SCHOOL OF PUBLIC HEALTH

COLLEGE OF HEALTH SCIENCES

UNIVERSITY OF GHANA

GESTATIONAL WEIGHT GAIN AND IT'S CONTRIBUTING FACTORS AMONG POST-NATAL WOMEN AT TEMA GENERAL HOSPITAL, GREATER ACCRA

BY

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THIS DISSERTATION IS SUBMITTED TO THE SCHOOL OF PUBLIC HEALTH, UNIVERSITY OF GHANA IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF MASTER OF PUBLIC HEALTH DEGREE

JULY, 2017

DECLARATION

I hereby certify that this submission is my own work towards my MPH dissertation produced under supervision and has not been previously submitted for a degree. All references have been duly acknowledged.

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DEDICATION

I dedicate this work to my husband Mr. Michael Wordey, and my son Liam Jayden Wordey for their unflinching support.

ACKNOWLEDGEMENT

I am grateful to God Almighty for giving me strength. I am also grateful to my supervisor Dr. Richmond Aryeetey for his guidance and to the Public Health unit of Tema General Hospital for granting me access to collect my data.

ABSTRACT

Background: Optimal gestational weight gain is an important factor linked with positive outcome for both mothers and their infants. Women who gain inadequate weight during pregnancy are at risk of bearing a baby with low birth weight whereas those who gain excessive weight are at increased risk of preeclampsia and gestational diabetes. In developing countries, data on gestational weight gain and its determinants are scarce as it is difficult to collect the information throughout the pregnancy period.

Objective: The aim of the study was to assess the prevalence of inadequate, adequate and excessive gestational weight gain and its associated factors.

Methods: This was a health-facility-based quantitative cross-sectional study which involved 322 post-natal women. A structured questionnaire guide and checklist was used to collect both primary and secondary data respectively. Data collected was analyzed using STATA version 14.0

Results: The study showed 22.7%, 29.2% and 48.1% prevalence of inadequate, adequate and excessive gestational weight gain respectively. Initial pregnancy BMI (p=0.043), marital status (p=0.014), employment status (p=0.009) and dietary patterns specifically starchy staples (p=0.053) and legumes, nuts and seeds (p=0.057) were significantly associated with gestational weight gain.

Conclusion: The proportion of women who gained excessive weight during pregnancy was high as compared to inadequate and optimal weights gained. There is the need to develop and incorporate gestational weight gain guidelines in the care of pregnant women to help mitigate excessive weight gain and optimize pregnancy and birth outcomes.

Key words: Gestational weight gain, BMI, diet and physical activity.

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LIST OF ABBREVIATIONS

BMI	Body mass index
GDHS	Ghana Demographic and Health Survey
GDM	Gestational diabetes mellitus
GWG	Gestational weight gain
IOM	Institute of Medicine
LGA	Large for gestational age
WHO	World Health Organization

CHAPTER ONE

INTRODUCTION

1.0 Background to the study

Historically, gaining a healthy weight appropriate for pregnancy was a struggle for women due to insufficient nutrition (Samura et al., 2016). However, in the past few decades, excessive weight gain has become prevalent globally, affecting all age groups, including pregnant women (Yao, Park, Foster, & Caughey, 2017; Guelinckx, Devlieger, Beckers, & Vansant, 2008). Excessive weight gain also known as obesity, is a global epidemic and pregnant women are more vulnerable to gaining excessive weight as a result of increased nutritional requirement during the period of pregnancy necessary for the mother and baby's health (Guilloty et al., 2015; Melere et al., 2013).

The weight gained by a woman during pregnancy known as gestational weight has important health implications for both mother and child (Institute of Medicine, IOM, 2009). Inadequate and excessive weight gain is linked with health risks for the mother and the foetus (Rhodes JR & Schoendorf KC, 2013). In spite of this, most developing countries in Africa have overweight and obesity prevalence rate of above 10% (Neupane, Prakash, & Doku, 2016). Two-thirds of American women are overweight or obese, and up to 50% of American women gain excess weight as compared to the current recommendation (Samura et al., 2016).

While inadequate gestational weight gain is associated with low birth weight, preterm delivery and anaemia, excessive weight gain can lead to adverse maternal and fetal outcomes such as large for gestational age (LGA) infants, caesarian delivery, gestational diabetes mellitus (GDM), preeclampsia, early pregnancy loss, and post-partum weight retention (Catalano &

Ehrenberg, 2006). Optimal gestational weight gain contributes to positive pregnancy outcomes such as growth and development of the foetus and reduced likelihood of mortality during pregnancy (Butte & King, 2005).

In recognition of the importance of gestational weight and its role in determining the health of the mother, foetus as well as birth outcomes, the Institute of Medicine (IOM) in 1990, issued the first evidence-based guidelines for gestational weight gain in relation to maternal pre-pregnancy body mass index (BMI). Primarily it was a concern for women with pre-pregnancy underweight and low gestational weight gain that spurred the creation of the first IOM guidelines (IOM, 1990). Now, amidst the prevalence of obesity among all groups and the observation that an increasing number of women were gaining weight excessively during pregnancy, the IOM revised their guidelines in 2009, adding recommendations for gestational weight gain based on a woman's pre-pregnancy body mass index (Samura et al., 2016; IOM & NRC, 2009). The IOM guidelines have defined limits for weight gain in pregnancy according to initial or pre-pregnancy BMI ranging from 12.5-18 kg in those with a BMI<18.5 kg/m^2, 11.5 - 16 kg for those with a healthy BMI of <24.9 kg/m^2 to 7 -11.5 kg in the overweight (BMI 25.0-29.9 kg/ m^2) and 5.0 -9.0 kg in the obese (≥ 30 kg/m^2). For twin pregnancy, the IOM recommends a gestational weight gain of 16.8–24.5 kg for women of normal weight, 14.1–22.7 kg for overweight women, and 11.3 –19.1 kg for obese women. The IOM guidelines recognize that data is insufficient to determine the amount of weight women with multifetal (triplet and higher order) gestations should gain (Gain & Pregnancy, 2013).

Additionally, gestational weight gain is also influenced by a range of biological, metabolic, and social factors, which include maternal multi-parity (Thame, Jackson, Maxwell, Osmond, & Antoine, 2010), maternal age, smoking, educational status (Rasmussen et al., 2009b),

healthy eating, physical activity (Butte & King, 2005), and inadequate counseling of mothers on weight gain during pregnancy (Brawarsky et al., 2005). The prevalence and factors influencing gestational weight gain are varied across different regions and settings highlighting the need for studies to identify the prevalence and influencing factors specific to different settings to inform recommendations regarding weight gain goals during pregnancy so as to avoid complications (Choi, 2017; Drehmer et al., 2010).

1.1 Problem statement

There is a rising prevalence of excessive weight gain in pregnancy which is of public health concern (Yao, Park, Foster, & Caughey, 2017). Several studies on gestational weight gain in developed countries indicated that more than 40% of women are gaining weight above the recommended IOM ranges(Campbell, Johnson, Messina, Guillaume, & Goyder, 2011; Yao et al., 2017). It is further estimated that over 75 % of African American women of reproductive age are overweight or obese and this increases their already high risk for obesity-related adverse pregnancy outcomes (Goodrich, Cregger, Wilcox, & Liu, 2013).

It is well documented that gestational weight gain and obesity is associated with adverse maternal and neonatal outcomes such as increased risk of pre-eclampsia, caesarean section, instrumental delivery, preterm delivery and gestational diabetes(Hui et al., 2014; Campbell et al., 2011; Guilloty et al., 2015; Tabb, Malinga, Pineros-Leano, & Andrade, 2017). In spite of the dangers posed by inadequate and excessive gestational weight gain, monitoring of gestational weight gain in developing countries is poor and there are few studies conducted in developing countries investigating weight gain during pregnancy (Drehmer et al., 2010). This can be attributed to the challenges associated with collecting data throughout the pregnancy

period in developing countries (Winkvist, Stenlund, Hakimi, Nurdiati, & Dibley, 2002) leading to a neglect of gestational weight gain as a public health issue in the developing world (Asefa & Nemomsa, 2016).

