BIRTH WEIGHT OF NEWBORNS IN RELATION TO NUTRITIONAL STATUS OF PREGNANT WOMEN ATTENDING ANTENATAL CLINIC AT THE NKAwie GOVERNMENT HOSPITAL IN ATWIMA NWABIAGYA DISTRICT, GHANA.

A. K. Edusei¹, J. Bentum² and B. Nkum³
¹Department of Community Health, School of Medical Sciences, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana  
²Nestle Ghana Limited, Accra, Ghana  
³Department of Medicine, School of Medical Sciences, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

ABSTRACT
The desire to achieve the Millennium Development Goals 4 and 5 has stimulated several investigations related to pregnancy and birth outcome. Gestational weight gain and haemoglobin levels of pregnant women attending antenatal clinics in the Nkawie Government Hospital were assessed to ascertain their appropriateness, and effect on the birth weight of the newborns. The study was observational and prospective; involving 150 singleton pregnant women aged 15-49 years, in their second trimester, with risk-free pregnancy selected through systematic random sampling. Structured questionnaire and records from maternal health clinics on body weight changes and haemoglobin levels were used for the assessment. Birth weights of babies born to the women were obtained from the hospital records. The study period was from July to October, 2012. Mean weight gains during second and third trimesters were 2.2± 2.1kg and 2.9± 2.2kg, respectively, with 91.2% and 95.3%, respectively unable to gain the recommended weight. Mean haemoglobin levels at first, second and third trimesters were 10.4± 1.8g/dl; 6.1± 1.6g/dl; and 9.9± 1g/dl, respectively. Mean birth weight was 2.9± 0.5kg. The respective correlation coefficients and p-values between weight gain during the second and third trimesters of pregnancy and birth weight which were 0.01 (p = 0.69) and 0.02 (p = 0.36) indicating a weak positive correlation. Birth weight is positively correlated with gestational haemoglobin levels at first and third trimester and infant birth weight with a correlation coefficient of 0.10 (p= 0.008) and 0.13 (p= 0.004), respectively. In this study, weight gain during the second and third trimester of pregnancy was not associated with birth weight. However, birth weight was associated with maternal haemoglobin levels in the first and third trimesters of pregnancy. Intensification of health education efforts to improve maternal nutrition at ANC (Ante natal clinic) is recommended.

INTRODUCTION
The problem of Maternal and child malnutrition, as a serious health problem confronting most low and middle income countries has been extensively studied and reported (Black et. al., 2013). The association between maternal malnutrition and foetal growth restrictions, low birth weight and increased risk of neonatal death has also been reported (Black et. al., 2013). Maternal malnutrition takes the form of undernutrition and overnutrition, manifesting as overweight and obesity. Whereas Low body-mass index, indicative of maternal undernutrition, continues to show a steady decline, though remains a prob-
lem in Africa, the prevalent of overweight and obesity as well as micronutrient deficiency is on the ascendency (Black et. al., 2013), for which reason the influence of such a phenomenon on pregnancy outcome need to be studied.

Almost ½ of pregnant women worldwide are anaemic (WHO, 2009). In Ghana, the situation is not so different since 2/3 of urban pregnant women and ½ of rural pregnant women attend ANC (Ante natal clinic) visit during their first trimester of pregnancy and yet 70.0% of these pregnant women are anaemic (GDHS, 2008). In pregnancy, good nutrition is essential to ensure good maternal health and reduce the risk of birth defects, suboptimal foetal growth and development as well as chronic health problems in their children (Rusescu, 2005).

