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Nutrition and Diet Quality during Pregnancy

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NUTRITION AND DIET QUALITY DURING PREGNANCY

By

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To my two beautiful nieces, Olivia and Zoe, you can do anything you put your minds to. And to my parents for always believing in me; I love you all to the stars and back.
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ABSTRACT

Purpose: The purpose of this study was two-fold: (1) identify predictors that influence diet quality in low SES pregnant women; and (2) explore relationships between perceived nutrition compliance of participants, healthy pregnancy weight gain, and diet quality. Hypothesized predictors to diet quality include: High Pre-pregnancy BMI, high educational level, high income level (above or below poverty line), medical/insurance coverage, presence of a previous/current medical condition, cost and ability to purchase healthy food, presence of social support, and source of nutrition information. Also it is hypothesized that healthy pregnancy weight gain will positively influence diet quality.

Methods: This quantitative/correlational study included 37 women in their second and third trimesters of pregnancy. Participants were recruited from a low-income clinic and a private healthcare facility. Participants were asked to complete a pregnancy nutrition survey on their demographics and activity level and eating habits. Three 24 hour dietary recalls (1 weekend day and 2 nonconsecutive weekdays) were used to assess their diet quality using the ESHA Food Processor software. Comparative, correlational, and linear regression analyses were conducted. The Diet Quality Index for Pregnancy (DQI-P) was used to assess overall diet quality. The DQI-P includes eight components: % recommended servings of grains, vegetables, and fruits, % recommendations for iron, calcium, and folate, % energy from fat, and meal pattern. Scores can range from 0 to 80, with ≥70 indicating adequate diet quality. Each component contributed 10 points.

Results: The mean score for the population was 27.1 (standard deviation 17.1). Women with the highest diet quality score are married, have a bachelor’s degree, an average family income between $45,000 and $60,000, and private medical insurance. Two of the eight hypothesized
predictors of diet quality were found to be significant. High pre-pregnancy body mass index (BMI) is associated with low DQI-P scores (p=.050). Source of nutrition information from family is associated with high DQI-P scores (p=.013). There was a significant negative correlation between diet quality and pre-pregnancy BMI (r= -.344; p=0.05). **Conclusion:** Low SES women are at-risk for low diet quality during pregnancy. Based on the results of this small convenience sample, there is a need for effective nutrition interventions to improve the diet quality of low SES pregnant women. Additional research is needed to better predict and utilize situations that motivate low SES pregnant women to achieve high diet quality scores by translating these motivational situations to other low SES pregnant women.
CHAPTER ONE
INTRODUCTION

Poor diet quality during pregnancy jeopardizes the health of the fetus (Godfrey et al., 1996; Kramer, 1987; Pickard, 1986; Reyes et al., 2013). Macronutrient and micronutrient deficiencies predispose the fetus to preterm birth, neural tube defects, and low birth weight for gestational age (Botto et al., 1999; McIntire et al., 1999; Siega-Riz et al., 2004; Carmichael et al., 2003). Premature births and low birth weight for gestational age are more prevalent among women of lower socioeconomic status (SES) (Kramer et al., 2000). Moreover, poor diet quality during pregnancy is associated with lower education (Rifas-Shiman et al., 2009), lower awareness about nutritional recommendations during pregnancy, and a poor pre-pregnancy weight status. These conditions are more prevalent among pregnant women with lower SES (Reyes et al., 2013; Brown, 2010; Fowles et al., 2011).

A large body of evidence has established factors influencing diet quality in at-risk pregnant women (Reyes et al., 2013; Fowles et al., 2012; Fowles et al., 2011; Watson et al., 2009; Rifas-Shiman et al., 2009; Kamau-Mbuthia & Elmadfa, 2007; Bodnar & Siega-Riz, 2002). High pre-pregnancy body mass index (BMI) is a negative factor to diet quality in that 76% of women who are overweight or obese are more likely to fall into the lowest diet quality tertile (Laraia et al., 2007). Another negative predictor is cost and lack of access to healthy foods. Women living more than four miles from a supermarket were more than twice the odds of having a low diet quality score compared to women who lived closer to the supermarket (Laraia et al., 2004). Stress and depressive symptoms are also important negative predictors to poor eating habits and overall diet quality (Fowles et al., 2010; Fowles et al., 2011).
However, there are some predictors that have been shown to increase the efficacy for high diet quality during pregnancy. Bodnar & Siega-Riz (2002) found that higher percentages of vegetable servings and higher diet quality were achieved with women with higher income and more education. Lastly, social support to comply with nutritional recommendations, particularly from a spouse or family member, had a significant positive impact on diet quality (Fowles et al., 2011; Rifas-Shiman et al., 2009).

Maternal nutrition plays an important role in pregnancy outcomes, and is associated with decreasing the risk of many maternal and fetal complications. In Florida in 2010, 1,397 infants died before their first birthday, an infant mortality rate of 6.5 per 1,000 live births (Peristats, 2015). The most common causes of infant mortality in the United States are birth defects; prematurity/low birth weight; sudden infant death syndrome (SIDS); maternal complications of pregnancy and respiratory distress syndrome (RDS). Florida was one of the states with the highest rates of the latter causes of infant death per 100,000 live births in 2010, with birth defects at 117 cases, prematurity/low birth weight at 118.4 cases, SIDS at 30.1 cases, maternal complications at 56.9 cases, and RDS at 10.3 cases (Peristats, 2015).

In 2003-2007, the average maternal mortality rate in Florida was 17.0 per 100,000 live births (Peristats, 2015). It is also estimated that between 1999 and 2007 16.4% of maternal mortality was contributed from preeclampsia and other hypertensive disorders in the state of Florida (PAMR, 2007). Iron deficiency during pregnancy is also of concern, as in 2004, 11.1% of Floridian women reported having pre-pregnant anemia and only 27.6% of mothers reported taking a daily multivitamin during the month before getting pregnant (Peristats, 2015; MMWR, 2007).
Some of the Healthy People 2020 objectives for maternal, infant, and child health are directly related to the promotion of early pregnancy nutrition education. Some examples of the initiatives include increasing the proportion of pregnant women who receive early and adequate prenatal care, reducing low birth weight, reducing preterm births, and reducing the occurrence of neural tube defects (US Dept. of Health & Human Services, 2014). In Florida, 73.1% of infants were born to women receiving early prenatal care in 2012, a 2.3% increase from the national Healthy People 2020 baseline (Peristats, 2015). However, Florida ranked lower in the other initiatives compared to national baselines.

According to the National Center for Health Statistics (NCHS), in 2012, 1 in 7 babies (13.7% of live births) were born preterm in the state of Florida. Between 2002 and 2012, the rate of infants born preterm in Florida increased more than 5%. Also, when disaggregated by race/ethnicity, the rate of preterm birth in Florida is highest for black infants (17.7%), followed by Native Americans (14.1%), Hispanics (13.4%), Asians (11.8%) and whites (11.1%; Peristats, 2015). In 2012, 1 in 12 babies (8.6% of live births) were low birth weight and 3,370 babies (1.6% of live births), were very low birth weight in Florida. Between 2002 and 2012, the rate of infants born low birth weight in Florida increased more than 2% (Peristats, 2015).

Only a limited number of researchers have studied the effects of poor diet quality in low SES women on pregnancy outcomes (Freisling et al., 2006; Kramer et al., 2000; Olds et al., 1986). Moreover, only one study was identified that assessed the effects of poor diet quality in low income women in their second and/or third trimesters (Bodnar & Siega-Riz, 2002). Targeted problem-specific public health initiatives would benefit from a better understanding of associations and the strengths of associations between factors that influence diet quality,
pregnancy impacts (i.e. healthy gestational weight gain), and perceived nutrition compliance during pregnancy.

**Purpose of Study**

The purpose of this study is two-fold: (1) contribute to the body of evidence in identifying which predictors influence diet quality in low SES pregnant women; (2) and explore relationships between perceived nutrition compliance, healthy pregnancy weight gain, and diet quality.

**Research Question & Hypotheses**

**Research Question:** Which predictors impact diet quality in a convenience sample of pregnant women with low SES?

**Hypothesis 1:** High Pre-pregnancy BMI, high educational level, high income level (above or below poverty line), medical/insurance coverage, presence of a previous/current medical condition, cost and ability to purchase healthy food, presence of social support, and source of nutrition information, will predict diet quality during pregnancy, as assessed by participant surveys.

**Hypothesis 2:** Healthy pregnancy weight gain will be associated with diet quality, as assessed by correlations between the diet quality index for pregnancy (DQI-P) and participants’ weight gain during pregnancy.
CHAPTER TWO

REVIEW OF THE LITERATURE

Nutrition during Pregnancy

A wholesome diet that meets recommended nutritional needs before and during pregnancy increases the prospects of positive outcomes for mother and baby. For example, poor nutritional status can alter maternal hormones and increase the likelihood of prenatal complications such as gestational diabetes mellitus (GDM), preeclampsia, and intrauterine growth restriction (Widen et al., 2010), putting both the mother and fetus at risk. In addition, common complications such as obesity and type 2 diabetes mellitus (T2DM) during pregnancy predispose offspring to the development of these conditions during adolescence and adulthood (Barger, 2010, Blumfield et al., 2012). Of utmost importance is nutritional adequacy prior to and during the first trimester, because malnutrition during this stage when vital organs and body systems are being created can have debilitating and permanent consequences on the fetus (Ramakrishnan et al., 2012).

Table 1. Summary of Dietary Recommendations during Pregnancy

- **Preconception daily intake of folic acid in a multivitamin to ensure adequate folate at time of neural tube development**
- **Gain the recommended weight for body mass index (BMI) by eating the following:**
  - Three meals a day and two snacks to avoid prolonged periods of fasting
  - Intake fruits and vegetables (five per day) and monounsaturated fats with adequate protein
  - Intake fiber-rich carbohydrates and limit carbohydrates with a high glycemic index (i.e. fruit juices and sodas)
  - At least two servings of omega-3 rich fish a week or consume omega-3 supplements
- **Ensure adequate intake of the following vitamins and minerals:**
  - Vitamin A (530-550 µg/d)* as beta-carotene and limit food sources of preformed vitamin A, such as liver or cod liver oil
  - Vitamin D from sunshine exposure; if not feasible, supplement with vitamin D₃ (1000-4000 IU/d depending on BMI and skin type)
  - Women who are vegan need vitamin B₁₂ supplements (2.2 µg/d)*
  - Iodine (160 µg/d)* through diet or a multivitamin
  - Iron (27 mg/d) through diet, multivitamin, or additional low-dose supplement if anemic
Calcium (1000 mg/d)* through diet with higher levels suggested for women at risk for preeclampsia

- Avoid foodborne illnesses that can cause maternal or fetal disease by eating:
  - Well-cooked meat, poultry (including eggs) and fish
  - Only pasteurized dairy and fruit juices
  - Avoid soft cheeses, processed meats, and raw sprouts

(Barger, 2010; *Source: Food and Nutrition Board, IOM, 2011)

Macronutrient Intake & Energy Requirements

Nutritional needs during pregnancy are outlined in the Dietary Reference Intakes (DRIs), published by the IOM (DRI, 2006). In order to assess the extent to which DRI recommendations are being met, dietary intake is recorded and analyzed to determine energy and nutrient contents. Energy and nutrients consumed are compared to the respective DRI. In calculating the DRI for energy, called the estimated energy requirement (EER), factors that influence prenatal energy needs are factored into the equation; i.e. pre-pregnancy weight, age, stage of gestation, basal metabolic rate (BMR) and physical activity levels (Blumfield et al., 2012, Widen et al., 2010).

