	366.87	223.09	86.3
Medium low	31	285.16	234.33	67.1
medium	5	140.24	202.07	33.0
Total	91	245.89	201.72	57.8
Main method of obtaining food				
Self production	76	237.18	204.05	55.8
Purchase	15	290.00	295.77	68.4
Total	91	245.89	201.72	

RWWG - Recommended Weekly Weight Gain (Allen, 2001).

employed husbands commit more of their income to family well being than husbands who are employed. According to the household provider, energy intake was highest (1481.1 Kcal/day) among women whom together with the husband were the main family provider. Households provided for by both husband and wife may seem to be at a better position

Table 9. Pre-pregnancy weights of women and their mean weight gain.

N	Percentage	Weight (kg) Min	Weight (kg) Max	Mean weight gain (g)	% of IOM's RWWG
16	29	46	54.5	356.389	62
20	36	55	59.5	329.130	66
11	20	60	64.5	269.285	67
9	16	≥ 65		211.363	70

RWWG- Mean weight has been used for each category of IOM
RWWG- Recommended Weekly Weight Gain

to feed the family since income is higher and family is better placed to manage the reality of high cost of living in Kenya. Women in this study need to be empowered to have incomes so that they can supplement the husband's income as a measure to improve their energy intake.

Energy intake observed against method of obtaining food was found to be highest among women whose households obtained food mainly through purchase (1503.6 Kcal/day). This may have been so because those who produced food may have had their food stocks depleted as a result of drought and famine and lacked money to buy enough food. They may be food insecure because they lack modern technologies and technological knowhow to produce enough food that would last them up to the next harvest season. This study was done during the hungry season (from the planting season), therefore, households that depended on own production may have depleted their stocks of food.

A Kenyan Energy economic survey defines food poor households as those not meeting a minimum calorie requirement of 2250 Kcal/day/adult (GOK/UNICEF, 1998). The figures obtained in this study therefore describe the women investigated as falling well below the energy requirement level. For these women this deficit is even higher since pregnant women's recommendation is normal requirement plus 300 Kcal/day (FAO, 2001). The finding from this study (1436.4 Kcal/day) is only about 57.5% of the Recommended Daily Allowances for energy. This translates into a deficit of about 1113.6 Kcal/day. Shetty (2002) describes women's energy intake in developing countries to be between 1200 – 1800 Kcal/day and observed that dietary intake remained low throughout pregnancy. This observation supports the findings from this study because energy intake falls within this range. This is an indication that the situation in developing Nations and especially in Kenya has not improved but may have become worse as problems of poor rural women have common roots in many regions and have broad applicability rather than isolated to the setting under study (Leslie, 1991). A FAO report states that high poverty levels interfered with farming in Nyanza and that many farmers could not access loans due to lack of collateral (Barasa, 2006). This may explain why energy intake from this study (carried out in the same region) remains fairly low. A recent study of the Lake Victoria region in Kenya (Waudo *et al*, 2005) where this study area falls found kilocalorie intake of women to be 1505 Kcal/day. This is very close to the findings from this study and further confirms the state of energy deficiency in the region. This finding is, however, synonymous with the finding obtained from weighed food intake and may be a reflection of the greater accuracy of food weighing over 24 hour recall for individual intakes.

This study was carried out during the long rains (during the months of March to august) a period also known as the hungry season during planting and weeding with depleted stocks of food. The situation was made worse following a period of drought and famine that affected the whole country meaning extreme food shortage and inflated food prices that were far beyond the means of most families who survive on less than a dollar a day (Barasa, 2006). This may explain why energy intake was slightly lower than that from Waudo *et al's* (2005) study carried out in the same region. The findings from a study in Malawi that seasonality of food availability and agricultural labour affected maternal nutritional status, birth outcomes and pattern of maternal weight change (Parker *et al,* 1990) may support this argument. Chalterjee *et al* (1989), however, argues that seasonal shortfall in food availability tends to affect women disproportionately since their already inadequate intake will be curtailed drastically and further states that even if food is available; it tends to be preferentially allocated to men. Therefore if another similar study was carried out in the same region during the period of food abundance there may not be a remarkable increase in energy intake.

Gestational Weight Gain

Weekly weight gain (WWG) of the women investigated was averagely 245.9 gm (57.9% of recommended weight gain) (table 9). This is low compared to approximately 350 – 500 grams recommended per week. This would imply that with a gestational duration of ≥38 weeks (Wardlaw, 2003), total weight gain (WG) would only be about 9 kg which is below the

10-12 kg recommendation for women who are adequately nourished (Allen, 2001). The finding from this study corresponds to the 5-9 kg range that is known to usually occur in developing countries (Wardlaw, 2003).