The causes of maternal malnutrition may include inadequate diets, food insecurity, recurrent infections, closely spaced reproductive cycles and economic instability. If women are not well nourished, they are more likely to give birth to weak babies resulting in high infant mortality rate (Kamla-Raj, 2006). Maternal malnutrition results in 1/10 maternal mortality and 1/5 perinatal mortality, low productivity, increased infections, IUGR, brain damage, and cretinism in infants (GDHS, 2008). Levy et. al., (2005) have demonstrated that maternal anaemia is an independent risk factor for both preterm delivery (OR = 1.2; 95% CI 1.1 – 1.2, p< 0.001) and low birth weight (OR = 1.1; 95% CI 1.1 – 1.2, p= 0.001). Ahmad et. al., (2011) corroborate this fact by establishing that low birth weight (64%) was significantly (p<0.001) higher in women with anaemia than those without anaemia (10%). Inadequate gestational weight gain is associated with LBW (Mohanty et. al., 2006). At birth, foetal weight is accepted as the single parameter that is directly related to the health and nutrition of the mother, and also an important determinant of the chances of the newborn to survive and experience healthy growth and development. About 60-80% of neonatal death is attributed to LBW (Lawn et. al., 2005). Low birth weight has been shown to be directly related to both immediate, long-term and very long-term development, survival and well-being (McCormick, 1985). As actions are planned towards the realization of MDG 4 and MDG 5 there is a need for a critical look at maternal nutrition during pregnancy.

Monitoring gestational nutritional status by taking anthropometric measurements is a promising means of optimizing foetal growth (Padilha et. al., 2009). It is well known that nutritional intervention focused on woman’s health during the reproductive stage, not only in the preconception period but also during the prenatal period, helps achieve adequate newborn nutritional status and is reflected in childhood health and nutritional conditions (WHO, 2006).

Several studies have shown an association between anthropometric indicators and pregnancy outcome. Both insufficient and excessive gestational weight gain are strongly associated with maternal–foetal complications such as gestational diabetes, hypertensive pregnancy disorders (HPD), macrosomia, and low birth weight (Mohanty et. al., 2006; Olsen et. al., 2004; Stotland et. al., 2005).

This research seeks to assess the birth weight of newborns in relation to nutritional status of pregnant women in Atwima Nwabiagya district of Ashanti Region, Ghana. In this study nutritional status of pregnant women was assessed in terms of gestational weight gain, and gestational haemoglobin levels.

MATERIALS AND METHODS
The study was observational and the design was a longitudinal, with the pregnant women being observed from the second trimester until delivery. The field work took place from July 2010 to October 2010. The study involved pregnant women who resided in the district and were attending antenatal clinic at the Nkwie government hospital (district hospital), and were in their second trimester, and had been visiting the ANC at least during the second trimester of pregnancy, and had had haemoglobin levels and weight recorded.
The sampling technique used in the study was systematic random sampling, used to select 150 singleton pregnant women attending ANC at the Nkawie Government Hospital. Pregnant women who had been attending ANC since their first or second trimester, and had had their haemoglobin levels checked as well as records of continual weight measurements taken were involved in the study.

Records of the weight and haemoglobin levels of pregnant women during the first and second trimesters of the pregnant women were obtained from the maternal health record books. Weight and haemoglobin levels were taken at each visit to the ANC in the third trimester till delivery. The adult weighing scale (seca M215, Fitness Monitors, UK) was used to determine the maternal weight during the study period, while the direct cyanmethaemoglobin method (Wooton, 1964) was the laboratory method used to determine the haemoglobin concentrations of the pregnant women. Birth weights of babies born to these women were also recorded from hospital records after delivery. Structured questionnaires were administered to the pregnant women when they reported for antenatal care. Pregnant women who had their first ANC attendance during the third trimester, complications during the pregnancy were excluded, and women with multiple pregnancies were also excluded from the study.

Ethical clearance was sought from the committee of human rights publications and ethics (CHRPE/KNUST). Permission for the study was sought from the district health directorate, which in turn sought permission from the hospital. Informed consent was obtained from the pregnant women. Data was entered using SPSS version 17.0.1 (SPSS Inc., Chicago IL, USA) and cleaned for abnormal values at regular intervals. It was then exported to STATA Intercool version 10.1 for analysis. The categorical variables were tabulated and reported as frequencies with their respective percentages. Continuous variables were summarised as means with their standard deviation and ranges.