Despite increasing obesity and gestational weight gain especially among women of reproductive age, the government of Ghana has committed resources to fighting infectious diseases because of the limited healthcare resources (Anderson, 2017). Pre-eclampsia which is a consequence of gestational weight gain has contributed to the high maternal mortality rate in Ghana (Bailey et al., 2017; Sumankuuro, Crockett, & Wang, 2017) yet there is little studies done to determine the prevalence of gestational weight gain and the contributory factors among different groups across the Ghanaian society (Addo, 2010; Abubakari & Jahn, 2016; Abubakari, Kynast-Wolf, & Jahn, 2015). Review of literature as far as this study is concerned found that no study has examined the prevalence of gestational weight gain and contributory factors in the Tema General Hospital. Therefore, this study aimed to assess the prevalence of gestational weight gain and its contributory factors among pregnant women in the Tema General Hospital of the Greater Accra Region.

1.2 Justification of the study

The prevalence of gestational weight gain as well as associated factors are not well established and highlighted in developing countries due to limited research investigating the issue of weight gain during pregnancy (Drehmer et al., 2010). There has been consistent evidence that the gestational period is a critical part of life in which both excessive and inadequate weight gain are associated with adverse pregnancy outcomes (Widen et al., 2015; Yao et al., 2017) yet there remains a lack of information in terms of prevalence and contributory factors to

determine the scope and magnitude of the problem and the interventions which need to be put in place to tackle the associated factors. The numerous adverse outcomes associated with inadequate and excessive weight gain can only be minimized if the prevalence and contributing factors are comprehensively identified and adequately articulated through research. According to Drehmer et al., (2010) it is important to understand the extent of prevalence of gestational weight and its associated factors in order to be able to revise guidelines and plans to address the situation. Results from this study would provide baseline information on prevalence of gestational weight gain and unearth the factors that contribute to sub optimal, adequate and excessive weight gain among pregnant women in the Tema General Hospital to enable the implementation of appropriate interventions.

1.3 Research questions

The following questions were asked in relation to the objectives of the study;

1. What proportion of women gained sub-optimal, optimal and excessive weights during pregnancy?
2. What is the association between weight gained during pregnancy and socio-demographic factors, dietary intake and physical activity?

1.4 General objective

To determine gestational weight gain and its associated factors.

1.4.1 Specific objectives

1. To determine prevalence of inadequate, adequate and excessive weight gain during pregnancy.

2. To determine relationship between gestational weight gain and socio-demographic factors, dietary intake and physical activity factors.

CHAPTER TWO

LITERATURE REVIEW

2.1 Definition of terms

While the term gestation generally refers to the physiological process of in-utero maturation or development, gestational weight denotes the weight of a mother during the process of pregnancy (Muktabhant, Lawrie, Lumbiganon, & Laopaiboon, 2015). This index has over time been found to be extremely significant in many outcomes related to the unborn child as well as the mother. Maternal and child health has been a public health priority since the commencement of orthodox medicine. Recommendations and guidelines regarding gestational weight have predictably evolved over the period (Kominiarek & Peaceman, 2017) and inevitably across different jurisdictions (Trotter et al., 2010). This suggests therefore that there are indeed safe and optimal weights for the period of pregnancy, with repercussions for either side of the norm (Zanardo, Mazza, Parotto, Scambia, & Straface, 2016).

2.2 Physiology of gestational weight gain

Pregnancy is a dynamic process, which affects the physiology and metabolism of the woman in order to accommodate fetal growth and development (Yao et al., 2017). During pregnancy, there is expansion of plasma volume and total body water as well as alterations in adiposity and these processes contribute to the physiologic weight gain (Yao et al., 2017).

Weight gain is generally a consequence of an imbalance between energy consumption and expenditure (Greenway, 2015). Many have also suggested the role of environmental as well as genetic factors (Choquet & Meyre, 2011). Evidently, there is an intimate bilateral

relationship between mother and foetus. While the foetus itself effects dynamic endocrinal and homeostatic changes in its mother, the converse has an overwhelming control of the foetus' circulation, growth, and metabolism (Kominiarek & Peaceman, 2017). Weight gain is naturally expected, as it corresponds with increased nutrients for utilization by the foetus. Michelle et al, (2017) indicated that placenta, foetus and amniotic fluid, which are the products of conception comprise approximately 35 percent of the total GWG. It has nonetheless been suggested that significant weight changes could affect many biochemical and physiological processes across different systems in the body. It may modify metabolism, circulation, nervous transmission, blood chemistry among others (Bhaskaran et al., 2014) which in advertently have a role to play in the overall health of the unborn child.

2.3 Prevalence of inadequate, adequate and excessive gestational weight gain

The amount of weight a pregnant woman gains is important in determining the health of the woman and the unborn child. Inadequate weight gain during pregnancy was a major challenge for pregnant women in the past due to limited nutrition (Kominiarek & Peaceman, 2017). This had implications for the woman and the foetus. Research indicates that inadequate weight gain is associated with increased risk of spontaneous preterm delivery and low birth weight infants as well as lower breastfeeding duration (Yao et al., 2017; Kowal, Kuk, & Tamim, 2012). However, the issue of inadequate weight gain in pregnancy and its negative consequences has changed dramatically over the past century following the recognition of high neonatal and infant mortality rates in the United States during the 1960s, during which the Committee on Maternal Nutrition highlighted the positive association between weight gain and birth outcomes (Kominiarek & Peaceman, 2017). Presently, inadequate weight gain in pregnancy

is low in developed countries while it is still common in some developing countries. Studies in the United States have demonstrated that there are disparities in the prevalence of inadequate weight gain during pregnancy among different races. For instance Black and Hispanic women are at a greater risk of low weight gain during pregnancy than white women and the prevalence of inadequate gestational weight gain ranges from 14 to 22% (Kowal, Kuk, & Tamim, 2012).

On the other hand, over the two decades since the Institute of Medicine first issued guidance on healthy weight gain there has been a striking increase in the prevalence of excessive weight gain during pregnancy across all population groups (Campbell et al., 2011). It is noted that 40–60% of women in the United States of America gain excessive weight during pregnancy (Tabb, Malinga, Pineros-Leano, & Andrade, 2017), 55% in Canada(Kowal et al., 2012) while a longitudinal survey of 12,583 women in Southampton, United Kingdom found that 43% gained excessive weight in pregnancy. The prevalence of excessive gestational weight gain is even higher among low-income racial/ethnic minorities reaching about 62% in the United States of America (Tabb et al., 2017). In addition, Widen et al., (2015) reported that excessive gestational weight gain disproportionally affects minority populations such that among women of reproductive age, 59% are overweight or obese whereas the prevalence of overweight or obesity is strikingly higher in non- Hispanic black (80%) and Hispanic (70%) women. However, most women gain adequate weight within the IOM recommended range during pregnancy in many parts of the world. Kowal et al., (2012) found that 41% of women gained normal weight during pregnancy in Canada while in the United States 32% of women gained gestational weight within the guideline recommended by the IOM (Widen et al., 2015).

2.4 Guidelines for determining gestational weight gain

The issue of gestational weight gain has been a well-documented concern since the sixteenth century with many subsequent varying concepts and recommendations (Kominiarek & Peaceman, 2017). With increasing weights at gestation over the century, many institutions have found it necessary to research and standardize guidelines into its control (WHO, 2011). The Institute of Medicine (IOM) proposed guidelines for weight gain in pregnancy in 1990. This was done to promote adequate gestational weight gain with the aim of preventing premature births. With the aim not being entirely achieved, the IOM guidelines for pregnancy weight gain were restructured in 2009 to utilize standard body mass index (BMI) categories developed by the World Health Organisation with a move towards better maternal health outcomes (Restall et al., 2014). The guidelines had three categories of gestational weight gain namely; low or inadequate, normal or adequate and excessive gestational weight gain with corresponding body mass indexes as demonstrated in Table 2.1. The body mass index have been classified into three with various ranges of values.

Many studies, prior to, and after these recommendations have thoroughly assessed these guidelines. For instance, Cheikh Ismail et al., (2016) in their aim to describe the trend of GWG in healthy pregnancies with good maternal and perinatal outcomes found that in spite of the varying cultures, behaviours, and clinical practices, there were strikingly similar patterns of weight gain in the populations studied. In their study, the proportion of variance explained by population differences was <10% of the total variance.

Table 2.1: Institute of Medicine guidelines for recommended gestational weight gain per week based on pre-pregnancy body mass index

Body mass index	Gestational weight gain (kg/wk)		
	Low	Normal	Excessive
Normal weight (18.5–24.9 kg/m^2)	<0.35	0.35–0.50	>0.50
Overweight (25.0–29.9 kg/m^2)	<0.23	0.23–0.33	>0.33
Obese (≥30.0 kg/m^2)	<0.17	0.17–0.27	>0.27

2.5 Risks of gestational weight gain to mother

GWG has potentially grave and enormous consequences to the mother. As illustrated in Figure 2.1 by the IOM (Lactation, 1990), the repercussions of GWG to the mother may broadly be put into two categories: during pregnancy and after pregnancy. Literature suggests most of the pathologies of overweight in pregnancy to be as a result of the accumulation of adipose tissue which acts as potent chemical mediators, capable of interacting with many physiological functions (Leddy, Power, & Schulkin, 2008).