Weight gain during pregnancy should be gradual and occur predominantly during the second and third trimesters. In order to achieve this gradual level of weight gain, pregnant women should increase energy requirements to approximately 340 kilocalories in the second trimester and approximately 452 kilocalories in the third trimester (Linkages, 2004).

Considering the energy yielding nutrients, the recommended dietary allowance (RDA) for carbohydrates during pregnancy is 175 grams per day. The recommended dietary intake for protein is 1.1 grams per kilogram of body weight or an additional 25 grams per day, and fat intake should be between 20-35% of total calories (Brown, 2010). According to the DRI recommendations, the acceptable macronutrient distribution range (AMDR) as percentage of total kilocalories for carbohydrates, fats, and protein are 45-65%, 20-35%, and 10-35%.
respectively. Even though there is agreement, malnutrition, whether due to overconsumption or under-consumption, increases risks of complications during pregnancy, and jeopardizes fetal outcomes as well. However, beneficial and adverse effects of individual nutrient deficits and/or excesses are unclear (Blumfield et al., 2012, Brown, 2010).

A meta-analysis of numerous cohort studies from developed countries found that fiber and energy consumption were constantly lower than the recommendation, while those of total fat and saturated fat consumption were higher than the recommendation (Blumfield et al., 2012). A prospective study by Blumfield et al. (2012) found that macronutrient consumption during pregnancy is associated with fetal adiposity as indicated by low protein intake, high fat intake, and low carbohydrate intake levels. It is important to note, however, that reliability and validity are often brought into question with dietary intake assessment, creating errors of underreporting and over reporting. For example, a prospective study of dietary intake by Nowicki et al. (2011) with pregnant women in North Carolina (n=998) in their second trimester, found that the prevalence of low energy reporting (LER) was 32.8% and high energy reporting (HER) was 12.9%, implying nearly half (45.7%) of their population was subject to misreporting dietary intake. Moreover, misreporting was not consistent among different body weight classes, relative to normal weight women. LER was higher in overweight and obese women, and lower in underweight women. Conversely, HER was higher in underweight women and lower in obese women than in their normal weight counterparts (Nowicki et al., 2011). Interestingly, researchers also found HER was more prevalent among African American women, women without a college education, and women with higher depressive and anxiety symptoms (Nowicki et al., 2011).
Micronutrient Intake & Deficiency Outcomes

Vitamins and minerals are essential for proper development and growth of a fetus. Zinc is important for cellular growth and reproduction, and iodine is vital for the regulation of thyroid hormone (Barger, 2010); therefore, if there is a deficiency in these nutrients, congenital hypothyroidism could develop causing mental retardation as well as underdeveloped growth in babies. Vitamin A is needed for reproductive health and immune function; however, pregnant women should only take the vitamin A precursor, beta carotene, because toxicity has occurred during pregnancy with retinol resulting in congenital malformation of the brain (Barger, 2010). The calcium and vitamin D RDA for 19-50 years old pregnant women is 1000 mg/day and 5 µg/day respectively (IOM, 2011). Both calcium and vitamin D are essential for bone formation, but the recommended consumption of calcium during pregnancy is primarily to preserve calcium in mother’s bones which can be lost during pregnancy (Brown, 2010).

On the other hand, vitamin D intake during pregnancy is extremely important due to the high prevalence of inadequate intake. In fact, the RDA for vitamin D is considered to be too low according to experts in the field (Brown, 2010). Vitamin D deficiency has ranged from 5% to 20% in light-skinned populations and 30% to 70% in dark-skinned populations (Dror et al., 2010). Women are encouraged to take additional vitamin D beyond the prenatal supplement in order to prevent adverse health outcomes such as low bone mineral content, impaired fetal brain development, rickets, and acute lower respiratory infection in infancy (Brown, 2010, Dror et al., 2010).

The B-complex vitamins such as B₁₂ and folate are vital for their role in rapid cell proliferation and folate intake, as 600 µg/day has shown to decrease the development of macrocytic anemia and neural tube defects (Barger, 2010; Linkages, 2004). Before pregnancy, women are
encouraged to consume 400 μg/day of folic acid to help prevent anencephaly (a severe underdevelopment of the brain) and spina bifida. Due to less than optimal compliance, the Food and Drug Administration (FDA) mandated folic acid fortification into grain products to boost folate intake (Brown, 2010, CDC, 1992). In a case-control study, Bailey et al. (2012) observed that an increased intake of dietary folate, vitamin B\textsubscript{6}, and B\textsubscript{12} presented a protective effect against the risk of childhood acute lymphoblastic leukemia, especially in women who drank alcohol during pregnancy.

The physiologic need for iron during pregnancy is extremely high. For women of childbearing age, the requirement for dietary iron is approximately 18 mg/day and the requirement for pregnant women is 27-30 mg/day particularly during the second and third trimesters (Brown, 2010). The absorbed iron is used for developmental growth of fetal organs, expansion of the mother’s red blood cells, the placenta, umbilical cord, and iron storage for compensation of blood iron loss during delivery (Milman, 2011). One of the most important functions of iron is for normal neurodevelopment during fetal and child growth. Iron deficiency during pregnancy may result in an infant or child having impaired memory function and changes to temperament which can mimic attention deficient disorder (Brown, 2010). To prevent iron deficiency, higher consumption of dietary iron prior to pregnancy is advised to assure storage of at least 300 mg at the start of conception (Brown, 2010).

**Gestational Weight Gain**

Optimal nutritional status before and during pregnancy contributes to high diet quality and positive pregnancy outcomes. Thus, obtaining a nutritional history, assessing and monitoring current dietary intake, and determining weight status before and during pregnancy are well accepted obstetric protocols (Barger, 2010, Widen et al, 2010). The Institute of Medicine (IOM) has established weight gain standards (Table 2) for each trimester of pregnancy based on
pregravid body mass index (BMI) status, calculated as weight in kilograms divided by height squared in meters (kg/m²).

The Healthy Eating Index (HEI), a USDA dietary intake assessment tool, offers a standard for assessing the quality of the total diet. Consumption of 12 food groups were used to calculate the HEI, where a HEI score above 80 was considered high, between 60 and 79.99 average, and below 60 was low (Tsigga et al., 2010). Using the HEI as a standard, researchers reported that the greatest HEI scores were attained by underweight and normal weight pregnant women (Tsigga et al., 2010). A low HEI score during pregnancy was associated with living in urban areas and being overweight or obese before and during pregnancy (Tsigga et al., 2010). Another study conducted on diet quality found an inverse relationship between SES, particularly household income, BMI, and HEI score, whereby the lower the income, the poorer the diet quality and the higher the BMI status (Bodnar et al., 2002).

Table 2. Pregnancy Weight Gain Recommendations Based on Pregravid BMI

<table>
<thead>
<tr>
<th>BMI Status</th>
<th>Rate of Weight Gain during 2nd and 3rd Trimesters</th>
<th>Total Weight Gain during Pregnancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight (&lt; 18.5)</td>
<td>1-1.3 lb per week</td>
<td>28 to 40 lbs.</td>
</tr>
<tr>
<td>Normal weight (18.5-24.9)</td>
<td>0.8-1 lb per week</td>
<td>25 to 35 lbs.</td>
</tr>
<tr>
<td>Overweight (25.0-29.9)</td>
<td>0.5-0.7 lb per week</td>
<td>15 to 25 lbs.</td>
</tr>
<tr>
<td>Obese (≥ 30)</td>
<td>0.4-0.6 lb per week</td>
<td>11 to 20 lbs</td>
</tr>
</tbody>
</table>

(IOM, 2009)

**Nutrition-related Pregnancy Complications**

Pregnancy is a vulnerable time for both mother and baby, as they are both more susceptible to infections, disorders, and diseases that can originate from a mother’s preexisting conditions (type 2 diabetes, obesity, malnutrition, etc.) or from conditions that may arise during pregnancy. More
detailed explanations of some major complications during pregnancy will be discussed further in the sub-sections below.

**Excessive Weight Gain**

The obesity epidemic has dramatically increased in the U.S. population. Obese women of childbearing age are more susceptible to a higher incidence of operative vaginal deliveries (emergency use of forceps or a vacuum device), cesarean deliveries, preeclampsia, and postpartum complications (Asbee et al., 2009). Excessive weight gain is measured based on whether or not a mother-to-be exceeds the IOM guidelines for weight gain previously described. The National Maternal and Infant Health Survey (NMIHS) found that in 1988, 20% of underweight women exceeded the recommendations, but 37% of normal weight women, and 64% of overweight women went over the goal recommendations (Keppel et al., 1993). Asbee and colleagues (2009) indicate that unnecessary gestational weight gain (GWG) not only causes problems during pregnancy, but it can also contribute to postpartum weight retention.

The NMIHS also found that when controlling for ethnicity, weight gain during pregnancy yielded different significant factors for postpartum weight retention. White women that exceeded the IOM guidelines retained 2.2 kg (4.8 lbs) postpartum and African American women that exceeded the IOM guidelines retained 5.8 kg (12.8 lbs) postpartum (Asbee et al, 2009). The Asbee interventional study (2009) on underweight and normal weight, overweight, and obese pregnant women found that women with higher pre-pregnancy BMI were more susceptible to increased weight gain in pregnancy. However, there was no statistical difference in compliance to the IOM guidelines and the rate of maternal and fetal complications, nor was there significance in the intervention groups’ adherence to the guidelines (Asbee et al., 2009).
However, it is evident that decreased weight gain due to consistent dietary and lifestyle counseling, results in decreased incidence of complications during pregnancy.

**Hyperemesis Gravidarum, Nausea & Vomiting of Pregnancy (NVP)**

Hyperemesis gravidarum is a condition that occurs in the first trimester of 20% of pregnancies, where there is intractable, dehydrating vomiting (Escott-Stump, 2011). In extreme cases, hospitalization and tube feedings may be needed, but drinking liquids between meals, consuming more B vitamins and vitamin C, as well as minimizing fat intake can help subdue the progressive symptoms (Escott-Stump, 2011). Nausea and vomiting of pregnancy (NVP) is different from hyperemesis gravidarum in that it occurs in 80% of pregnancies and can be due to bacteria such as *H. pylori* (Goldberg, et al., 2007). Medical nutrition therapy for NVP should include small frequent meals separate from liquid intake, high protein snacks, and avoidance of pungent odors, aromas and spices (Escott-Stump, 2011).

**Preeclampsia**

Preeclampsia in pregnancy occurs due to abnormal placenta formation that might be related to immune dysfunction, genetics, and irregular inflammatory changes (Barger, 2010). It is a syndrome characterized by high blood pressure and protein in the urine, often accompanied by headaches, sudden weight gain, edema, and changes in vision (Brown, 2010). The full mechanism is unclear, but symptoms that can arise include oxidative stress, vascular vasospasm (spasm leading to the narrowing of blood vessels), capillary leakage, and coagulation (Barger, 2010). Major complications of preeclampsia include fetal growth restriction, premature birth, and even death (Brown, 2010).