RESULTS AND DISCUSSION

The WHO, (2006) recommends that pregnant women in their second trimester should gain at least 0.5kg per week. Therefore, in total at least about 6kg of gestational weight must be achieved during the second trimester. However from the results obtained from this study, 138 (91.2%) of the respondents did not reach this cut off point and only 12 (8.8%) met this cut off point. It was even more surprising that some of the women instead of gaining weight rather lost weight during this period, whiles others were gaining and losing weight intermittently. Mean weight gain in the second trimester of pregnancy was 2.2 ± (2.1) kg. Upon further analysis by correlation to ascertain the relationship between weight gain during second trimester of pregnancy and birth weight, a correlation coefficient of 0.01 with a p-value of 0.69 was obtained. This suggests that in this population, though the study showed that all the women who gained the expected weight in the second trimester (8.8%) had children with birth weight 2.5kg or above (Table 1) birth weight is not significantly associated with pregnancy weight gain in the second trimester.

<table>
<thead>
<tr>
<th>Total weight gain in 2nd trimester</th>
<th>&lt;2.5kg N</th>
<th>%</th>
<th>≥2.5kg N</th>
<th>%</th>
<th>Total N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;6kg</td>
<td>22</td>
<td>15.9</td>
<td>116</td>
<td>84.1</td>
<td>138</td>
<td>91.2</td>
</tr>
<tr>
<td>≥6kg</td>
<td>0</td>
<td>0.0</td>
<td>12</td>
<td>100.0</td>
<td>12</td>
<td>8.8</td>
</tr>
</tbody>
</table>

Table 1: Distribution of pregnant women by total weight gain during second trimester and corresponding birth weight
The WHO, (2006) recommends that pregnant women in their third trimester (last three months of pregnancy) are supposed to gain at least 0.5kg per week. Thus total weight gain during the last three months of pregnancy should be at least 6.5kg, given a 37 week term of pregnancy (WHO, 2006). Results from the study indicate that almost all the pregnant women did not gain the expected weight. Mean weight gain was 2.9 ± 2.2 kg. As much as 143 (95.3%) of the respondents, could not attain this weight gain. This indicates a slightly higher increment, as compared to respondents in the second trimester who could not gain the required weight. Upon further analysis by correlation to ascertain the relationship between weight gain during the third trimester of pregnancy and birth weight, a correlation coefficient of 0.02 was obtained, suggesting a positive relationship. The earlier assertion that weight gain in the second trimester of pregnancy is not associated with birth weight appears confirmed for the third trimester too, because as much as 92.3% of the women who did not meet the expected weight gain in the third trimester, had birth weights 2.5 kg or above (Table 2).

**ANAEMIA STATE OF PREGNANT WOMEN**

The prevalence of anaemia among the pregnant women was based on the classification by the Ghana Health Service (2004). These include the following categories:

- **Moderate/mild anaemia** (Hb 7.0 - 10.9g/dl)
- **Severe anaemia** (Hb 4.0 – 6.9g/dl)
- **Very severe anaemia** (Hb below 4.0g/dl)

Based on these, anaemia prevalence was identified by trimester of pregnancy.

The prevalence of anaemia at first, second and third trimesters were 63.3%, 80.7% and 88.7%, respectively. Mean haemoglobin levels at first, second and third trimesters were 10.4± 1.8g/dl;

<table>
<thead>
<tr>
<th>Pregnancy Trimester</th>
<th>First (N = 150)</th>
<th>Second (N = 150)</th>
<th>Third (N = 150)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N %</td>
<td>N %</td>
<td>N %</td>
</tr>
<tr>
<td>Severe</td>
<td>5 3.3</td>
<td>8 5.4</td>
<td>0 0.0</td>
</tr>
<tr>
<td>Mild/moderate</td>
<td>90 60.0</td>
<td>113 75.3</td>
<td>133 88.7</td>
</tr>
<tr>
<td>No anaemia</td>
<td>55 36.7</td>
<td>29 19.3</td>
<td>17 11.3</td>
</tr>
<tr>
<td>Total</td>
<td>150 100.0</td>
<td>150 100.0</td>
<td>150 100.0</td>
</tr>
</tbody>
</table>