According to a Kenyan Demographic Health Survey (CBS/MOH, 1993), mean weight of women was found to be 56 kg. Using this finding as a reference, women investigated may have been underweight prior to conception as well as during gestation as 23% were < 60 kg (50.5 – 59.4 kg) while in their 3rd trimester and 15% were ≤ 56 kg in 2nd trimester of pregnancy. Assuming the women added 1.5 kg in 1st trimester and 350-500g linearly per week throughout gestation in 2nd and 3rd trimesters (Wardlaw, 2003); averagely these women ought to weigh 66.5 kg by mid 3rd trimester. WG is inversely related to pre-pregnancy weight of the women (table 9). Thin women gained more weight and fatter women gained least weight. These findings are synonymous with the guidelines for pregnancy WG of Food and Nutrition Board of 1990 that recognizes the fact that the amount of WG in pregnancy is related to BMI (Allen, 2001). WG is inversely related to body Mass Index (BM)I so that it will be higher in thinner women as long as the energy sparing adaptations associated with low fat mass can buffer any concurrent low energy intakes.

However for all weight categories WG was lower than the recommended WG and for thin women in this study group, there may be a higher risk of low birth weight. The Food and Nutrition Board recommends that black women should gain amounts of weight at the upper end of the recommended range because these amounts are more compatible with their producing a normal birth weight infant (Allen,2001). Therefore these women need to be helped to gain higher amounts of weight. Fatter women in this study group may not be at great risk of low birth weight infants because they tend to gain relatively low amounts of weight and yet produce normal birth weight infants and the recommendation is that they should gain much less weight than thinner women (Allen, 2001).

Table 8 summarises weekly weight gain according to maternal characteristics. According to education level, it was highest among women with some secondary education (339.44g/week) and lastly those with tertiary education (157.31g/week). Those with some secondary education had the highest weight gain probably because their energy intake was lowest and therefore probably the thinnest therefore likely to attain high weight gains due to the adaptive mechanisms. The inverse is true for those with tertiary education. Women who were casual workers had the highest weight gain (316.66g/week) and the unemployed had the least (235.69g/week) in the women's occupation category.

According to husband's education level and occupation, weight gain was highest among women whose husbands had completed secondary (435g/week) and casual workers (315.25g/week) respectively. There was low gestational weight gain among women of low wealth index (178.82g), comparatively a Colorado study (Murray and Wells, 2003) found that inadequate weight gain was statistically more prevalent among women who reported their household income to be below the federal poverty level than those above. The prevalence of low weight gain was not significantly different among age groups, marital status or education level and more than 1:5 of women gained inadequate weight during pregnancy. A number of studies have examined socio-demographic and psychosocial characteristics in relation to prenatal weight gain; however interrelationships among such risk factors as age, parity, income, maternal education complicate interpretation of findings (Suitor, 1997).

Correlation Results between Weight Gain and Maternal Variables

Pearson's product moment correlation was carried out to determine the relationship between maternal calorie intake, gestational weight gain and selected maternal variables. Energy intake, had a significant and positive correlation with women's occupation ($r=0.274$, $p < 0.045$). (Table 10). Weight gain had a significant correlation with women's energy intake ($r = 0.265$, $p <0.011$), occupation ($r= 0.208$, $p < 0.047$), and morbidity ($r= 0.231$, $p < 0.046$) (table 11). Age had no positive and significant relationship with either weekly weight gain or energy intake. Suitor (1997) reviewed studies on energy intake and weight gain and found the effect of energy intake with weight gain to be modest with coefficients ranging from $r = 0.1$ to $r = 0.2$ after controlling for confounding variables. This findings are similar or close to the observation from this study of $r = 0.274$. These findings support the hypothesis that energy intake influences weight gain and therefore interventions that improve energy intake should be promoted in this sample of pregnant women at Rongo Sub-District hospital to help the women gain adequate weight during gestation.

CONCLUSION

The sample of pregnant women at Rongo Sub-District Hospital was relatively young. This study highlights the plight of pregnant women attending ante-natal clinic at Rongo Sub-District hospital; the low living standards of majority of the women, the high illiteracy levels, harsh living conditions, women's unemployment and a struggle by pregnant women to survive despite constraints paused by the women's environment.

Pregnant women at Rongo Sub-District hospital consume fewer calories than the value recommended as adequate.

Table 10. Pearson's Product Moment Correlations between Energy Intake and Maternal variables.