Risk factors for preeclampsia include a BMI ≥ 30, a maternal age of < 18 or > 40 years of age, previous history of chronic high blood pressure, preeclampsia, kidney disorders, diabetes, as well
as women diagnosed with lupus or other immune disorders and polycystic ovarian syndrome (Brown, 2010). Studies have not been able to successfully prove that antioxidants such as vitamin C and E can help prevent preeclampsia by depleting free radicals. However, randomized control trials of calcium supplementation of 1500-2000 mg per day have been shown to decrease the prevalence of preeclampsia (Barger, 2010). Several nutritional interventions of increased calcium and fiber have been associated with decreased risk (Wallis & Saftlas, 2008; Hofmeyr et al., 2007). Other considerations for women with preeclampsia is testing for folic acid alleles and taking up to 600 µg of folate regularly throughout the pregnancy (Escott-Stump, 2011). Women who are at-risk should consume adequate amounts of fruits, vegetables, and dairy products before and during pregnancy (Brown, 2010).

**Gestational Diabetes Mellitus (GDM)**

Pregnancy is often accompanied by hyperglycemia and insulin resistance. Gestational diabetes mellitus (GDM) is an advanced version of this phenomenon, defined as glucose intolerance during the course of pregnancy. The pathophysiology of GDM is unclear, but it may be related to extreme metabolic changes observed during “normal pregnancy” or reflect an individual’s predisposition for type 2 diabetes (T2DM) (Hedderson et al., 2010). Research is examining genome variation sequencing in an attempt to increase our knowledge of the mechanisms behind GDM and the extent to which it is inherited (Kwak et al., 2012 & Shaat et al., 2007). Genetic variations are dissimilarities in the DNA sequence from one person to another which also include insertions or deletions of one or more bases in the sequence (Shaat et al., 2007).

Genetic studies have identified the presence of multiple gene variations associated with women diagnosed with GDM. Some mutations include glucokinase (GCK), insulin receptor (INSR), human leukocyte antigen (HLA), insulin-like growth factor 2 (IGF2), and maturity onset diabetes
of the young (MODY) (Shaat et al., 2007 & Watanabe, 2011). GDM is one of the most common pregnancy complications in the United States, affecting approximately 5% of all pregnancies and up to 14% of high risk populations. Prevalence rates of GDM vary according to the presence of risk factors, diagnostic criteria utilized, and/or according to the timing of the diagnostic test during the pregnancy (Bowers et al., 2012).

The development of GDM is linked with maternal and fetal complications, including an increased risk for cesarean delivery, preeclampsia, T2DM in the mother, development of congenital anomalies, macrosomia, obesity, and T2DM in adulthood (Perkins et al., 2007, Chen et al. 2009). It is well established that a previous history of GDM, family history of T2DM, race/ethnicity, and age are non-modifiable risk factors for GDM. Physical inactivity before and during pregnancy, unhealthy diets, and pregravid obesity (central adiposity) are modifiable risk factors for GDM, and therefore target areas for prevention and treatment (Tobias et al., 2012 & Zhang et al., 2011). Current recommendations for the management of GDM center on medical nutrition therapy and control of modifiable risk factors. Current dietary recommendations for pregnant women with diabetes (either GDM or T2DM) include a general balanced intake of whole grains, dietary fiber (40 grams/day), fresh fruits and vegetables, and low glycemic index (GI) foods each day for optimal glycemic control. Specifically, the macronutrient distribution recommendations for maternal diabetes (GDM and T2DM) include: 45-60% carbohydrates, up to 35% fats, and 10-20% proteins based on a 2000-2500 kcal/day diet (Dämon et al., 2011). Pre-pregnancy dietary fiber intake has been implicated as a protective factor in decreasing risk of GDM.

A prospective study has shown that each 10 gram/day addition in total fiber consumption is related with 26% decrease in GDM risk and each 5 gram/day addition in fruit or cereal is related
with a 23% or 26% decrease respectively (Zhang et al., 2006). Insulin therapy is sometimes required to maintain adequate blood glucose levels if diet and exercise are ineffective as management options (Grant et al., 2011). Additional recommendations might include utilizing carbohydrate exchanges and carbohydrate counseling for an even glycemic distribution throughout the day (Louie et al., 2012). Overall, the foundation of GDM management is nutrition counseling; however, it remains unknown whether or not a protective effect for the development of GDM is offered by one dietary component or dietary pattern.

**Food Safety**

Food safety practices are extremely important in preventing foodborne illness during pregnancy. Pregnant women are more susceptible to infectious pathogens such as *Coxiella burnetii*, *Listeria monocytogenes*, *Toxoplasma gondii*, and hepatitis E virus (Brown, 2010). Pregnant women are advised to follow general food safety practices such as washing hands and cleaning cooking surfaces frequently, refraining cross-contamination by separating raw foods from other foods, and cooking foods at proper temperatures (Widen et al., 2010). Foods that pregnant women are advised to avoid include undercooked meat, seafood (sushi and fish containing high levels of methyl mercury), or egg products, raw sprouts, and unpasteurized juices, milk, and milk products such as brie and feta cheese (Brown, 2010).

**Eating Habits & Diet Quality**

Prospective longitudinal studies have observed that women’s dietary patterns prior to pregnancy are similar to that observed during pregnancy (Crozier et al. 2009, Cuco et al. 2006). In a study on low-income African-American adolescent mothers (n=109), poor dietary habits characterized by high sugar intake and low intake of whole fruits and vegetables were common postpartum in both mothers and toddlers, increasing risks of childhood obesity (Papas et al., 2009). Therefore, it is imperative that women of reproductive age and women trying to conceive consume the
recommended dietary intakes of macronutrients and micronutrients. A survey of consumption habits of healthy and unhealthy food and beverages and medications by Santiago et al. (2013) found that many pregnant women (n=200) consumed substances considered teratogenic in nature. For example, a high percentage of Hispanic women (87.4%) consumed methyl mercury through tuna, PCBs through salmon consumption, and BPA through canned goods (Santiago et al., 2013). Caffeinated drinks (80.1%), fast food products (96%), and sugary desserts (97.5%) were the top food and beverages that pregnant women admitted to consuming throughout their pregnancies (Santiago et al., 2013).

Adherence to healthful dietary pattern has been shown to lower the risk of complications such as T2DM and GDM during pregnancy and postpartum (Tobias et al., 2012). Researchers identified two diets and one dietary pattern that could potentially be used to lower risk of complications, when consumed by women prior to pregnancy (Tobias et al., 2012). The alternate Mediterranean Diet (aMED), a heart healthy diet centered around fruits, vegetables, whole grains, olive oil, nuts, and beans; the Dietary Approaches to Stop Hypertension (DASH), a diet aimed to decrease sodium, sweets and saturated fat intake; and the alternate Healthy Eating Index (aHEI), a scoring system based on diet quality, were negatively associated with risk of GDM. Tobias et al. (2012) found that the aMED diet had the least impact on reduced risk of GDM at 24%; the DASH diet followed at 34%, and the aHEI diet pattern had the most impact on reduced risk of GDM at 46%. This suggests that an overall healthy diet pattern, specifically the aHEI, yields the most protective effect in the reduction of GDM. Some common foods shared between the three diets patterns include minimally processed foods, nuts and legumes, and low GI carbohydrates, such as whole grains, fruits and vegetables (Tobias et al., 2012).
Diet quality is a problem in many pregnancies, but particularly in pregnant women with low SES. A cross sectional study on predictors of dietary quality in low-income pregnant women in their first trimester (n=118) found that psychosocial distress and poor dietary habits directly influence quality of diet (Fowles et al., 2011). Poor eating habits resulted in inadequate intakes of vegetables, fruits, folate, and iron (Fowles et al., 2011; Siega-Riz et al., 2004). Using the DQI-P scoring system, Fowles et al. (2012) found the the median score was 53.3, where three women (4%) scored more than 70 (indicating adequate diet quality). However, 68 women (96%) had inadequate diet quality scores. Fowles and colleagues (2012) published results negatively correlating diet quality to stress, control over meal preparation, depression, skipping meals, and positively correlating diet quality to social support. This suggests that specific dietary and psychological intervention is needed in at-risk populations.

**Motivators & Obstacles to Nutrition Compliance**

There are various factors (independently and combined) that effect a pregnant woman’s will to comply with nutrition guidelines. As Lucan et al. (2010) mentions, some factors that may encourage diet-related chronic diseases include cultural values and heritage, personal tastes and preferences, SES, and societal influences, through media and marketing. Obesity rates among low-income women are greater than 50% with the highest rates in the African American community (Ogden et al., 2012). Therefore, when discussing pregnancy nutrition compliance among low SES populations, it is imperative that predictors, modifiable risk factors, and observed behaviors are evaluated along with an *emic* (insider) perspective, using qualitative methods such as one-on-one interviews and focus groups (Lucan et al., 2010). The goal is to understand how an individual’s perspective and social context influence their nutrition-related behaviors (Reyes et al., 2013).
In African American women of childbearing age, Kannan et al. (2009) conducted an assessment of nutrition influences in relation to birth outcomes using a cultural framework called the PEN-3 Theoretical Model. Kannan et al. (2009) were one of the first researchers to implement an assessment of nutritional perspectives based on this model, which focuses on three domains: cultural identity (person, extended family, neighborhood), cultural empowerment (positive, existential, negative), and relationships and expectations (perceptions, enablers, nurturers) to use for the development of a nutrition education intervention program for African American women in Michigan. Their results indicate a need for the incorporation of family into nutrition counseling sessions. Family plays an important part in either enabling or nurturing healthy eating habits, educating the importance of prenatal care, and finding community-based resources to support more availability to educational materials focused on nutrition and healthy lifestyles (Kannan et al., 2009).

In a study, a semi-structured interview was conducted regarding the motivators and barriers to healthy eating in pregnancy for low-income, overweight, African American women. Themes were compiled through interview sessions related to the barriers and motivators to healthy eating (Table 4). It was found that despite the good intentions of the mothers to want to improve their diet quality, barriers outweighed their efforts (Reyes et al., 2013). These barriers included cost, food availability, palatability, pregnancy-related symptoms such as fatigue/sleepiness, family pressure to eat, and feelings that their baby could be deprived if they did not eat certain foods (Reyes et al., 2013). The lack of nutrition knowledge and what can be defined as “healthy” eating were the two most prevalent factors of poor food choices (Reyes et al., 2013).

A focus group conducted in Canada on the feasibility and acceptance of a novel nutrition and exercise program to manage excessive GWG, found that behavior change during pregnancy can
be achieved with the ability to control and achieve a healthy lifestyle, support from family/friends and healthcare providers, and most importantly, a clear understanding of nutrition guidelines (Walji et al., 2013). Even though pregnant women are more likely to be concerned and motivated to achieve nutritional goals for the sake of their unborn child, they also may face barriers that are physical, emotional, and financial that can make lifestyle changes difficult (Walji et al., 2013). The results of this focus group indicate that improvement must be made on inter-professional collaboration at healthcare facilities; specific instructions for lifestyle recommendations and additional educational resources for healthcare providers on prenatal nutrition education are vital for optimal nutrition compliance (Walji et al., 2013).