During early pregnancy GWG has been associated with spontaneous abortions as well as multiple miscarriages. Leddy et al., (2008) found the odds of the occurrence of spontaneous abortions and multiple miscarriages being 1.2 and 3.5 times respectively among obese mothers as compared to non-obese mothers.

Late pregnancy also holds equally grave risks for overweight mothers. Such outcomes may include hypertensive disorder of pregnancy, gestational non-proteinuric hypertension, preeclampsia, gestational diabetes mellitus, preterm birth and intrauterine fetal demise (stillbirth) (Leddy et al., 2008). Kiel et al., (2007) found that the amount of total weight gain associated with minimal risk for preeclampsia and caesarean delivery was 4.6–11.4 and 0–4.1 for class I and II obesity, respectively. Also, a meta-analysis of 9 studies by Chu et al., (2007) showed that pregnant women who are obese have a projected risk of stillbirth twice that of pregnant women with healthy weight. Hedderson et al., (2008) also concluded from their study that weight gained in the preceding five years to conception, at a rate of 1.1 to 2.2 kg per year, resulted in an increased risk of developing gestational diabetes mellitus. This was more evident for women who were not initially overweight.

Postpartum risks refer to the risks that could potentially occur after delivery. Significant associations have been drawn to the medical requirement for cesarean delivery. GWG has also been linked with decreased vaginal-birth-after-caesarean success. Leddy et al., (2008) also found increased odds of operative morbidity, anesthesia complications, and excessive blood loss during delivery. With no clear underlying pathophysiology, the researchers also suggested the increased occurrence of postpartum endometritis, wound infection as well as postpartum thrombophlebitis in obese mothers. As shown in Figure 2.1, post-partum depression and retention of the weight gain may be a significant detrimental consequence to the mother. Rooney & Schauberger, (2002) suggested that the period following delivery may be critical for long-term weight gain and the progression to maternal obesity and also indicated that excess weight which is gained during pregnancy and persistent weight retention one year postpartum are reliable predictors of overweight a decade or so later. Contrary to the IOM

however, Kominiarek & Peaceman, (2017) suggested that GWG had no significant bearing on the duration nor initiation of lactation.

2.6 Risks of gestational weight gain to the child

Significant associations have been drawn between child morbidity and mortality with weight gain in pregnancy. Though the specific mechanisms are still unclear; they could be as a result of altered physiological processes such as activation of the maternal or fetal hypothalamic-pituitary-adrenal axis, amnio-chorionic induced systemic inflammation, thrombosis and lesions of intrauterine vessels, pathologic distention of the myometrium as well as cervical insufficiency (Kominiarek & Peaceman, 2017). Forno et al., (2014) in their meta-analysis involving fourteen studies found that an increase in maternal BMI was associated with a 2% to 3% increase in the odds of childhood asthma. High GWG was associated with higher odds of asthma or wheeze ever (OR = 1.16; 95% CI, 1.001–1.34). Leddy et al., (2008) also found that there were higher numbers of babies with fetal macrosomia and birth weight less than 4000g to mothers who had gained weight during pregnancy. There was also the notable occurrence of obstructed labour caused by shoulder dystocia. The striking association with weight at birth has been well recognized by many authors and institutions including the WHO which additionally intimated that being born small for the required gestational age is a significant prognosticator of neonatal mortality and morbidity, growth deficiencies, cognitive developmental stunting as well as chronic diseases in adulthood (WHO, 2011). As shown in Figure 2.1, there are suggested standards of birth weight in relation to the weight gained during pregnancy. Kominiarek & Peaceman, (2017) again demonstrated higher odds of the development of childhood obesity in children born to mothers who gained weight in gestation.

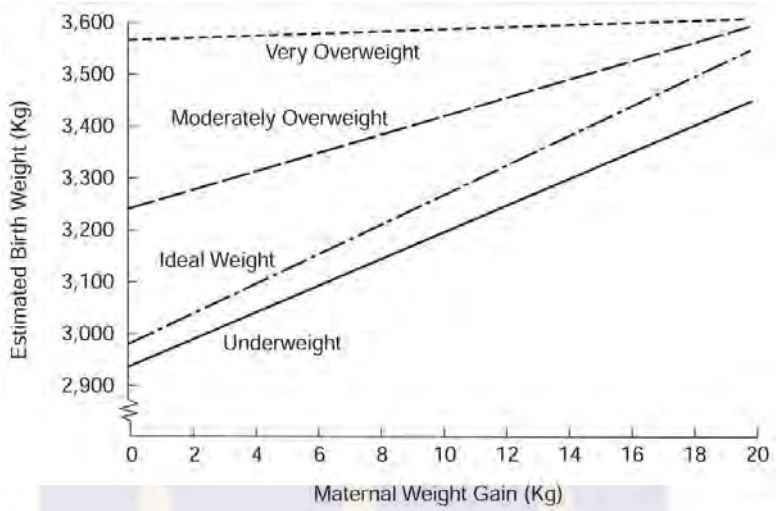

Figure 2.1: Birth weight as a function of maternal weight gain and prepregnancy weight for height.

2.7 Associated factors

While variations among some indices may not be particularly striking, some sociodemographic characteristics have been well noted to be related pregnancy weight gained. The IOM in 1990 recognized some of these indicators and recommended them for targets of policy driven action among other interventions. The CDC in 2004 reported that in the United States of America, there was a surge in the racial and ethnic diversity of births with a greater proportion of infants in 2005 born to nonwhite mothers between 1990 and 2005. Risks have even been suggested to differ among parity of the mothers (Restall et al., 2014).

There seems to be conclusive evidence to suggest that dietary intake has a significant bearing on GWG and pregnancy outcomes. Though some authors have suggested many undesirable trends in dietary habits among pregnant women, the evidence may not be conclusive to suggest causality nor association with pregnancy outcomes. For instance, the proportion of energy

consumed from soft drinks has nearly tripled; energy from fruit drinks doubled, while energy from milk has reduced in the last few decades (Rasmussen, Yaktine, & Guidelines, 2009a). Though statistics are relatively scarce for Ghana and Africa, other authors have to the contrary intimated a gradual increase was evident in the proportions of attempts at weight loss among reproductive females from 1989 to 2000 (Serdula et al., 1994). Pregnant women are typically not exempt from the general assertion that physical inactivity has an adverse effect on health and general well-being. Physical inactivity is tied with the development of weight gain. Age at pregnancy, socioeconomic status, and geographical locations are also possible contextual factors to predisposition of GWG. Other authors have also suggested ethnicity and sex of the child to have some association with GWG and outcomes (Kominiarek & Peaceman, 2017).

2.8 Contextual situation

Ghana is not exempted from the burden of the unwelcoming effects of GWG. Addo, (2010), in a study to ascertain pregnancy weight gain effects across the various body mass index (BMI) groups on maternal and perinatal outcomes in women delivering singletons at term in Kumasi, found that a significant association existed between GWG and adverse pregnancy outcomes. The study specifically indicated stillbirths, higher caesarean section rates, post-partum bleeding, fetal macrosomia and retained placenta. It was however found that normal fetal outcome is possible throughout the range of BMI and weight gain investigated. Similar to the findings of Addo, (2010), Abubakari, Kynast-Wolf, & Jahn, (2015) also found irrepressible evidence that pre-pregnancy body mass index and GWG influence birth weight. In addition to these, there have been several other studies which further highlights the weight of the condition on birth outcomes and society as a whole (Ayensu, Annan, Edusei, & Badu, 2016), (Fosu, Munyakazi, & Nsowah-Nuamah, 2013).

2.9 Chapter summary

This chapter reviewed the works of other authors that have explored the subject matter of gestational weight gain. It emerged from the review that excessive gestational weight gain during pregnancy is highly prevalent globally. However, differences exist in prevalence between developed and developing countries. Differences also exist in the extent to which the subject matter has been researched into and highlighted among developed and developing countries. While there is adequate research into gestational weight gain in developed countries bringing to the fore accurate and reliable data relative to its prevalence, there is little research regarding gestational weight gain in developing countries. This leaves a gap in developing countries pertaining to the prevalence of gestational weight gain making it difficult to put in the needed interventions to address the situation.