Variable	Energy Intake	Significance level (p value)
Age	-0.027	0.061
Family size	-0.031	0.052
Energy expenditure on physical activity	0.063	0.642
Women's occupation	0.274*	0.045
Husbands' occupation	.0 117	0.053
Economic Activities	0.098	0.501
Productive Activities	-0 006	0.015
Domestic Activities	-0.045	0..562
Personal care	- 0.058	0.274
Leisure activities	-0 .024	0.029
Morbidity	0.061	0.056

*Significant at p<0.05

Table 11. Pearson's Product Moment Correlations between Weekly Weight Gain and Maternal Variables

Maternal Variable	Weekly Weight Gain	Significance level (p value)
Age	-0 .030	0.07
Family size	0.135	0.55
Women's occupation	0.208*	0.047
Husbands' occupation	0.083	0.052
Morbidity	0.231*	0.046
Energy intake	0.265*	0.011
Infant birth weight	0.004	0.025
Birth weight and mother's pre-pregnancy weight	0.23	0.064

*Significant at p<0.05

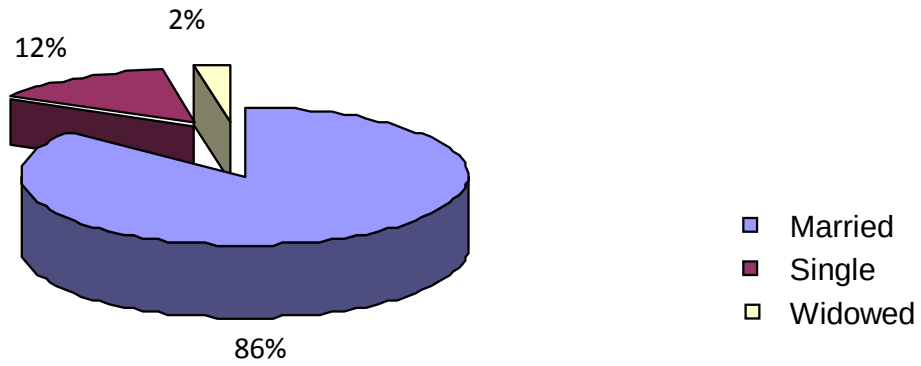

Figure1. Marital status of the pregnant women

This finding confirms several observations in developing countries that the extra energy cost of pregnancy is imposed upon a limited supply of food and that pregnant women may not have the possibility of increasing their energy intake very much (Vinoy, Rossetta and Taylor, 2000).

Average weekly weight gain was less than the standard estimated values (350 – 500g) (Allen, 2001) weekly. The study found weight gain among the women despite the low caloric intakes similar to findings from several other studies