Table 3. Themes of Motivators & Barriers to Healthy Eating in Low-Income Women

<table>
<thead>
<tr>
<th>Motivators</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. A healthy mom means a healthy baby</td>
</tr>
<tr>
<td>2. Physical symptoms, like heartburn and nausea, inhibit unhealthy food intake</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Barriers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Taste and cost are strong drivers of food intake</td>
</tr>
<tr>
<td>2. Limited access to healthy food, but easy access to unhealthy food</td>
</tr>
<tr>
<td>3. Food supply fluctuates each month</td>
</tr>
<tr>
<td>4. Lack of meal schedule persists in pregnancy</td>
</tr>
<tr>
<td>5. Pregnancy-related fatigue and sleepiness inhibit cooking</td>
</tr>
<tr>
<td>6. Misunderstanding about what defines “healthy”</td>
</tr>
<tr>
<td>7. Mothers don’t want to deprive their babies</td>
</tr>
<tr>
<td>8. Family and friends pressure mothers to eat</td>
</tr>
</tbody>
</table>

(Reyes et al., 2013)

Physical Activity

Even though physical activity is not included in a hypothesis in this study, it is important to note because, accurate assessment of participants’ caloric needs requires a self-reported measure of physical activity. The American College of Obstetrics and Gynecologists’ (ACOG) 2002 guidelines on exercise during pregnancy recommends that women engage in 30 minutes or more of moderate exercise on most (if not all) days of the week (ACOG, 2002). There are reports of
numerous benefits of physical activity for the general health and psychological well-being of the mother as well as benefits to the fetus. Exercise during pregnancy has also been shown to decrease unhealthy behaviors such as smoking and alcohol consumption during pregnancy (Zhao et al., 2012).

Contrary to popular belief, physical activity is relatively safe for pregnant women. Vladutiu and colleagues (2010) found that in a cohort study of 1,469 pregnant women in North Carolina, very few women (n=34) reported any physical activity related injuries. The rates of physical activity and exercise related injuries during pregnancy were 3.2 per 1000 hours and 4.1 per 1000 hours respectively with the majority (55%) of injuries as bruises or scrapes (Vladutiu et al., 2010). However, a standardized definition of what constitutes’ adequate physical activity during pregnancy is warranted. Results of a study of low-income African American women’s beliefs about exercise during pregnancy, revealed that the definition of daily exercise activities was too elusive, ranging from light household chores to running (Krans et al., 2012).

There are many benefits of physical activity for the fetus, including: decreased resting fetal heart rate, improvement in the viability of the placenta, and increased amniotic fluid levels (Prather et al., 2012). However, caution is advised for the mother not to exert over 90% intensity of heart rate maximum as this can cause adverse effects to the fetus, including fetal bradycardia (low heart rate) and high umbilical artery pulse, which are associated with cardiovascular risk to the fetus (Salvesen et al., 2012). Overall, to help in motivating women to exercise during pregnancy, healthcare providers should provide education regarding the appropriate amount and type of exercise regimen, as well as explain the benefits that exercise provides to the pregnant woman and her baby (Prather et al., 2012).
**Current Pregnancy Nutrition Counseling & Education**

Nutrition counseling is a strategy to improve maternal and fetal outcomes. The first task of pregnancy nutrition counseling is to make a nutritional assessment of the woman’s energy needs, BMI, and weight gain status. As previously mentioned, the USDA and IOM provide an interactive DRI for healthcare professionals via the internet to calculate EER, pre-pregnant BMI, and determine the DRI for macronutrients and micronutrients (Widen et al., 2010). In order for pregnant women to meet the added calorie requirement in the second and third trimesters, counseling should focus on simple dietary adjustments that can be made to the woman’s current diet (Widen et al., 2010). Brief FFQs and quick screening tools such as *Starting the Conversation for Pregnant Women* are a great way to get a general overview of the pregnant woman’s dietary patterns, based on health behavior techniques that indicates whether or not she is ready to make necessary changes, or has started to make these changes (Widen et al., 2010; Glasgow et al., 2005). According to Girard & Olude (2012), nutrition education and counseling is most effective when provided with nutrition support (food, supplements) and follow-ups.

A qualitative study conducted in the United Kingdom on advice and information provided to pregnant women for healthy weight management found that only 25.4% (n=60) of women received weight gain advice from their healthcare provider and all information was generally brief. Many of the questionnaire responses from the participants requested more support in weight management, diet and exercise, anxiety and body image issues. The lack of advice and support from healthcare providers will inevitably lead women to seek information from other less reputable sources such as magazines, online blogs, and family and friends; often making them more confused and anxious (Brown, 2012).
A single-blind randomized intervention study on dietary counseling to improve fat quality during pregnancy found that intensive nutrition counseling aimed to increase unsaturated fatty acids and favorable fat composition during the first trimester helps in increasing essential fatty acid status in infants. Results indicated that at baseline, dietary intakes of nutrients were similar between the intervention group (n=45) and the control group (n=45), however, intensive and specific dietary counseling resulted in higher monounsaturated and polyunsaturated fatty acids in the intervention group as compared to the control group. Lower intake of saturated fatty acids in the intervention group versus the control group was also reported (Niinivirta et al., 2011).

A randomized controlled trial was conducted by Laitinen et al. (2009) on probiotics supplementation with dietary counseling and its effects on glucose metabolism at the first pregnancy trimester in normoglycemic women (n=256). Laitinen et al. (2009) found that blood glucose concentration were least in probiotics/diet group during pregnancy and over 12 months postpartum. This suggests that combined dietary counseling and probiotics supplementation is consistent in improving glucose metabolism and insulin sensitivity in normoglycemic women (Laitinen et al., 2009). Although further research is need to determine whether or not this intervention will yield similar results in pregnant women with GDM, T2DM, or impaired glucose tolerance, the study proves that proper diet and supplementation counseling prior to pregnancy and during prenatal care is crucial in prevention of glucose metabolism disorders.

Adamo and colleagues (2013) conducted a pilot study on maternal obesity management (MOM), an intervention to test the feasibility of keeping mothers within gestational weight gain limits to reduce childhood obesity. Pregnant women with a pre-pregnant BMI >18.5 between 12 and 20 weeks gestation were randomized into an intervention group (n=30) who received a MOM Trial Guide to Healthy Gestation handbook, and a physical activity and nutrition program. The control
group (n=30) received standard clinical care. Results from the study indicated weight-related outcomes tends to be more satisfactory and showed inclinations of progress regarding gestational weight gain and fetal growth in the intervention group versus the control group (Adamo et al., 2013).
CHAPTER THREE

METHODS

Population & Data Collection Procedures
Participants were recruited through a convenience sample of women aged 18-45 years (n=37), who were in their second or third trimesters of pregnancy, and varied in SES status. This quantitative/correlational study took place in two healthcare settings, Bond Community Health Center (BCHC) and Azalea Women’s Healthcare (AWH) Center, both located in Tallahassee, FL. BCHC is a clinic that provides comprehensive family health services to uninsured and insured patients with particular concern for low-income groups (Bond, 2013). AWH is a women’s healthcare center affiliated with the Tallahassee Memorial Hospital providing obstetrics and gynecological (OBGYN) services to patients with all types of insurance including Medicaid (Azalea, 2014). The study took place between April 2014 and December 2014. Recruitment, IRB approvals, and BCHC approvals occurred in March-April, 2014. The schedule for recruitment and study implementation at BCHC was April – August 2014. The IRB was revised and approved to include AWH for recruitment and implementation in September-December 2014.

Components to Diet Quality Scoring Tool
The Diet Quality Index-Pregnancy (DQI-P) was used to assess overall diet quality. Eight components are present in the DQI-P scale:

1. Percentage of suggested vegetables, fruits, and grains intake.
2. Percentage of suggested iron, folate, and calcium intake.
3. Percentage of energy from patterns of snack and meal as well as total fat.
A score of 0 to 10 has been allocated to each of the components, constituting a total score between 0 and 80. A total score of ≥70 reflects the most desirable general dietary quality
(Bodnar & Siega-Riz, 2002). Meeting the minimum number of cups or ounces based on the recommendation for that food group result in allotting a score of 10 to that component. It is scored 0 if any of that food group is not consumed by participant. Intermediate scores are calculated proportionately; for instance, a score of 5 is given if a woman consumes 1 cup of fruit instead of the recommended 2 cups (Fowles et al. 2011). The scoring for meal and snack patterns is as follows: two snacks and three meals delivers a score of 10; zero to one snack or two snacks with three and/or two meals delivers a score of 5; zero to one snack or one snack and two and/or one meals one meal provides a score of 0 (Bodnar & Siega-Riz, 2002).

The data needed to compute dietary quality were derived from the 24 hour diet recalls collected and analyzed using the ESHA Food Processor software (SQL Version 10.13.1). This software has been shown to be comparable to other nutrient databases, where it is generally accurate for 5% of most nutrients and within 10% for the remainder (McCullough et al., 1999). A new feature to this software included a breakdown of the percentages of food groups consumed based on individual recommendations, using the government’s Choose my Plate model. This feature was very important for analyzing diet quality, as it is a requirement for 3 components of the DQI-P score.

As secondary study measures, correlations will be calculated to determine the extent to which complications during pregnancy, subjective nutrition compliance, and diet quality score are associated.

**Pregnancy Nutrition Survey Tool**

The Florida State University Institutional Review Board (IRB), Use of Human Subjects in Research Committee has reviewed and approved the methodologies of this study. There are three survey instruments utilized in this study:
Demographics and Activity Level Survey (DALS) (Appendix C)
Eating Habits Survey (EHS) (Appendix D)
24 hour Diet Recall Interview (Appendix E)

A majority of the questions included on the DALS are adapted from nutritional assessment instruments used by the Supplementary Feeding Program for Pregnant Women, Infants, and Children (WIC) (Department of Health Services California, 2005; Nutrition, 2008) before or after scheduled appointments with their healthcare provider. Informed consent will be obtained in the BCHC OBGYN and the AWH waiting area, the DALS, and EHS. The first 24-hour recall will be administered immediately afterwards in the same settings after obtaining consent. Two additional 24-hour recalls will be administered by telephone on the second and third day after obtaining the first face-to-face recall. The goal was to administer a 24 hour diet recall on two nonconsecutive weekdays and one weekend day. The protocol for administering the telephone 24-hour recall will follow the methodology of the California Department of Public Health 24-hour recall (CDPH, 2014). Hematological data was obtained (if available) from each participants’ medical record.