Furthermore, it was obvious from previous studies that the factors associated with gestational weight gain are multifaceted and varied across different settings. The factors associated with gestational weight gain are well documented in developed countries but least identified in developing countries such as Ghana.

2.10 Conceptual framework

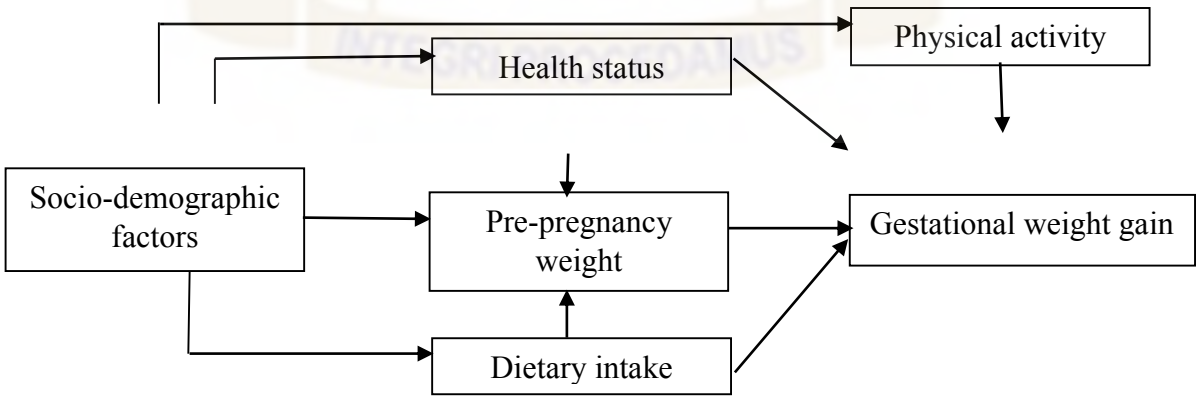

Figure 2.2: Determinants associated with Gestational weight gain (Author's own construct)

This framework is based on the 2009 IOM conceptual framework and existing empirical evidence which details the determinants of gestational weight gain. It seeks to explain the influence of various factors on gestational weight gain by women in the reproductive age. Pre-pregnancy weight index, dietary intake health status and physical activity which are all determinants of pregnancy weight gain are also dependent on the individual's socio-demographic situation which varies widely. The demographic setting of a pregnant women may influence the type of food she consumes which results in her overall nutrition and this contributes to gestational weight gain.

Worldwide, socio-economic characteristics have been recognized to influence gestational weight gain in both developed and developing countries (Drehmer et al., 2010). Age may influence an individual's dietary intake and physical activity, hence older women who get pregnant may be less active resulting in them gaining excessive weight whereas younger pregnant women who are expected to be more active would either gain inadequate or adequate gestational weight. Other factors such as education and income can impact the dietary habit and physical activity levels of pregnant women.

CHAPTER THREE

METHODOLOGY

3.1 Study design

The study is a quantitative cross-sectional design.

3.2 Area of study

Data for the study was collected from the maternity unit of Tema General Hospital. Tema Metropolis is a coastal district situated about 30 kilometers East of Accra, the Capital city of Ghana. It shares boundaries in the northeast with the Dangme West District, south-west by Ledzokuku Krowor Municipal, north-west by Adentan Municipal and Ga East Municipal, north by the Akuapim South District and south by the Gulf of Guinea. The total population of the Tema Metropolis is 292,773 with 47.8 percent males and 52.2 percent females. The metropolis is entirely urban. Females between the reproductive ages of 15-49 years constitute 89,924. The Metropolis has a Total Fertility Rate of 2.3 and a General Fertility Rate of 68.3 births per 1000 women aged 15-49 years. The 35-39 years age group has the highest children ever born (23,711), followed by 40-44 years age group (22,992) and 30-34 years age group (22,381). About 31.5 percent of the population are in service and sales occupation, 20.2 percent are in craft and related occupation, 10.4 percent are in elementary occupations and 9.8 percent are professionals. The lowest proportion of the employed population are in skilled agriculture, forestry and fishery occupation (4.2%), followed by clerical support occupation (4.4%). Among the employed females, higher proportions are in service and sales occupations (46.2%), elementary occupations (11.7%) and clerical support occupation (4.7%) (Ghana Statistical Service, 2014).

3.3 Target population

The target population for this study was women between the ages of 18 to 49 years who had delivered singletons and were in attendance at post-natal clinic in Tema General Hospital.

3.3.1 Inclusion criteria

Women aged between 18 to 48 years, who had delivered singletons and consented to take part in the study.

3.3.2 Exclusion criteria

Women aged between18 to 49 years, who had delivered singletons but started antenatal clinic after 20 weeks of pregnancy were excluded.

3.4 Research variables

3.4.1 Dependent variable

Gestational weight gain classified into inadequate, adequate and excessive.

3.4.2 Independent variables

1. Socio-demographic characteristics
2. Early pregnancy (≤20wks) body mass index: This was calculated using recorded initial pregnancy weight and height from respondents' maternal health record book.
3. Dietary intake: Food frequency over the pregnancy period was recorded and used to determine diet diversity score of respondents.

4. Physical activity over the pregnancy period: This was measured using the average score of reported brisk activities engaged in during the three trimesters of the pregnancy.

3.5 Sample size

The sample size required for the study was calculated using the Cochran formula

$$n = \frac{(z^2 * pq)}{d^2}$$

Where (p= 0.69) was the proportion of women who gained inadequate gestational weight (Asefa & Nemomsa, 2016) , z is the standard normal deviate of 1.96 which corresponds to 95% confidence level and d is an absolute precision (margin of error) which is 0.05.

Thus n, the sample size was calculated as follows:

$$n = \frac{(z^2 * pq)}{d^2}$$

$$n = \frac{((1.96)^2 * (0.69) * (1 - 0.69))}{0.05^2}$$

Therefore, $n = 329$

An incomplete response rate of 10% (33) was added to obtain the final sample size. Thus n= 329+33(10% of sample size for incomplete questionnaire)

Final Sample size (n) = **362**

3.6 Data Collection Instrument

1. A questionnaire was used for collection of primary data. The questionnaire was made up of 3 sections: Section A covered socio-demographic characteristics, Section B covered household assets and wealth, Section C covered dietary pattern and Section D covered physical exercise frequency over the pregnancy period.

2. Secondary data such as initial pregnancy weight and number of antenatal visits was obtained from the maternal health records book and recorded in a checklist.

3.7 Sampling technique

Consecutive sampling technique which is a non-probability sampling technique was used. On each day of sampling, all women in attendance at the post-natal clinic of the Tema General hospital were approached and eligible candidates were selected. The data collection instrument was then administered to eligible women who consented to participate in the study. The questionnaire was interviewer administered. This procedure was done on each day of the sampling until the required sample size was obtained.

3.8 Data processing and analysis

Data coding and entry was done concurrently with data collection after questionnaires were checked for completeness. Data from the questionnaires was recorded and analyzed using STATA version 14.0.

Weight gained during pregnancy was determined by subtracting the weight at first ANC from the weight at last ANC. This information was obtained from the checklist which was used to collect secondary data. Descriptive statistics were presented in proportions, frequencies, percentages and tables and bivariate analysis was done to assess association between socio-

demographics, pre-pregnancy BMI and diet with gestational weight gain. The frequency of consumption of various food groups was analyzed by adapting the guidelines of Nutrition and Consumer Protection Division, Food and Agricultural Organization of the United Nations for measuring household or individual dietary diversity. All food groups consumed by the women during pregnancy were categorized into food groups and the frequency of consumption of each food group determined on daily, occasional and never basis.

The physical activity level of participants during pregnancy was assessed. Physical activity level was measured by reported deliberate undertaking of brisk activity in the three trimesters of the pregnancy.

3.9 Data quality control

Two (2) Data Collection Assistants were trained on how to effectively administer questionnaires and obtain secondary data from maternal health records books.

Pre-test: The questionnaire was pre-tested on 10 women at the Tema General Hospital who met the criteria for the main study to determine validity and clarity and to eliminate possible ambiguity. Feedback was used to make the necessary modifications necessary to optimize the questionnaire.

3.10 Ethical Consideration

Study proposal was submitted to the Ghana Health Service Ethics Review Committee (GHS-ERC) for review and clearance before commencement of data collection. Permission was also obtained from the administration and Public health unit of Tema General Hospital to access the post-natal clinic. The objectives and aims of the study was explained to the participants

and an informed consent obtained. Participation in the study was voluntary, no compensation was given and information provided was protected. Participants were identified through numerical codes as names were excluded from the questionnaire to strengthen confidentiality.