The WHO, 2006 recommends that pregnant women in their third trimester (last three months of pregnancy) are supposed to gain at least 0.5kg per week. Thus total weight gain during the last three months of pregnancy should be at least 6.5kg, given a 37 week term of pregnancy (WHO, 2006). Results from the study indicate that almost all the pregnant women did not gain the expected weight. Mean weight gain was 2.9 ± 2.2 kg. As much as 143 (95.3%) of the respondents, could not attain this weight gain. This indicates a slightly higher increment, as compared to respondents in the second trimester who could not gain the required weight. Upon further analysis by correlation to ascertain the relationship between weight gain during the third trimester of pregnancy and birth weight, a correlation coefficient of 0.02 was obtained, suggesting a positive relationship. The earlier assertion that weight gain in the second trimester of pregnancy is not associated with birth weight appears confirmed for the third trimester too, because as much as 92.3% of the women who did not meet the expected weight gain in the third trimester, had birth weights 2.5 kg or above (Table 2).
6.1± 1.6g/dl; and 9.9± 1g/dl, respectively. Even though the highest prevalence was recorded during the third trimester, confirming the report of WHO (2006) in which anaemia is said to be significantly higher in the 3rd trimester of pregnancy than the first two trimesters, there was no record of severe anaemia for that period. The high percentage of severe anaemia for the second trimester could be as a result of the decline in the haematocrit level during the second trimester of pregnancy. Except for the prevalence of anaemia at first trimester, prevalence at the other trimesters was higher than the national prevalence among pregnant women of 70.0% (GDHS 2008). Correlation analysis established a positive association between gestational haemoglobin levels at first and third trimester and infant birth weight with a correlation coefficient of 0.10 (p= 0.008) and 0.13 (p= 0.004), respectively. This implies that an increase in haemoglobin level at first and third trimester is expected to cause an increase in birth weight. A p-value of 0.008 further makes this association stronger. This confirms the results of work done by Levy et al., (2005), on maternal anaemia during pregnancy, and low birth weight which indicated an association between these two. Ahmad et. al., (2011) also studied the effect of different level of haemoglobin on birth outcome and their findings also showed that maternal anaemia during pregnancy increases significantly the risk of Low Birth Weight babies, thus conforming with the findings of this study. However, there was no association between haemoglobin level at second trimester and infant birth weight (correlation coefficient = 0.03, p-value = 0.42), possibly due to less physiological demand on the haemoglobin at this stage of pregnancy.

CONCLUSION
Mean weight gain for 2nd and 3rd trimesters were 2.2 ± (2.1) kg and 2.9 ± (2.2) kg, respectively. Most (91.2%) and 95.3% of the pregnant women did not obtain the required weight of at least 6.0kg and 6.5kg during second and third trimester of pregnancy, respectively. Prevalence of anaemia for first, second and third trimesters were 63.2%, 80.6% and 88.7%, respectively. There was no significant relationship between gestational weight gain and infant birth weight. There was a relationship between infant birth weight and haemoglobin levels at first and third trimesters of pregnancy. Generally, the nutritional status of pregnant women attending ANC at the Nkawie government hospital is poor as anaemia rate was high in all trimesters and majority of the pregnant women did not gain the required weight during pregnancy. This notwithstanding, the effects of the poor nutritional status evidenced by inadequate gestational weight gain and high levels of anaemia on the infants birth weight was minimal, as only 8.0% of babies born had LBW and this is lower than the LBW rate of 11.6% in Ashanti Region (GDHS, 2008) and 12.0% in sub Saharan Africa.

REFERENCES
Gynecol Reprod Biol, Oct 1; 122 (2): 182 6
Rusescu, A., (2005). Nutritional Status of pregnant women, children under five years old and school children aged six to seven years. Institute for mother and child care, Romania