Data Analysis
Data analysis was conducted using SPSS, Version 22.0 (SPSS, Chicago, IL). Descriptive statistics are presented as means ± standard deviations for continuous variables and as frequencies for categorical data. Pearson two-tailed coefficients were used to examine the relationship between predictors and diet quality. A two-tailed $P$ value of $<0.05$ was considered statistically significant. Linear regression was used to analyze how much variance to diet quality could be explained by the independent variables (predictors).
CHAPTER FOUR

RESULTS

Characteristics of Subjects

The women in this study were on average, 29 years old, had completed some college, and were 29.86 weeks pregnant at the time of the initial survey administration (Table 4). Most women were either single or married, had an annual income of \( \leq \$29,000 \), insured by Medicaid, were classified as overweight with a pre-pregnancy BMI of 28.9, and Black. However, out of the total population, 46% had a BMI status of obese. Only a small percentage of women (24%) reported having any medical conditions while pregnant. Anthropometric data show that on average, women maintained an appropriate weight gain status for the second and third trimesters, based on IOM weight gain recommendations (Table 5). Hematological data also showed that hemoglobin and hematocrit values for women in both trimesters were in range of the reference values (Abbassi-Ghanavati et al., 2009) indicating no pregnancy anemia.

Table 4. Participant Characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>28.65</td>
<td>6.27</td>
</tr>
<tr>
<td>Pre-pregnancy BMI (kg/m(^2))</td>
<td>28.85</td>
<td>7.72</td>
</tr>
<tr>
<td>Gestational age (weeks)</td>
<td>29.86</td>
<td>7.10</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>N (Total=37)</th>
<th>% of N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Race/Ethnicity</td>
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<td></td>
</tr>
<tr>
<td>Black</td>
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<td>46</td>
</tr>
<tr>
<td>White</td>
<td>11</td>
<td>30</td>
</tr>
<tr>
<td>Asian</td>
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<tr>
<td>Hispanic</td>
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<td>11</td>
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<tr>
<td>Mixed Race</td>
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<table>
<thead>
<tr>
<th>Pre-Pregnancy Body Mass Index</th>
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<tbody>
<tr>
<td>Underweight</td>
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<td>3</td>
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<tr>
<td>Normal</td>
<td>10</td>
<td>30</td>
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<tr>
<td>Overweight</td>
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<td>21</td>
</tr>
<tr>
<td>Obese</td>
<td>15</td>
<td>46</td>
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Table 4 –continued.

<table>
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<tr>
<th>Marital Status</th>
<th>Single</th>
<th>Living w/ Significant Other</th>
<th>Married</th>
<th>Separated</th>
<th>Divorced</th>
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<tbody>
<tr>
<td></td>
<td>12</td>
<td>6</td>
<td>17</td>
<td>1</td>
<td>1</td>
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<td>Income Level</td>
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<td>Less than $15,000</td>
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<td>20</td>
<td>8</td>
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<td>$15,000-$29,000</td>
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<td>$30,000-$44,000</td>
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<td>Over $60,000</td>
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<td>8</td>
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<td>Education Level</td>
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<td>22</td>
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<td>Some College</td>
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<td>Associate’s Degree</td>
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<tr>
<td>Bachelor’s Degree</td>
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<td>Master’s Degree or Higher</td>
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<td>5</td>
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<td>Medical Coverage</td>
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<td>31</td>
<td>11</td>
<td>31</td>
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<tr>
<td>Medicaid</td>
<td>20</td>
<td>56</td>
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<tr>
<td>No Insurance/Other</td>
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<td>13</td>
<td>5</td>
<td>13</td>
<td>13</td>
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<tr>
<td>Presence of a Medical Condition</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Yes</td>
<td>9</td>
<td>24</td>
<td>9</td>
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<tr>
<td>No</td>
<td>28</td>
<td>76</td>
<td>28</td>
<td>76</td>
<td>76</td>
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</tbody>
</table>

Table 5. Anthropometric & Hematological Characteristics of Women by Trimester, n=33

<table>
<thead>
<tr>
<th>Trimester</th>
<th>N</th>
<th>Age (y)</th>
<th>Weight Gain (lbs.)</th>
<th>Pre-pregnancy BMI</th>
<th>Hemoglobin (g/dl)</th>
<th>Hematocrit (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd</td>
<td>13</td>
<td>27.62 +/- 5.01</td>
<td>5.08 +/- 8.55</td>
<td>28.10 +/- 7.99</td>
<td>11.46 +/- 1.28</td>
<td>34.68 +/- 3.32</td>
</tr>
<tr>
<td>3rd</td>
<td>20</td>
<td>29.21 +/- 6.89</td>
<td>17.71 +/- 19.43</td>
<td>29.33 +/- 7.71</td>
<td>11.15 +/- 1.36</td>
<td>33.73 +/- 3.80</td>
</tr>
</tbody>
</table>

(values are shown as means ± standard deviation)
**Diet Quality Analysis**

Diet quality was assessed for each participant using 24 hour food recalls, and the Diet Quality Index for Pregnancy (DQI-P). DQI-P is a scoring tool that was developed to examine overall diet quality based on current pregnancy nutritional recommendations and national dietary guidelines (Bodnar & Siega-Riz, 2002). The DQI-P score is based on eight dietary components as shown in Table 6. The first three components are the percent recommended servings of grains, fruits, and vegetables based upon the Dietary Guidelines for Americans. These recommendations are given as ranges because the amounts of servings are dependent on individual energy requirements. The next three dietary components reflect nutrients of particular importance for pregnancy: iron, calcium and folate. Lastly, the percentage of energy from fat in the diet and the amount of meals and snacks consumed per day were also assessed. All dietary components were analyzed subjectively (not used for diet quality score) by participants in the eating habits survey tool, and objectively using the food analysis software.

Results of the DQI-P analysis indicated that 76%, 87%, and 54% of the population was getting less than half of the recommended daily servings of grains, vegetables and fruits respectively. Folate, iron, and calcium intake is also of great concern, as a vast majority of the population is getting less than 50% of the recommended intake for these nutrients from their diet. Almost half of the population met the total fat recommendation of \( \leq 30\% \) of energy intake, and overall, meal patterns were good with almost half of the population consuming 2-3 meals and 1-2 snacks per day.
Table 6. Dietary Components included in the Diet Quality Index for Pregnancy Score, n=37

<table>
<thead>
<tr>
<th>Component</th>
<th>Score Categories¹</th>
<th>% Population in Subgroup</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-11 servings of grains per day (% recommended servings)²</td>
<td>≥ 100%</td>
<td>8.1</td>
</tr>
<tr>
<td></td>
<td>99%-50%</td>
<td>16.2</td>
</tr>
<tr>
<td></td>
<td>&lt; 50%</td>
<td>75.7</td>
</tr>
<tr>
<td>3-5 servings of vegetables per day (% recommended servings)²</td>
<td>≥ 100%</td>
<td>2.7</td>
</tr>
<tr>
<td></td>
<td>99%-50%</td>
<td>10.8</td>
</tr>
<tr>
<td></td>
<td>&lt; 50%</td>
<td>86.5</td>
</tr>
<tr>
<td>2-4 servings of fruits per day (% recommended servings)²</td>
<td>≥ 100%</td>
<td>29.7</td>
</tr>
<tr>
<td></td>
<td>99%-50%</td>
<td>16.2</td>
</tr>
<tr>
<td></td>
<td>&lt; 50%</td>
<td>54.1</td>
</tr>
<tr>
<td>Folate intake (% RDA)³</td>
<td>≥ 100%</td>
<td>10.8</td>
</tr>
<tr>
<td></td>
<td>99%-50%</td>
<td>21.6</td>
</tr>
<tr>
<td></td>
<td>&lt; 50%</td>
<td>67.6</td>
</tr>
<tr>
<td>Iron intake (% RDA)</td>
<td>≥ 100%</td>
<td>13.5</td>
</tr>
<tr>
<td></td>
<td>99%-50%</td>
<td>16.2</td>
</tr>
<tr>
<td></td>
<td>&lt; 50%</td>
<td>70.3</td>
</tr>
<tr>
<td>Calcium intake (% AI for age)</td>
<td>≥ 100%</td>
<td>16.2</td>
</tr>
<tr>
<td></td>
<td>99%-50%</td>
<td>32.4</td>
</tr>
<tr>
<td></td>
<td>&lt; 50%</td>
<td>51.4</td>
</tr>
<tr>
<td>Total fat ≤ 30% energy intake⁴</td>
<td>≤ 30%</td>
<td>48.6</td>
</tr>
<tr>
<td></td>
<td>&gt;30%, ≤ 35%</td>
<td>16.2</td>
</tr>
<tr>
<td></td>
<td>&gt; 35%, ≤ 40%</td>
<td>21.6</td>
</tr>
<tr>
<td></td>
<td>&gt; 40%</td>
<td>13.6</td>
</tr>
<tr>
<td>Meal Pattern⁵</td>
<td>3 meals/2 snacks</td>
<td>40.5</td>
</tr>
<tr>
<td></td>
<td>3 meals/0-1 snack(s) or 2 meals/2 snacks</td>
<td>48.6</td>
</tr>
<tr>
<td></td>
<td>2 meals/0-1 snack(s) or 1 meal/snack</td>
<td>10.9</td>
</tr>
</tbody>
</table>

¹Used as a continuous percentage (0% to 100%) where ≥100%= 10 points, 99%-50%= 5 points, and <50%= 0 points.
²Based on the Dietary Guidelines for Americans. Recommendations where individualized for each participant using the Food Processor software.
³As dietary folate equivalents.
⁴Scoring based on the following categories: ≤30%= 10 points; >30%, ≤35%= 7 points; >35%, ≤40%= 4 points; >40%= 0 points.
⁵Scoring based on the following categories: 3 meals/2 snacks= 10 points; 3 meals/0-1 snack(s) or 2 meals/2 snacks= 5 points; 2 meals/0-1 snack(s) or 1 meal/snack= 0 points.

The mean DQI-P score for the sample population was 27.1 (standard deviation 17.1) out of 80 possible points. A score of ≥ 70 is considered having good diet quality (Fowles et al., 2012; Bodnar & Siega-Riz, 2002). Of the 37 women in the sample, 81% scored a 40 or below, 8% scored between 41 and 50, 6% scored between 51 and 60, and 5% scored between 61 and 75.

Table 7 shows the mean values of the DQI-P score based on income level and race/ethnicity.
Results in the table show some similar DQI-P scores between income levels with the exception of an average score of 56.0 for those with an income between $45,000 and $60,000. It is also interesting to note that based on race/ethnicity, white and Asian women had the highest mean diet quality score, followed by Hispanic and mixed race women respectively. Black women had the lowest mean diet quality score.