3.11 Study Area Approval

An introductory letter from the University of Ghana, School of Public Health and ethical clearance from the Ghana Health Service's (GHS) Ethical Review committee was presented to the administration and the Public health unit of Tema General Hospital for approval and assistance for the study.

3.12 Consenting

The Principal Investigator and Data Collection Assistants read and explained information on the consent form to the individual participants. The nature, purpose, risk and benefits of the study was explained to each respondent. Participants who agreed to the terms and conditions in the consent were asked to either sign their signatures or thumbprint before the interview.

3.13 Privacy and Confidentiality

Primary and secondary data collected during the study from each study participant was kept confidential. To strengthen confidentiality, names were excluded from the questionnaires, and participants were identified through numerical codes.

3.14 Data Storage/Security

All hardcopy data was kept under lock and key and soft copy data was password protected.

3.15 Data Usage

Data collected was used purposely for the research study.

3.16 Voluntarily Withdrawal

Participants in the study had the right to withdraw at any time without any consequences. Participants who choose to withdraw had their information excluded from the study. Respondents were entitled to ask questions at any point in the study for clarification. Any aspect of the questions that was not well understood was clarified by the interviewer.

3.17 Compensation/Payments

There was no compensation for participating in the study and respondents were told before they consented to take part in the study.

3.18 Conflict of Interest

The principal researcher had no conflict of interest.

CHAPTER FOUR

RESULTS

4.1 Introduction

This chapter presents the data analysis and interpretation. A total sample of 322 women were used in all analyses.

4.2 Description of the study samples

Table 4.1 summarizes the descriptive analysis of women in the study. Most of the women were between the ages of 21-30 (n=174, 54.04%) with the mean age and standard deviation of 29.04 (SD=5.35). Majority of the respondents were married consisting of 57.14% (n=184). Only 7.14% (n=23) women had no formal education and majority 75.78% (n= 244) were employed with most of them being traders. While 98.45% (n=317) women lived in urban areas, most of the respondents were Christians 87.58% (n=282). Majority of the women earned income equal to and above the current minimum wage of eight cedis eighty pesewas in Ghana.

More than half (n= 164, 50.93%) of the women had normal weight as their initial pregnancy weight, 11.18% (n=36) were obese and only 0.93% (n=3) were underweight. Most 48.14% (n= 155) women gained excessive weight during the period of the pregnancy while 22.67% (n= 73) did not gain adequate weight.

Table 4.1: Summary table of socio-demographics of study participants (n-322)

Characteristics of study population	Mean ± SD or (N)	Percentage (%)
Age	29.04 ± 5.35	
≤ 20	21	6.52
21-30	174	54.04
31- 40	127	39.44
Education		
None	23	7.14
Primary	34	10.56
JHS	111	34.47
SHS/Tec/Voc	126	39.13
Tertiary	28	8.70
Marital status		
Single	54	16.77
Married	184	57.14
Cohabiting	77	23.91
Divorced	5	1.55
Widowed	2	0.62
Employment status		
Employed	244	75.78
Unemployed	78	24.22
Monthly income		
< 250	41	12.73
≥ 250	281	87.27
Residence		
Urban	317	98.45
Rural	4	1.24
Peri-urban	1	0.31
Religion		
Christian	282	87.58
Muslim	39	12.11
***Others**	**1**	**0.31**
Initial pregnancy BMI (kg/m^2)		
Underweight	**3**	**0.93**
Normal weight	**164**	**50.93**
Overweight	**119**	**36.96**
Obese	**36**	**11.18**
Gestational weight gain		
Inadequate	**73**	**22.67**
Adequate	**94**	**29.19**
Excessive	**155**	**48.14**

A comparison of initial pregnancy BMI and the proportions of women who gained weight during pregnancy was done. The results showed that majority of women (48.1%) gained excessive gestational weight. Based on initial pregnancy BMI, only 33.3% of the underweight women, 37.8% of the women with normal BMI, 21% of the overweight women and 16.7% of the obese women gained adequate gestational weight. Table 4.2 below shows a summary of the comparison of initial pregnancy BMI and proportion of weight gained during the pregnancy.

Table 4.2: Summary table of proportions of weight gain during pregnancy and initial pregnancy BMI (n-322)

Initial Pregnancy BMI	Weight Gain		
	Inadequate N (%)	Adequate N (%)	Excessive N (%)
Underweight	2(66.7)	1(33.3)	0(0.0)
Normal	52(31.7)	62(37.8)	50(30.5)
Overweight	9(7.6)	25(21.0)	85(71.4)
Obese	10(27.8)	6(16.7)	20(55.6)
Total	73(22.7)	94(29.2)	155(48.1)

4.3 Background characteristics of women and gestational weight gain

Table 4.3 illustrates a bivariate analysis done to assess association between characteristics of respondents and gestational weight gain. The marital status ($p<0.05$) employment status ($p<0.01$) and initial pregnancy BMI ($p < 0.05$) of the women were significantly associated with gestational weight gain. Age and educational level of the women were not associated with gestational weight gain but more women aged between 31-40 years gained excessive weight during pregnancy than 21-30 years old women. Women who attained senior high school level education were more likely to gain adequate weight than women of other educational level.

Table 4.3: Association between Socio-demographic characteristics with GWG

Characteristic	Gestational weight gain			P-value
	Inadequate	Adequate	Excessive	
	N (%)	N (%)	N (%)	
Age				0.855
≤20	7 (33.33)	10 (47.62)	4 (19.05)	
21-30	49 (28.16)	50 (28.74)	75 (43.10)	
31-40	17 (10.97)	34 (21.94)	76 (49.03)	
Educational level				0.142
None	6 (26.09)	4 (17.39)	13 (56.52)	
Primary	11 (32.35)	9 (26.47)	14 (41.18)	
JHS	21 (18.92)	36 (32.43)	54 (48.65)	
SHS/Tec/Voc	28 (22.22)	40 (31.75)	58 (46.03)	
Tertiary	7 (0.25)	5 (17.86)	16 (57.14)	
Marital status				**0.014***
Single	19 (35.19)	12 (22.22)	23 (42.59)	
Married	35 (19.02)	52 (28.26)	97 (52.72)	
Cohabitating	18 (23.38)	26 (33.77)	33 (42.86)	
Divorced	0 (0.00)	3 (60.00)	2 (40.00)	
Widowed	1 (50.00)	1 (50.00)	0 (0.00)	
Employment Status				**0.009****
Employed	56 (22.95)	72 (29.51)	116 (47.54)	
Unemployed	17 (21.79)	22 (28.21)	39 (50.00)	
Monthly Income				0.453
<250	9 (21.95)	13 (31.71)	19 (46.34)	
≥250	64 (22.78)	81 (28.83)	136 (48.40)	
Residence				0.958
Urban	72 (22.71)	92 (29.02)	153 (48.26)	
Rural	1 (25.00)	1(25.00)	2 (50.00)	
Peri-urban	0 (0.00)	1 (100.00)	0 (0.00)	
Religion				0.128
Christian	63 (22.34)	81 (28.72)	138 (48.94)	
Muslim	10 925.64)	13 (33.33)	16 (41.03)	
Others	0 (0.00)	0 (0.00)	1 (100.00)	
Initial pregnancy BMI				**0.043***
Underweight	2 (66.67)	1 (33.33)	0 (0.00)	
Normal weight	52 (31.71)	62 (37.80)	50 (30.49)	
Overweight	9 (7.56)	25 (21.01)	85 (71.43)	
Obese	10 (27.78)	6 (16.67)	20 (55.56)	

Note *Denotes p<0.05, **Denotes p<0.01

4.4 Dietary patterns of participants

The dietary patterns of participants were analyzed by categorizing all food items consumed into the diet diversity score food categories. Not all participants responded to questions on consumption of various food groups. All (100%) women consumed starchy staples during pregnancy while organ meat (65.8%) was the least consumed food group. In terms of frequency of consumption, starchy staples (85.7%) were consumed more on daily basis than all other food groups and eggs (75.5%) were the most consumed food groups by pregnant women on occasional basis. Majority (4.7%) of the women reported never consuming other vitamin A rich fruits and vegetables food during pregnancy as illustrated in table 4.4

Table 4.4: Dietary patterns of participants.