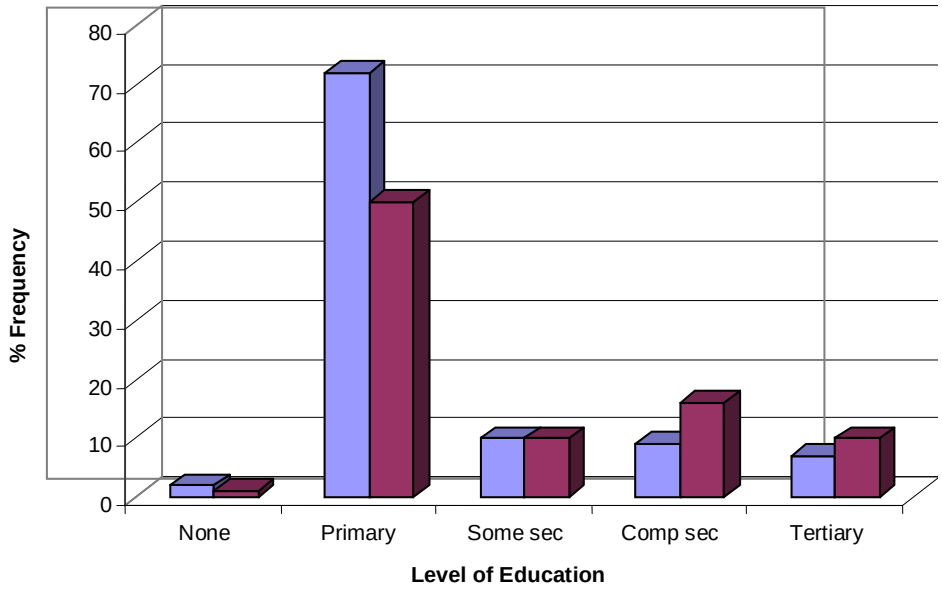

Figure 2.Highest education level of subjects and husband

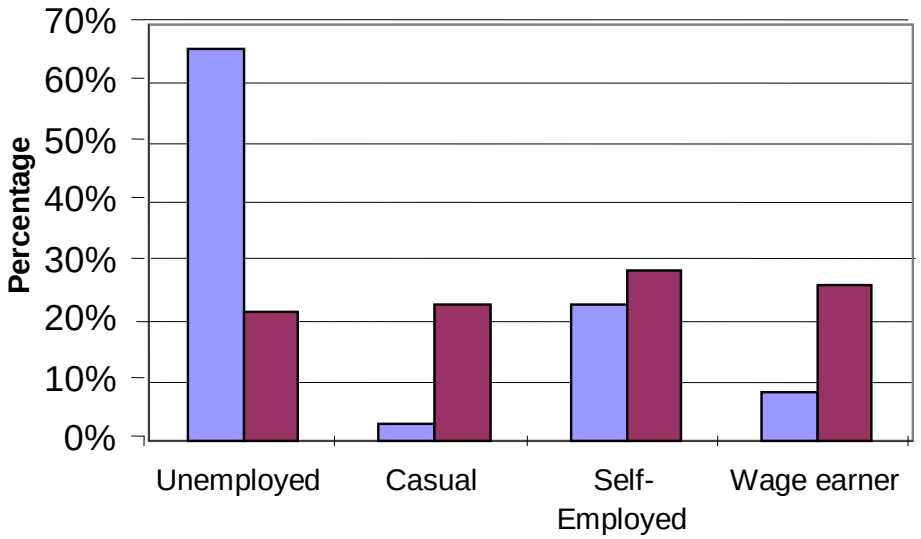

Figure 3. Employment status of subjects and husbands

although the weight gains were below the IOM recommendations for all categories of women. Weight gain was found to be highest for thinner women and lowest for fatter women and this observation confirms that women with a lower pre-pregnancy weight, gain more weight which could have helped prevent low birth weight of their infants.

This study found energy intake to have a significant and positive correlation with women's occupation, and weight gain while weight gain had a significant correlation with women's occupation and morbidity. It also suggests possible confounding by certain socio-demographic factors as indicated by significant relationships obtained through correlations between weight gain and these variables. This study raises the possibility that because of low energy intake or socio-demographic factors of this study population, weight gain is below the recommended values and therefore maternal nutritional status and health, and foetal growth and development may be at risk in this population.

Figure 4. Women's household's wealth index

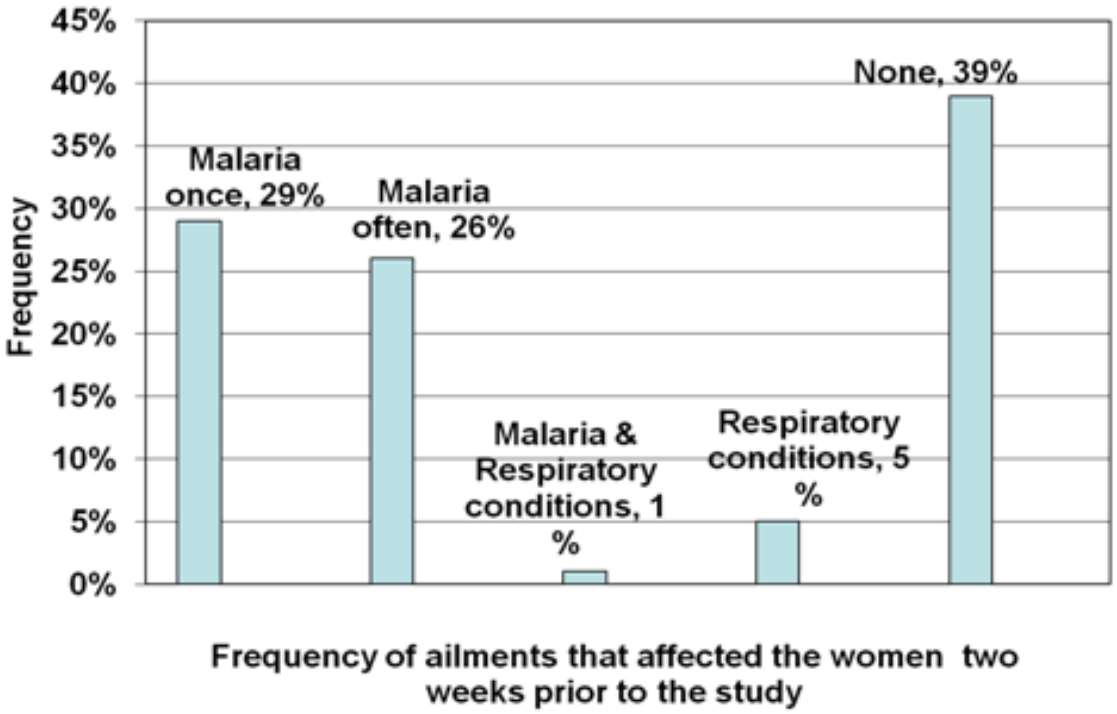

Figure 5. Frequency of ailments that affected the women two weeks before study

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