Table 7. Mean of Total Diet Quality Score Based on Income Level & Race/Ethnicity

<table>
<thead>
<tr>
<th>Income Level</th>
<th>Mean score</th>
<th>N</th>
<th>Std. Dev</th>
<th>Minimum</th>
<th>Maximum</th>
<th>% of total N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than $15,000</td>
<td>25.4</td>
<td>11</td>
<td>18.55</td>
<td>9</td>
<td>75</td>
<td>29.7</td>
</tr>
<tr>
<td>$15,000-$29,000</td>
<td>24.7</td>
<td>12</td>
<td>15.27</td>
<td>9</td>
<td>55</td>
<td>32.4</td>
</tr>
<tr>
<td>$30,000-$44,000</td>
<td>24.1</td>
<td>8</td>
<td>16.44</td>
<td>0</td>
<td>55</td>
<td>21.6</td>
</tr>
<tr>
<td>$45,000-$60,000</td>
<td>56.0</td>
<td>3</td>
<td>12.73</td>
<td>47</td>
<td>65</td>
<td>8.1</td>
</tr>
<tr>
<td>Over $60,000</td>
<td>24.7</td>
<td>3</td>
<td>5.03</td>
<td>20</td>
<td>30</td>
<td>8.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>Mean score</th>
<th>N</th>
<th>Std. Dev</th>
<th>Minimum</th>
<th>Maximum</th>
<th>% of total N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>22.3</td>
<td>17</td>
<td>10.71</td>
<td>9</td>
<td>50</td>
<td>45.9</td>
</tr>
<tr>
<td>White</td>
<td>33.2</td>
<td>11</td>
<td>21.68</td>
<td>0</td>
<td>65</td>
<td>29.7</td>
</tr>
<tr>
<td>Asian</td>
<td>33.0</td>
<td>3</td>
<td>36.50</td>
<td>9</td>
<td>75</td>
<td>8.1</td>
</tr>
<tr>
<td>Hispanic</td>
<td>27.5</td>
<td>4</td>
<td>6.46</td>
<td>20</td>
<td>35</td>
<td>10.8</td>
</tr>
<tr>
<td>Mixed Race</td>
<td>25.5</td>
<td>2</td>
<td>16.26</td>
<td>14</td>
<td>37</td>
<td>5.4</td>
</tr>
</tbody>
</table>

The majority of the dietary components that comprise the DQI-P score were not being met in this population’s daily diet. Grains, vegetables, fruits, folate, iron, and calcium were all components that were immensely neglected. However, the higher the amount of servings consumed yielded higher DQI-P scores. For example, most women that maintained 50% or more of the daily
recommendations for grains, folate, iron, calcium, and meal pattern had an overall higher diet quality score than those that maintained less than 50% of the daily recommendations.

**Linear Regression Analysis of Predicted Variables on Diet Quality Score**

Diet quality was individually regressed on the following predictors: pre-pregnancy BMI, education level, income level, sources of nutrition information, sources of social support, ability to afford healthy foods, medical coverage, presence of medical conditions, and appropriate weight gain. Of the nine hypothesized predictors, two were found to be good predictors of diet quality during pregnancy (Table 8). The amount of variation in diet quality can be explained by the independent or predictor variables. The higher the variance, the greater the contribution the predictor has on the diet quality score.

**Table 8. Significant Predictors to Diet Quality Scores**

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Variance (%)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-pregnancy BMI</td>
<td>9</td>
<td>.050</td>
</tr>
<tr>
<td>Source of Nutrition Info: Family</td>
<td>15.3</td>
<td>.013</td>
</tr>
</tbody>
</table>

Other variables from the survey that were not included in the hypotheses were found to predict diet quality. Participation in physical activity (p=.023), and eating fast foods (p=.006), both had a negative impact on diet quality. Regression analyses’ significant predictors are shown in Table 9. The beta coefficient represents the slope and the constant represents the y-intercept of the equation that predicts DQI-P scores based on a given predictor. For example, the equation for predicting diet quality based on pre-pregnancy BMI is y= -.768x + 49.701, where the higher the BMI, the lower the DQI-P score. In the case of family as a source for nutrition education, the women that sought pregnancy nutrition recommendations from family received higher DQI-P scores.
Table 9. Regression Analysis

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Beta</th>
<th>Constant</th>
<th>t</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-pregnant BMI</td>
<td>-.768</td>
<td>49.701</td>
<td>-2.04</td>
<td>.050</td>
</tr>
<tr>
<td>Nutrition Info:</td>
<td>15.333</td>
<td>22.500</td>
<td>2.64</td>
<td>.013</td>
</tr>
<tr>
<td>Family</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Relationship between DQI-P Score, Nutrition Compliance, Pre-pregnancy BMI & Appropriate Weight Gain

As indicated by Table 10, there is a significant negative correlation between diet quality and pre-pregnancy BMI (r= -.371), which is confirmed by the regression model. Although not statistically significant, there is a small positive correlation between diet quality and nutrition compliance, which would suggest that to some degree, the participants’ self-report of their compliance to nutritional recommendations in some cases aligned with their diet quality outcome during pregnancy. Also, there is a positive relationship between diet quality and appropriate weight gain (not significant). When comparing the mean DQI-P scores to nutrition compliance responses, out of 34 participants, 14.7% of women reported 25% compliance with a mean DQI-P score of 21 (standard deviation 10.9). 35.3% of women reported 50% compliance with a mean DQI-P score of 26.8 (standard deviation 20.3). 29.4% of women reported 75% compliance with a mean DQI-P score of 31 (standard deviation 15.3), and 20.6% of women reported 100% compliance with a mean DQI-P score of 24 (standard deviation 15.0).

Table 10. Correlations between Diet Quality Score, Nutrition Compliance, Pre-pregnancy BMI, and Appropriate Weight Gain

<table>
<thead>
<tr>
<th></th>
<th>DQI-P</th>
<th>Nutrition Compliance</th>
<th>Pre-Pregnant BMI</th>
<th>Weight Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>DQI-P</td>
<td>Pearson r</td>
<td>.067</td>
<td>-.344*</td>
<td>.274</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>.707</td>
<td>.050</td>
<td>.101</td>
</tr>
<tr>
<td>Nutrition Compliance</td>
<td>Pearson r</td>
<td>.067</td>
<td>1</td>
<td>.151</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>.707</td>
<td>.425</td>
<td>.136</td>
</tr>
</tbody>
</table>
Table 10 continued.

<table>
<thead>
<tr>
<th></th>
<th>Pearson $r$</th>
<th>Sig. (2-tailed)</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-pregnant BMI</strong></td>
<td>-.344*</td>
<td>.050</td>
<td>.425</td>
</tr>
<tr>
<td></td>
<td>.151</td>
<td>1</td>
<td>-.475**</td>
</tr>
<tr>
<td><strong>Weight Gain</strong></td>
<td>.274</td>
<td>.101</td>
<td>-.475**</td>
</tr>
<tr>
<td></td>
<td>.261</td>
<td>.136</td>
<td>1</td>
</tr>
</tbody>
</table>

* Correlation is significant at the 0.05 level (2-tailed). ** Correlation is significant at the 0.01 level (2-tailed).

**Descriptive Frequencies of Survey Questions**

Although responses to survey questions in Table 11 have no statistical significance, the percentages of the sample size in relation to the responses are interesting to mention. The majority of women reported having a good appetite at the time of survey administration; however, this contradicts many 24 hour recalls that consisted of a reporting of only 1 or 2 items or food groups per meal, per day. A high percentage of women (85.3%) were planning to breastfeed their babies, and many mothers had breastfed in past pregnancies (65.7%). It is not surprising that most women received their nutrition recommendations from their primary doctor or books/magazines. The doctor is often the first healthcare provider to engage with the pregnant woman during her first prenatal visit. Participants also received nutrition information from “other” sources. In this sample, the other source of information was primarily from a Women’s, Infants, and Children (WIC) clinic. What is intriguing is that even though over 90% of the women were not concerned with their eating habits during pregnancy, 35% of women reported that they attempted only half the time to comply with nutritional recommendations.
<table>
<thead>
<tr>
<th>Survey Question</th>
<th>Response</th>
<th>N</th>
<th>% of total N</th>
</tr>
</thead>
<tbody>
<tr>
<td>How would you describe your appetite?</td>
<td>Good</td>
<td>24</td>
<td>68.5</td>
</tr>
<tr>
<td></td>
<td>Fair</td>
<td>10</td>
<td>28.6</td>
</tr>
<tr>
<td></td>
<td>Poor</td>
<td>1</td>
<td>2.9</td>
</tr>
<tr>
<td>Do you plan to breastfeed in your baby?</td>
<td>Yes</td>
<td>29</td>
<td>85.3</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>5</td>
<td>14.7</td>
</tr>
<tr>
<td>Where do you get your nutrition information from?</td>
<td>Doctor</td>
<td>19</td>
<td>55.9</td>
</tr>
<tr>
<td></td>
<td>Nurse</td>
<td>8</td>
<td>23.5</td>
</tr>
<tr>
<td></td>
<td>Dietitian</td>
<td>5</td>
<td>14.7</td>
</tr>
<tr>
<td></td>
<td>Books/Magazines</td>
<td>17</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Family</td>
<td>12</td>
<td>35.3</td>
</tr>
<tr>
<td></td>
<td>Friends</td>
<td>8</td>
<td>23.5</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>16</td>
<td>47.1</td>
</tr>
<tr>
<td>To what percent do you comply with nutrition recommendations?</td>
<td>25%</td>
<td>5</td>
<td>14.7</td>
</tr>
<tr>
<td></td>
<td>50%</td>
<td>12</td>
<td>35.3</td>
</tr>
<tr>
<td></td>
<td>75%</td>
<td>10</td>
<td>29.4</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>7</td>
<td>20.6</td>
</tr>
<tr>
<td>Are you concerned about your eating habits?</td>
<td>Yes</td>
<td>3</td>
<td>8.8</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>31</td>
<td>91.2</td>
</tr>
</tbody>
</table>
CHAPTER FIVE

DISCUSSION

Assessing for diet quality during pregnancy is vital in assuring optimal nutrition for both mother and baby. This study contributes to a large body of evidence that identifies factors that influence diet quality in low income pregnant women. This study also addresses the limited amount of literature assessing pregnancy diet quality from a retrospective point of view, where women in their second and third trimesters have already sustained certain eating habits and received or have not received, nutrition recommendations prior to the start of the study.

There are several diet index models that have been used in research to quantify diet quality during pregnancy (Tsigga et al., 2010; Rifas-Shiman et al., 2009; Haines et al., 1999; Kennedy et al., 1995; Patterson et al., 1994). For example, the Healthy Eating Index (HEI) was used in a study comparing HEI score during pregnancy with pre-pregnant and pregnant weight status (Tsigga et al., 2010). The HEI is measured using 12 food group/nutrient components, primarily focusing on macronutrient percentage, total and whole fruits, and grains, milk, meat and beans, trans and saturated fats, cholesterol, sodium, fiber, vitamin D, folate, calcium, and iron percentage.

The DQI-P was the measurement tool used in this study for four reasons: 1) the index is a validated tool based off of the Dietary Guidelines for Americans and current pregnancy nutrition recommendations; 2) the food groups utilized, included other important dietary nutrients, such as B vitamins, vitamins A and C, zinc, cholesterol, saturated fat, and dietary fiber, which were not directly assessed in the DQI-P index; 3) percent of total calories from fat and meal patterns are key components to the diet during pregnancy, and 4) this index is more simplistic and may be easier to administer in a public health setting (Bodnar & Siega-Riz, 2002). Iron and total calcium
intake were assessed versus the primary food groups they are obtained from, because research has shown that in this population, iron is mostly consumed from grains fortified with iron (i.e. cereals and breads), and calcium intake is contributed from foods other than dairy (Bodnar & Siega-Riz, 2002). Dietary folate was included as a component because of the significance it has on promotion of birth weight (Scholl et al., 1996) and prevention of neural tube defects (Barger, 2010; Linkages, 2004; Lawrence et al., 1981).