Food category consumption	**Frequency of**			**Total consumption (%)**
	Daily	**Occasionally**	**Never**	
Starchy staples	276(85.7)	46(14.3)	0	100.0
Dark green leafy vegetables	78(24.2)	187(58.1)	4(1.2)	82.3
Other vitamin A rich fruits and	136(42.2)	119(34.0)	15(4.7)	79.2
vegetables	231(71.7)	37(11.5)	3(0.9)	83.2
Other fruits and vegetables	107(33.2)	143(44.4)	23(0.7)	77.6
Organ meet	23(7.1)	189(58.7)	0	65.8
Eggs	43(13.4)	243(75.5)	1(0.3)	88.8
Legumes, nuts and seeds	87(27.0)	177(55.0)	6(1.9)	81.9
Milk and milk products				

4.5 Patterns of food group consumption and gestational weight gain

Details of bivariate analysis between food groups consumption and gestational weight gain among pregnant women is illustrated in table 4.5. Consumption of starchy staples (p=0.053) and legumes, nuts and seeds (p=0.057) were significantly associated with gestational weight gain.

Table 4.5: Bivariate analysis between dietary patterns and gestational weight gain

Food category consumption	**Frequency of**			**P-value**
	Daily	**Occasionally**	**Never**	
Starchy staples	276(85.7)	46(14.3)	0	**0.053**
Dark green leafy vegetables	78(24.2)	187(58.1)	4(1.2)	0.653
Other vitamin A rich fruits and	136(42.2)	119(34.0)	15(4.7)	0.724
vegetables	231(71.7)	37(11.5)	3(0.9)	0.678
Other fruits and vegetables	107(33.2)	143(44.4)	23(0.7)	0.851
Organ meet	23(7.1)	189(58.7)	0	0.644
Eggs	43(13.4)	243(75.5)	1(0.3)	**0.057**
Legumes, nuts and seeds	87(27.0)	177(55.0)	6(1.9)	0.924
Milk and milk products				

4.6 Pattern of physical activity

Table 4.6 shows the physical activity patterns of participants during pregnancy. In all the three phases of pregnancy, majority of the women never engaged in deliberate brisk physical

activity. In the first trimester, 179 (55.6%) women reported never undertaking any deliberate brisk physical activity compared to 267 (82.9%) women in the third trimester. Majority 34 (10.6%) of women engaged in brisk physical activity on weekly basis in the first trimester while the frequency of physical activity on weekly basis was least 3 (0.9%) in the third trimester. A significant number (45%) of the women reported no physical activity in the three trimesters of the pregnancy.

Table 4.6: Patterns of physical activity of participants

Phase of pregnancy and schedule of physical activity	Frequency (N=322)	Percentage (%)
First Trimester		
Weekly	34	10.6
Occasionally	76	23.6
Never	179	55.6
Second Trimester		
Weekly	21	6.5
Occasionally	35	10.9
Never	243	75.5
Third Trimester		
Weekly	3	0.9
Occasionally	6	1.9
Never	267	82.9

In bivariate analysis between pattern of physical activity during pregnancy and gestational weight gain, no significant association was found between physical activity in any of the three phases of pregnancy and gestational weight gain.

Table 4.7 summarizes logistics regression model for study participants. Only initial pregnancy BMI was significantly associated with gestational weight gain. All other covariates were not statistically significant at 0.05 level of significance. This showed that apart from initial pregnancy BMI, none of the independent variables was a good predictor of gestational weight gain among women. Compared to women who had initial pregnancy BMI classification of underweight, overweight women were more likely to gain excessive gestational weight (p=0.050) while obese women were 1.46 time more likely to gain gestational weight than women with normal weight (p= 0.006).

Table 4.7: Summary table of the logistics regression model results among women (n= 322)

Variables	GWG OR (95%CI)	*p*-value
Age		
≤ 20	Ref	0.88
21-30	1.07 (.43-2.66)	0.59
31- 40	1.31 (.49-3.48)	
Education		
No formal education	Ref	
Primary	1.19 (.43-3.27)	0.74
JHS	.98 (.41- 2.36)	0.97
SHS/Tec/Voc	1.31 (.54-3.16)	0.55
Tertiary	.76 (.26- 2.27)	0.62
Marital status		
Single	Ref	
Married	.99 (.72-2.44)	0.36
Cohabiting	1.15 (.58- 2.30)	0.68
Divorced	.54 (.09-3.44)	0.52
Widowed	.50 (.02-10.60)	0.66
Occupation		
Employed	Ref	
Unemployed	.87 (.45-1.71)	0.70
Residence		
Urban	Ref	
Rural	2.15 (1.06-4.36)	0.13
Peri-urban	1.33 (.71-2.49)	0.37
Ethnicity		
Ga	Ref	
Akan	1.33 (.72-2.44)	0.36
Ewe	1.50 (.78-2.89)	0.22
Northner	1.40 (.64-3.06)	0.40
Other	1.06 (.41- 2.70)	0.91
Religion		
Christian	Ref	0.78
Islam	1.12 (.47- 2.69)	0.98
Traditionalist	37	
Physical activity		
Yes	Ref	0.43
No	1.23 (.50-2.47)	
Initial pregnancy BMI		
Underweight	.Ref	
Normal weight	1.38 (.71-2.32)	0.324
Overweight	2.14 (.52-1.99)	**0.050**
Obese	1.46 (1.31-1.87)	0.006

CHAPTER FIVE

DISCUSSION

This study aimed to determine prevalence of gestational weight gain classified as inadequate, adequate and excessive it's associated factors among women at Tema General Hospital of the Greater Accra Region of Ghana. Specific objectives determined the proportion of women who gained weight during pregnancy based on their pre-pregnancy BMI and determined whether socio-demographic factors, physical activity and diet were associated with gestational weight gain during pregnancy.

With increasing weight at gestation over the century, many institutions have found it necessary to research and standardize guidelines into its control (WHO, 2011). The determination of gestational weight gained during pregnancy is based on the initial pregnancy weight. Prior to this study more than half (50.93%) of the women had initial pregnancy weight classified as normal weight with only 11.18% being obese. The study found that the proportion of women who gained excessive weight during pregnancy based on their pre-pregnancy BMI was 48.1%. This is higher than those who gained inadequate (22.7%) and adequate (29.2%) weight during pregnancy. Women with pre-pregnancy BMI classification of overweight and obese were 2.14 times 1.46 times more likely to gain excessive gestational weight respectively compared to women with initial pregnancy BMI classification of underweight. This reflects the general excessive weight gain during pregnancy being reported in several studies in different settings globally (Yao, Park, Foster, & Caughey, 2017; Guelinckx, Devlieger, Beckers, & Vansant, 2008). This has implications for pregnancy outcomes. Kowal, Kuk and Tamim (2012), noted

that many factors influence pregnancy outcome, however, maternal weight gain is a critical element that influences both fetal development and infant and maternal morbidities.

Excessive and inadequate weight gain are inappropriate and are associated with adverse pregnancy outcomes (Yao et al., 2017). Evidence from research shows that when weight is gained during pregnancy above that recommended by the IOM guidelines, it is an independent risk factor for several consequences including preeclampsia, gestational diabetes, cesarean delivery, large for gestational age foetus, and neonatal morbidity and mortality (Truong, Yee, Caughey & Cheng, 2015; Hinkle & Sharma, 2010). Conversely, inadequate weight gain or weight loss during pregnancy increase the risks of small for gestational age babies and preterm birth (Johnson et al., 2013; Catalano et al., 2014; Truong et al., 2015).

Several factors could be responsible for the excessive weight gained by the women in this study during pregnancy. According to Choquet & Meyre (2011), the role of environmental as well as genetic factors can be a contributive factor of weight gain. Also, the excessive weight gain of women could be because of genetic and biological factors. For example, a study done by Kominiarek & Peaceman, (2017) suggested that there is an intimate bilateral relationship between mother and foetus. While the foetus itself effects dynamic endocrinal and homeostatic changes in its mother, there is an overwhelming control of the foetus' circulation, growth, and metabolism.

Furthermore, weight gain is naturally expected, as it corresponds with increased nutrients for utilization by the foetus. Michelle et al, (2017) indicated that placenta, foetus and amniotic fluid, which are the products of conception comprise approximately 35 percent of the total GWG.

Bivariate analysis between characteristics of participants and gestational weight gain, showed initial pregnancy BMI to be significantly associated with gestational weight gain. This was still significant in multivariate analysis and further support the fact that majority of women gained excessive weight in this study during pregnancy.