**Diet Quality**

Diet quality is a problem in many pregnancies, but particularly in pregnant women with low SES. In this study, women with an income of less than $15,000 had an average diet quality score of 25.4, and women with a higher income between $45,000 and $60,000 had an average diet quality score of 56.0. The overall average diet quality score for the entire population was 27.1. Granted this study has a small sample size, this average is extremely low compared to other reports of diet quality in low income women, averaging at 50.0 (Fowles et al., 2011), 53.3 (as median value; Fowles et al. 2012), and 56.0 (Bodnar & Siega-Riz, 2002). In the present study, women with the highest diet quality were married, have a bachelor’s degree, have an average income between $45,000 and $60,000, and have private medical insurance.

Most of the women in the study did not have adequate diet quality that meets the nutritional recommendations for pregnancy in the United States. The majority of the population was only meeting less than half of the recommended daily servings for every dietary component except total fat and meal pattern. These findings are similar to other reports of low SES pregnant women having inadequate intakes of fruits, vegetables, folate, iron (Siega-Riz et al., 2004; Fowles et al., 2011) and grains (Bodnar & Siega-Riz, 2002). However, as mentioned in the results, the higher the amount of recommended servings or the lower the total fat percentage, the
higher the diet quality score. This information is very useful for future intervention studies, in which they could stress the importance of getting in as much of the daily nutritional recommendations as possible, and that essentially, consuming one serving of a diet component is better for the quality of the diet than no servings at all.

**Good and Bad Predictors to Diet Quality during Pregnancy**

In the present study, only two out of nine independent variables hypothesized were found to be significant predictors to diet quality during pregnancy. Below is a more detailed discussion of the two good predictors, followed by a brief discussion of the predictors that were found to be insignificant predictors in this study.

**High Pre-pregnancy BMI**

The incidence of obesity among pregnant women has been estimated between 19% and 38% (Yoge & Catalano, 2009). Of the 37 participants in this study, 7 (21%) were overweight (BMI of 25-29.9) and 15 (46%) were obese (BMI ≥ 30). Women with a higher pre-pregnancy BMI were more likely to have a lower diet quality score where (p=0.050). Laraia and colleagues (2007) found that pregravid obesity was associated with a 76% increased odds of falling into the lowest diet quality tertile, compared with underweight women. This may be due to a rolling over of poor eating habits from preconception into pregnancy and/or a lack of willingness to change eating habits due to a multitude of reasons. Lack of appropriate nutritional knowledge could also be a factor for this population.

**Source of Nutrition Information/Recommendation(s)**

Advice women receive during pregnancy on weight gain and diet is brief and generally not related to weight management. A lack of detailed and personalized information from healthcare providers leads women to seek information for themselves from potentially unreliable sources
(Brown & Avery, 2012). However, in the present study, nutritional advice from family members had a significant positive correlation to diet quality. Women who sought advice from family yielded higher diet quality scores ($p=.013$). This shows that family members could potentially provide legitimate and reputable nutrition knowledge, especially if they are a family member that has had children and has passed down advice that was either given to them by a healthcare provider or from another knowledgeable family member.

Moreover, the coupling of correct nutrition recommendations with a significant family dynamic could also be a potential motivator to comply, yielding an overall higher diet quality throughout pregnancy. Interestingly enough, only 35% of the women in the study reported taking nutrition advice from family. Perhaps the mean diet quality score for the population would had increased if more of the population reported ‘yes’ to accepting nutrition knowledge from family members.

**High Education Level**

In the present study, there was a very small amount of variance (2.1%) in diet quality that could be explained by education level (not significant). Others reported education to be independently related to nutritional knowledge and diet quality, where less educated women had less nutrition knowledge and DQI-P scores (Fowles et al., 2011; Rifas-Shiman et al., 2009). When the DQI-P instrument was administered in the Pregnancy, Infection, and Nutrition (PIN) study ($n=2063$), researchers found higher percentages of recommended vegetable servings were consumed by better educated women (Bodnar & Siega-Riz, 2002). Although not significant in this study, women with at least a bachelor’s degree consumed over the recommended amount of fruit and vegetable servings.
**High Income Level**

As mentioned above, in the current study, women with the lowest income levels had the lowest mean diet quality scores. Women with an income above $29,000 had an average diet quality score of 34.9, which is higher than the average score for the total population. According to the literature, women who were >350% of the poverty level had significantly higher DQI-P scores, and women with higher income consumed a higher amount of vegetables servings (Bodnar & Siega-Riz, 2002). The present study found this to be true for fruit and grain servings.

**Appropriate Weight Gain**

Excess caloric intake during pregnancy is linked with poor diet quality during pregnancy and increased dietary intake after pregnancy. Increasing physical activity and controlling dietary intake are two key factors in reducing the risk of excessive gestational weight gain (GWG; Goodrich et al., 2013). In a focus group on GWG in low-income African American women, researchers found that the cultural implications of acceptance of a larger body size, may present a challenge to limit excessive GWG in this population (Groth et al., 2012). In the present study, overall, appropriate weight gain was accomplished for women in both the second and third trimesters. What is interesting to point out is that most women classified as overweight or obese were under the ideal weight gain range, or had actually lost weight during their pregnancy.

**Medical Insurance Coverage**

The assumption prior to the start of the present study was that, the presence of either Medicaid or private medical insurance would increase the chances of diet quality due to some level of exposure to pregnancy nutrition recommendations from healthcare professionals. This hypothesis did not prove to be true in this population. The variance of diet quality explained by medical insurance coverage was extremely minimal at -1.3%. However, it is interesting to note that
though not significant, when comparing diet quality score to type of medical insurance coverage, women with private insurance had a mean score of 38.4 and women under Medicaid had a mean score of 21.1. This could infer that there may be a difference in the quality of access to nutrition knowledge and recommendations given, based on what type of medical insurance a woman acquires. According to the National Center for Health Statistics, between 2010 and 2012, about 1 in 3 women of childbearing age (29.7%) were uninsured in Florida (Peristats, 2015). Although no studies were found that specifically assessed diet quality to type of medical coverage obtained, one study indicated that Medicaid eligible pregnant women were likely to be under-reported for nutrition risk factors during prenatal nutritional assessments, based on ethnic background (Fuentes-Afflick et al., 1995).

**Presence of Past/Current Medical Condition(s)**

Presence of a medical condition during pregnancy can alter eating habits either by restricting certain foods or limiting food items. This may affect low-income women with limited access to healthier food options. Also, the presence of medical disorders or diseases can lead to other high risk complications. For example, gestational diabetes mellitus is associated with obesity, hypertension, and adverse pregnancy outcomes (Aviram et al., 2011). Despite the implications that are associated with having a medical condition during pregnancy, in the present study, this did not prove to be a significant predictor to overall diet quality.

**Presence of Social Support**

Although this study did not find social support to be a significant predictor to diet quality during pregnancy, there have been several accounts of support playing a positive role in the diet quality of low income women. In a study on stress, depression, social support, and eating habits on diet quality (n=71), diet quality was positively related to support from others (r=0.38). Less support
from friends and family may reduce dietary quality in low-income pregnant women (Fowles et al., 2012). Despite what the data indicates in this study, the literature is in agreement that social support may serve to buffer the negative influence that psychosocial distress has on dietary quality (Fowles et al., 2011).

Cost/Lack of Ability to Purchase Healthy Foods

Only a small percent of women in the study reported running out of money or struggling with purchasing healthy foods. Despite the minimal impact cost plays in diet quality score, there have been findings of environmental factors associated with cost and access that directly effects diet quality. Laraia et al. (2004) found that women living greater than four miles from a supermarket were more than twice the odds of having a low DQI-P score compared to women living within two miles of a supermarket, after controlling for individual characteristics, and other food retail outlets.

Other Areas of Interest

Comparisons between Survey Responses on Diet and Food Analysis of 24 Hour Food Recalls

In addition to completing 24 hour recalls for food analysis, participants was asked to self-report how many daily servings they consumed of fruits, vegetables, grains, whole meals, and snacks. They were also asked to estimate how much folate, iron, and calcium they believed they consumed from food sources. However, comparison between these micronutrients to their actual diet intake will be skewed, as the survey tool wasn’t specific enough, and participants were most likely thinking about how much of these nutrients they were getting from prenatal or multivitamins rather than from the diet, but regardless, it is interesting to compare their subjective perception versus their actual intake.
For the grains, vegetable, and fruit components, many women thought they consumed at least 50-99% of their daily servings, while in reality, the majority of women consumed less than 50% of their daily recommended servings. When comparing participants’ perceptions of their daily meal patterns to their actual meal and snack consumption, over half of the population thought they ate 3 meals and 2 snacks or more per day. However, when counting the amount of meals and snacks recorded in the 24 hour food recalls, the majority of the population was split between consuming 3 meals/2 snacks and 3 meals/0-1 snack(s) or 2 meals/2 snacks.

With the subjective information from the survey, a perceived DQI-P score could also be calculated. When comparing to the objective DQI-P score, almost all of the women believed their diet quality was higher than it actually was.

**Qualitative Responses to Motivators and Barriers to Eating Habits during Pregnancy**

The last components of the survey tool were free response questions, asking participants to explain what their motivations and barriers are in complying with nutritional recommendations during pregnancy. For motivations, the most popular response was the health of themselves and the health of their baby. Some women thought about the physical benefits to healthy eating and focused on making sure to not exceed weight gain recommendations, and maintaining healthy eating habits in order to lose the baby weight quicker postpartum. Other women appreciated how much energy they were feeling on a healthy eating regimen. Also, some women were motivated through the management of their medical conditions whether it is from gestational diabetes mellitus, type 2 diabetes, high blood pressure, or any other condition they are dealing with. Lastly, an interesting motivation that a few participants mentioned was confidence in themselves to produce a healthy baby whether they complied with nutrition recommendations or not. The women, who expressed that they often neglected to follow nutrition recommendations, but still
believed they would have a healthy baby regardless, were all women with a previous childbirth experience.

For barriers to nutrition compliance, the major concerns were having the time and energy to prepare healthier foods, and lack of appetite which hindered regular eating throughout the day. What is interesting to note here is that earlier in the survey, participants were asked to rank their appetite as either “good”, “fair”, or “poor”. The majority of women reported having a good appetite, while less than 3% of the women considered their appetite to be poor. Other common responses to barriers included lack of money, nausea, having cravings particularly to fast food items, and lacking the desire to comply. Some odd comments that came up a couple of times in this population was struggling to eat healthier foods because “the baby did not like it”, meaning the mother could not stomach nutritionally recommended foods. This statement seems pretty far-fetched and it may very well be another explanation such as nausea that is the culprit to their upset stomachs.