Additionally, socio-demographics of respondents such as marital status and employment status showed a statistically significant association with gestational weight gain. Other characteristics of the women including age, religion, place of residence, level of education and ethnicity were not associated with gestational weight gain. This agrees with Restall et al. (2014) who indicated that while variations among some indices may not be particularly striking, some socio-demographic characteristics have been well noted to be related to the gain of weight in pregnancy. The IOM in 1990 recognized some of these indicators and recommended them for targets of policy driven action among other interventions. The CDC in 2004 reported an increase in the diversity of racial and ethnic births in the United States where a larger proportion of babies were born to mothers who were not white. Risks have even been suggested to differ among parity of the mothers (Restall et al., 2014).

However, the finding that age, educational level, monthly income and ethnicity were not associated with gestational weight gain contradicts findings of a study which suggested that maternal age, parity, ethnicity, and educational or economic status are important determinants for gestational weight gain in different populations (Abbasalizad, 2016).

Hui et al, (2014) indicated that behavioural interventions including dietary patterns and physical activities could mitigate excessive gestational weight gain and thus minimize the impact of excessive gestational weight gain on pregnancy outcomes**.** The importance of

dietary and exercise patterns as a way of controlling gestational weight gain is underscored by the development of a toolkit for implementation of the IOM pregnancy weight gain guidelines and the encouragement of its utilization by the 2013 IOM dissemination workshop. The toolkit encourages care providers to counsel patients on diet and exercise in pregnancy and to make referrals to nutritionists as needed to ensure appropriate gestational weight gain (Samura et al., 2016).

Analysis of the association between dietary patterns of women and gestational weight gain in this study revealed that eating of starchy staples as well as legumes, nuts and seeds were significantly associated with gestational weight gain. This is consistent with findings by Guilloty et al., (2015) that in addition to pre-pregnancy weight status, certain dietary patterns have been associated with gestational weight gain. Other studies found that consumption of dairy products, meats, sweets, artificially or sugar sweetened beverages is related to excessive gestational weight gain, while consumption of whole grains, fruits and vegetables is related to adequate gestational weight gain (Chu et al., 2009; Stuebe, Oken & Gillman, 2009; Sayon-Orea, 2013).

However, analysis of association between physical activity and gestational weight gain showed no significant association between physical activity and gestational weight gain in the study. This contradicts results of a study done by Asefa & Nemomsa (2016). In their study, the mothers who under-took physical exercise at least once a week were 2.1 times more likely to gain adequate gestational weight compared to those that did not. A previous study conducted indicated that women in low-income countries tend to have a higher physical workload which is sustained during pregnancy and this workload was believed to contribute to high incidences of low birth weight(Campbell et al., 2011). Current research has however

showed potential health benefits of aerobic and strength-conditioning exercise during pregnancy and the postpartum period (Muktabhant et al., 2015). In view of the above, the general low level of physical activity during pregnancy reported in this study has health implications and it would be crucial for pregnant women to engage in recommended levels of physical activities during pregnancy to guarantee the needed health benefits as outlined in previous studies.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusion

The aim of the study was to determine the prevalence of inadequate, adequate and excessive gestational weight gain and its related socio-demographic, dietary and physical activity factors among women at Tema General Hospital. A structured questionnaire was developed to collect primary data while secondary data was collected from participants maternal health records book using a checklist. Analysis of the data revealed that excessive gestational weight was highly prevalent with majority (48.1%) of the women gaining excessive gestational weight while only 22.7% gained inadequate gestational weight and 29.2% of them had adequate gestational weight. Socio-demographic factors such as initial pregnancy weight, marital status and employment status were significantly associated with gestational weight gain. Eating of starchy staples as well as legumes, nuts and seeds were also associated with gestational weight gain. However, physical activity was not associated with gestational weight gain. In general, there was low level of engagement in physical activity among the women.

6.2 Recommendations

Against the backdrop of the study findings, the following recommendations were made for policy makers and implementers

1. Guidelines should be developed in accordance with the IOM guidelines and incorporated in the care of pregnant women in order to help promote appropriate gestational weight gain during pregnancy.

2. The services of nutritionists should be fully utilized through referrals of all pregnant women to guide their dietary patterns during the pregnancy period.
3. Exercise schedules should be developed and made part of the entire care of pregnant women to help promote physical activity among pregnant women.

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APPENDICES

CONSENT FORM

Title: Gestational weight gain and its contributing factors among post-natal women.

Introduction: This study is being conducted by Esther Dzifa Agbayizah, a student of the School of Public Health, University of Ghana.

Purpose of study: This study seeks to identify the factors which contribute to weight gain during pregnancy. Information provided for the study will help in making necessary recommendations to enable women gain optimal gestational weight.

Study procedure: You are selected because you have recently delivered. You will be asked about your socio-demographic characteristics, diet intake including fruits and vegetables and physical activity during your pregnancy. This interview will take about thirty (30) minutes to complete.

Benefits: This study aims to collect information that will identify factors which contribute to gestational weight gain. There is no direct benefit to you for participating other than the satisfaction that you are contributing to increase knowledge in weight gain during pregnancy.

Risks: There is very minimal or no risk in this study. Precaution has been taken to protect the information which you will provide. However, there is always a risk that the data collected could be breached. To prevent this your identity such as name will not be collected.

Confidentiality: To protect your information, code numbers will be used to identify you and no names will be used. Information you provide will be treated as strictly confidential and will

solely be used for the study. Information collected will be stored under lock and key and will be password protected.

Compensation: Your time and participation is appreciated. However, there is no compensation involved.

Withdrawal from study: Participating in this study is entirely voluntary and you are entitled to refuse to participate as this will not affect you in any way. There is no penalty for withdrawing.

Do you have any questions?

If you need further clarity regarding this study, you may contact:

Principal Investigator: Esther Dzifa Agbayizah 0209460977
Supervisor: Dr. Richmond Aryeetey 0244-129669
Hannah Frimpong 0507041223

Participant statement and signature

I declare that the purpose, procedures as well as risks and benefits of the study have been thoroughly explained to me and I have understood. I hereby agree to take part in this study.

Signature of participant _____ Date…… / ……/ ……..
(Thumbprint for those who cannot read and write)

Interviewer's Statement:

I have explained this consent form to the subject in simple language that she understands, clarified the purpose of the study, procedures to be followed as well as the risks and benefits involved. The subject has freely agreed to participate in the study.

Signature of interviewer ……. Date ……../……../……

I. Structured Questionnaire

Study title: Factors contributing to gestational weight gain among post-partum women at Tema General Hospital.

Questionnaire number _____

Interview Date ___ /___/___

Name of interviewer_____

Respondent's Number _____

Section A: Socio-demographic characteristics of the respondents.

1. How old are you?(Completed years) _____
2. What is your current marital status?

[ ] Single [ ] Married [ ] Cohabiting [ ] Divorced/separated [ ] Widowed

3. What is your highest educational level completed?

[ ] No Formal Education [ ] Primary Education [ ] Junior High Education

[ ] Senior High/Vocational/Technical [ ] University/ Polytechnic/ Training College

4. Which ethnic group/tribe do you belong to?

[ ] Ga [ ] Akan [ ] Ewe [ ] Northerner [ ] Other (specify)……

5. What is your religious affiliation?

[ ] Catholic [ ] Anglican [ ] Methodist [ ] Presbyterian [ ] Pentecostal/Charismatic

[ ] Other Christian [ ] Islam [ ] Traditionalist/Spiritualist [ ] No religion [ ] Other (specify) ……

6. Where do you currently live? .....

7. What is your current occupation? ……..

8. What is your total income from your current occupation? .....

9. What is your income from other sources…….

SECTION B: Household Assets and wealth

Q1. What is the main source of drinking water for your households?	**Q2. What is the main source of water used by your household for other purposes such as cooking and hand washing?**
1. Piped into dwelling place 2. Piped into yard/plot 3. Piped into neighbour 4. Public tap/standpipe 5. Tube well or borehole 6. Protected well 7. Unprotected well 8. Rainwater 9. Tanker truck 10. Cart with small tank 11. Surface water (river/dam, ponds, streams, canal) 12. Bottled water 13. Sachet water 14. Others specify…….	1. Piped into dwelling place 2. Piped into yard/plot 3. Piped into neighbour 4. Public tap/standpipe 5. Tube well or borehole 6. Protected well 7. Unprotected well 8. Rainwater 9. Tanker truck 10. Cart with small tank 11. Surface water (river/dam, ponds, streams, canal) 12. Bottled water 13. Sachet water 14. Others specify…….

Q3. Where is that water source located?	**Q4. How long does it take you to go there, get water, and come back?**
1. In own dwelling place 2. In own yard/plot 3. Others specify……	Minutes: …… Don't know: ……

Q5. What kind of toilet facility do members of your household usually use?	**Q6. Do you share this toilet with other households?**
1. Flush to septic tank 2. Flush to pit latrine 3. Ventilated improved pit latrine 4. Pit latrine with slab 5. Pit latrine without slab/open pit 6. Bucket toilet 7. No facility/bush/field 8. Others specify……..	1. Yes, other household members 2. Yes, public 3. Not applicable 4. No response

Q7. How many households use this toilet facility?	**Q8. Where is this toilet facility located?**
Number of people: ……. Don't know……	1. In own dwelling 2. In own yard/plot 3. Others specify……..

Q9. What type of fuel does your household mainly use for cooking?	**Q10. Is cooking usually done in the house, in a separate building or outdoor**	**Q11. Do you have a separate room which is used as kitchen?**
1. Electricity 2. LPG 3. Natural Gas 4. Biogas 5. Kerosene 6. Charcoal 7. Straw/shrubs/grass 8. Agricultural crop 9. Animal dung 10. Others specify: …..	1. In the house 2. In a separate room 3. Outdoors 4. Others specify: …	1. Yes 2. No

Q12. Does your household have any of the following?	**Codes for Q12(circle appropriate)**
1. Electricity	1. 1 Yes 2 No
2. A wall clock	2. 1 Yes 2 No
3. A radio	3. 1 Yes 2 No
4. Television	4. 1 Yes 2 No
5. A mobile phone	5. 1 Yes 2 No
6. A refrigerator	6. 1 Yes 2 No
7. A freezer	7. 1 Yes 2 No
8. An electric generator	8. 1 Yes 2 No
9. A washing machine	9. 1 Yes 2 No
10. Computer/laptop	10. 1 Yes 2 No
11. Video DVD/VCD	11. 1 Yes 2 No
12. Sewing machine	12. 1 Yes 2 No
13. Bed	13. 1 Yes 2 No
14. Table	14. 1 Yes 2 No
15. Cabinet/cupboard	15. 1 Yes 2 No
16. Access internet	16. 1 Yes 2 No
Q13. What material is used for the floor of your house?	**Q14. What material is used to roof your house?**
1. Earth/sand floor	1. No roof (NR)
2. Dung floor	2. Thatch/palm leaf (NR)
3. Wood planks	3. Rustic mat (RR)
4. Parquet or polished floor	4. Palm/bamboo (RR)
5. Vinyl or asphalt strips	5. Cardboard (RR)
6. Ceramic/marble/porcelain tiles/terrazzo	6. Metal (FR)
7. Woolen carpet/synthetic carpet	7. Wood (FR)
8. Linoleum/rubber carpet	8. Calamine/cement fibre (FR)
9. Others specify…….	9. Ceramic/brick tiles (FR)
	10. Cement (FR)
	11. Roofing shingles (FR)
	12. Asbestos/slate roofing sheets (FR)
	13. Others specify…….

Q15. What material is used for the exterior walls of your house?
1. No walls (Natural Walls)
2. Cane/palm/trunks (NW)
3. Dirt (NW)
4. Bamboo with mud (Rudimentary Walls)
5. Stone with mud (RW)
6. Uncovered adobe (RW)
7. Cardboard (RW)
8. Refuse wood (RW)
9. Cement (Finished Wall)
10. Stone with lime/cement (FW)

11. Bricks (FW) 12. Covered adobe (FW) 13. Wood planks/shingles(FW) 14. Others specify……..

Q16. Does your household have any of the following?	**Codes for Q16 (circle appropriate)**
1. A wrist watch	1. 1 Yes 2 No
2. A bicycle	2. 1 Yes 2 No
3. A motor bike	3. 1 Yes 2 No
4. A motor king	4. 1 Yes 2 No
5. Animal drawn cart (e.g. donkey cart)	5. 1 Yes 2 No
6. A car or truck	6. 1 Yes 2 No
7. Tractor	7. 1 Yes 2 No
8. Others specify……	8. 1 Yes 2 No

Section C: **Food frequency during pregnancy**

1. How many times did you eat in a day during your 1st trimester?

[ ] Once [ ] Twice [ ] Thrice [ ] Other (specify)……

2. How many times did you eat in a day during your 2nd trimester?

[ ] Once [ ] Twice [ ] Thrice [ ] Other (specify)……

3. How many times did you eat in a day during your 3rd trimester?

[ ] Once [ ] Twice [ ] Thrice [ ] Other (specify)……

In the table below, indicate for each food commodity, how often you consumed this during the last trimester (last three months of your pregnancy).

Table 1: Evaluation of Food frequency during pregnancy

Commodity	Frequency of consumption				
	Daily	Weekly	Monthly	Occasionally	Never
Starchy roots and Plantain					
Cassava & products					
Yam					
Cocoyam					
Sweet potato					
Plantain					

Cereals & Cereal Products					
Maize					
Rice					
Millet					
Bread					
Biscuits					
Animal Products					
Meat					
Fish & Sea-food					
Poultry					
Egg					
Milk & Diary products					
Snail					
Others					
Legumes & nuts					
Cowpea					
Soybean					
Groundnut					
Bambara					
Agushie					
Fruits					
Orange					
Mango					
Pineapple					
Pawpaw					
Banana					
Watermelon					
Vegetables					
Tomato					
Onion					
Leafy vegetables					
Okro					
Garden eggs					
Pepper					
Fats and Oils					
Refined vegetable oil					
Palm oil & products					
Palm kernel oil					
Groundnut oil					

Coconut oil					
Margarine					
Shea butter					
Palm fruits					

Section D: **Pregnancy Physical Activity Questionnaire**

1. Did you engage in physical activity during your pregnancy? [ ] Yes [ ] No

Table 2: Evaluation of physical activity over pregnancy period.

1st trimester	
1. I was active during my pregnancy [ ] Highly active [ ]Moderately active [ ] Minimally active	2. I took time off work during my pregnancy [ ] Most of the pregnancy time [ ]For a short duration of the pregnancy [ ] Did not take time off work
3. I had help with household chores and activities during pregnancy [ ] Most of the time [ ] Some of the time [ ] Only for a brief period [ ] No help was available to me	4. I walked to get to places during my pregnancy [ ] Most of the time [ ] Some of the time [ ] I hardly walked during my pregnancy
5. I was engaged in deliberate exercise during my pregnancy period (exercise means engaging in stretching or aerobic activities with or without an instructor) [ ] Most of the time [ ] Some of the time [ ] Only for a brief period [ ] I did not engage in exercise	
2nd trimester	
1. I was active during my pregnancy [ ] Highly active [ ]Moderately active [ ] Minimally active	2. I took time off work during my pregnancy [ ] Most of the pregnancy time [ ]For a short duration of the pregnancy [ ] Did not take time off work
3. I had help with household chores and activities during pregnancy [ ] Most of the time [ ] Some of the time [ ] Only for a brief period [ ] No help was available to me	4. I walked to get to places during my pregnancy [ ] Most of the time [ ] Some of the time [ ] I hardly walked during my pregnancy
5. I was engaged in deliberate exercise during my pregnancy period (exercise means engaging	

in stretching or aerobic activities with or without an instructor) [ ] Most of the time [ ] Some of the time [ ] Only for a brief period [ ] I did not engage in exercise	
3rd trimester	
1. I was active during my pregnancy [ ] Highly active [ ]Moderately active [ ] Minimally active	2. I took time off work during my pregnancy [ ] Most of the pregnancy time [ ]For a short duration of the pregnancy [ ] Did not take time off work
3. I had help with household chores and activities during pregnancy [ ] Most of the time [ ] Some of the time [ ] Only for a brief period [ ] No help was available to me	4. I walked to get to places during my pregnancy [ ] Most of the time [ ] Some of the time [ ] I hardly walked during my pregnancy
5. I was engaged in deliberate exercise during my pregnancy period (exercise means engaging in stretching or aerobic activities with or without an instructor) [ ] Most of the time [ ] Some of the time [ ] Only for a brief period [ ] I did not engage in exercise	

This is the end of the interview. Thank you

II. Checklist from maternity health record book

1. **Height of woman.....**
2. **Number of weeks pregnant at first ANC visit.....**
3. **Weight at first ANC visit.....**
4. **Weight at last ANC visit …….**
5. **Number of ANC visits before birth …….**
6. **Number of weeks pregnant at delivery …….**
7. **Baby's weight at birth …….**