This study found many themes of motivators and barriers to nutrition compliance that supports the literature. Reyes et al. (2013) found similar themes, where the most common motivators were having a healthy baby and physical symptoms inhibiting the consumption of unhealthy foods. They found more barriers including cost, food availability, palatability, pregnancy-related symptoms such as fatigue/sleepiness, family pressure to eat, and feelings that their baby could be deprived if they did not eat certain foods (Reyes et al., 2013). What this study did not see in the responses was any cultural implications that may affect diet quality; however the literature has found that an individual’s perspective and social context can significantly influence their nutrition-related behaviors (Reyes et al., 2013; Lucan et al., 2010; Kannan et al., 2009).
Physical Activity versus Diet Quality Score

Although physical activity was not hypothesized to be a predictor to diet quality in this study, it was found to have a significant positive impact on DQI-P score. The more a participant exercised per day, the higher their DQI-P score (p=.023). Although it is recommended for pregnant women to engage in at least 30 minutes of physical activity on most days of the week (ACOG, 2002), the amount of time (minutes) per day was not a significant factor to overall diet quality in this study.
CHAPTER SIX

CONCLUSION

This study found that low SES women may represent an at-risk group for low diet quality during pregnancy. However, the total sample size exhibited an average poor diet quality score indicating that improved pregnancy nutrition education is warranted for all pregnant women. Not all predictors to diet quality were observed in this study, but all besides medical insurance coverage and presence of medical conditions have been shown to significantly affect diet quality during pregnancy. Researchers found psychosocial distress and poor eating habits contributed to low diet quality (Fowles et al., 2011). Social support, particularly from a spouse, age, high education level, and nutrition knowledge has also been shown to increase diet quality (Fowles et al., 2010; Siega-Riz et al., 2004).

Ultimately, the main objective of this study was to contribute to the foundation for a preventative pregnancy nutrition education model. This model would be a standardized tool that would address all predictors associated to diet quality. Dietitians and other healthcare professionals could incorporate this model as their first line of pregnancy nutrition education. This model’s specific goal would be to overcome obstacles to healthy eating based on both behavioral and medical risk factors associated with pregnancy in low SES populations.

Based on this study, some key components to such a preventative model could include: (1) promotion of a healthful diet that includes knowledge on recommended ranges to grains, vegetables, and fruits; (2) education on how to get the most crucial micronutrients from food sources (i.e. calcium from dairy and dark-leafy vegetables); and (3) providing education sessions (either one-on-one or as a group) on why nutrition is an important factor to a healthy baby. These suggestions along with being mindful of the predictors associated with diet quality will help
healthcare providers succeed in educating pregnant women on an individual basis, about the importance of nutrition during pregnancy.

Hypotheses Tested

Hypothesis 1: High Pre-pregnancy BMI, high educational level, high income level (above or below poverty line), medical/insurance coverage, presence of a previous/current medical condition, cost and ability to purchase healthy food, presence of social support, and source of nutrition information, will predict diet quality during pregnancy, as assessed by participant surveys.

In this study, only high pre-pregnancy BMI (p=.050) and source of nutrition information from family members (p=.013) significantly predicted diet quality during pregnancy.

Hypothesis 2: Healthy pregnancy weight gain will positively influence diet quality, as assessed by the diet quality index for pregnancy (DQI-P) -- and calculation of participants weight gain.

High pre-pregnancy BMI was significantly negatively correlated with diet quality (r=−.344) and appropriate weight gain (r=−.475), therefore healthy pregnancy weight gain is indirectly related to increasing diet quality during pregnancy.

Limitations of the Study/Recommendations

Due to small sample size and short duration of study, findings should not be generalized to the overall population of pregnant women. Studies conducted with a larger sample population, over the entire course of the second and third trimesters, and with five to seven 24 hour food recalls per week, would have significantly more generalizable results to predictors affecting diet quality during pregnancy. Also, answers generated from the survey tool were largely based on the participants’ subjective perspective. For example, indications of variables such as percentage of nutrition compliance, frequency of meal patterns and other food/drink options, and amount or
serving of fruits, vegetables, grains, folate, iron, and calcium were all based on what the participant thought they were consuming. Therefore, amount of subjective reporting in this study can cause significant under and over-reporting of intake and even socially desirable responses.

Consumption of fruits, vegetables, grains, folate, iron, and calcium were also assessed by diet analysis of the 24 hour food recalls, which increased the efficacy of estimated consumption for these dietary components. Also, variation between foods eaten on weekdays and weekends can also affect diet quality scores. Nonetheless, utilizing a standardized 24 hour recall template (CDPH, 2014) may minimize inherent dietary recall errors, by incorporating up to three, nonconsecutive recalls (Fowles et al., 2011) with insistence on at least one weekend recall.

Some recommendations which could have improved the study include having a larger sample size for better comparison to results from the literature, and creating a more detailed survey tool. Finding out exactly how much nutrition knowledge the participants knew rather than the source of their nutrition information, could have given valuable data on what nutrition recommendations are internalized. Also, when asking participants to check off how much folate, iron, and calcium consumed, although it is implied that the researcher wants to know how much of these nutrients they consumed from food, it is vaguely written, and participants could have been answering based on how much of these micronutrients they get from prenatal or multivitamins. Lastly, in order to track and compare ideal total weight gain, a follow-up for the last pregnancy weight prior to giving birth, should be included.

**Future Research**

In order to get a more accurate account of diet quality during pregnancy, future research should implement the present study over the entire course of the second and third trimesters. Future
studies should also control for WIC and SNAP. The promotion of a healthful diet that includes knowledge of recommended servings of grains, vegetables, fruits, and how to consume adequate micronutrients from food sources is needed. An expansion on the environmental and behavioral characteristics related to nutrition compliance and diet quality should be researched, utilizing focus groups as a tool to understanding the contextual and cultural influences to diet quality. Focus groups could also bring insight to the sources for nutrition information, what information was given, and how much was retained. Also, perceptions of what pregnant women define nutrition compliance to be, is interesting to find out. Lastly, future research should determine the impact of diet quality on pregnancy outcomes and child development.
APPENDIX A

HUMAN SUBJECTS COMMITTEE APPROVAL

APPROVAL MEMORANDUM (Initial IRB Approval)

Date: 3/25/2014

To: Jamila Madden

Dept.: NUTRITION FOOD AND EXERCISE SCIENCES

From: Thomas L. Jacobson, Chair

Re: Use of Human Subjects in Research

Pregnancy Nutrition Compliance

The application that you submitted to this office in regard to the use of human subjects in the research proposal referenced above has been reviewed by the Human Subjects Committee at its meeting on 03/12/2014. Your project was approved by the Committee. The Human Subjects Committee has not evaluated your proposal for scientific merit, except to weigh the risk to the human participants and the aspects of the proposal related to potential risk and benefit. This approval does not replace any departmental or other approvals, which may be required. If you submitted a proposed consent form with your application, the approved stamped consent form is attached to this approval notice. Only the stamped version of the consent form may be used in recruiting research subjects. If the project has not been completed by 3/11/2015 you must request a renewal of approval for continuation of the project.

As a courtesy, a renewal notice will be sent to you prior to your expiration date; however, it is your responsibility as the Principal Investigator to timely request renewal of your approval from the Committee. You are advised that any change in protocol for this project must be reviewed...
and approved by the Committee prior to implementation of the proposed change in the protocol. A protocol change/amendment form is required to be submitted for approval by the Committee. In addition, federal regulations require that the Principal Investigator promptly report, in writing any unanticipated problems or adverse events involving risks to research subjects or others. By copy of this memorandum, the Chair of your department and/or your major professor is reminded that he/she is responsible for being informed concerning research projects involving human subjects in the department, and should review protocols as often as needed to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

This institution has an Assurance on file with the Office for Human Research Protection. The Assurance Number is FWA00000168/IRB number IRB00000446.

Cc: Jenice Rankins, Advisor

HSC No. 2014.12228

APPROVAL MEMORANDUM (for change in research protocol #1)

From: Thomas L. Jacobson, Chair

Re: Use of Human subjects in Research

Project entitled: Pregnancy Nutrition Compliance

The application that you submitted to this office in regard to the requested change/amendment to your research protocol for the above-referenced project has been reviewed and approved. Please be reminded that if the project has not been completed by, you must request renewed approval for continuation of the project. By copy of this memorandum, the chairman of your department and/or your major professor is reminded that he/she is responsible for being informed
concerning research projects involving human subjects in the department, and should review protocols as often as needed to insure that the project is being conducted in compliance with our institution and with DHHS regulations. This institution has an Assurance on file with the Office for Human Research Protection. The Assurance Number is IRB00000446.

Cc:

HSC NO.

05/29/2014

Jamila Madden

NUTRITION FOOD AND EXERCISE SCIENCES

Pregnancy Nutrition Compliance

03/11/2015

2014.12977

Jenice Rankins, Advisor

APPROVAL MEMORANDUM (for change in research protocol #2)

From: Thomas L. Jacobson, Chair

Re: Use of Human subjects in Research

Project entitled: Nutrition and Diet Quality during Pregnancy

The application that you submitted to this office in regard to the requested change/amendment to your research protocol for the above-referenced project has been reviewed and approved. Please be reminded that if the project has not been completed by, you must request renewed approval for continuation of the project. By copy of this memorandum, the chairman of your
department and/or your major professor is reminded that he/she is responsible for being informed concerning research projects involving human subjects in the department, and should review protocols as often as needed to insure that the project is being conducted in compliance with our institution and with DHHS regulations. This institution has an Assurance on file with the Office for Human Research Protection. The Assurance Number is IRB00000446.

Cc:
HSC NO.
09/12/2014
Jamila Madden
NUTRITION FOOD AND EXERCISE SCIENCES
Nutrition and Diet Quality during Pregnancy
03/11/2015
2014.12977
Jenice Rankins, Advisor
APPENDIX B

CONSENT FORM

FSU Thesis Study Consent Form

Pregnancy Nutrition Compliance

You are invited to be in a research study on determining predictors to complying and noncomplying with nutrition recommendations during pregnancy. You were selected as a possible participant because you are a pregnant woman in your 2nd or 3rd trimester. We ask that you read this form and ask any questions you may have before agreeing to be in the study.

This study is being conducted by Jamila Madden, Department of Nutrition, Food, and Exercise Sciences at The Florida State University.

Background Information:

The purpose of this study is: To assess whether it’s hard or easy to follow nutrition recommendations when pregnant and which predictors affect a pregnant woman from not meeting those recommendations. What I hope to achieve from this study is to find out what factors are associated with nutrition compliance and noncompliance so that future research can set a framework for an intervention that will help pregnant women overcome any struggles in maintaining their healthy nutrition throughout pregnancy based on their specific needs and concerns.

Procedures:

If you agree to be in this study, we would ask you to do the following things:

- Filling out 2 survey forms (2 pages back and front)
- Filling out up to 3 food records, in person and by phone, listing all foods you ate in the last 24 hours
- Consent to allowing the researchers view your medical or dietary record in order to track your pregnancy outcomes

**Risks and benefits of being in the Study:**

There are no known risks from participating in this study.

The benefits to participation are:

The overall study could potentially be an internal learning experience for participants to be made aware of any struggles they may have to nutrition compliance or any strengths they may have.

**Compensation:**

**Stage 1:** Fill out the survey and you will receive a $10 gift card and information on where to get free diapers and baby supplies

**Stage 2:** The research student will call you 2 times this week so you can report what you have eaten that day, and you will be entered into a drawing to win a $50 gift card to Babies R Us.

**Confidentiality:**

The records of this study will be kept private and confidential to the extent permitted by law. In any sort of report we might publish, we will not include any information that will make it possible to identify a subject. Research records will be stored securely and only researchers will have access to the records.

**Voluntary Nature of the Study:**

Participation in this study is voluntary. Your decision whether or not to participate will not affect your current or future relations with the University, Bond Community Health Center or Azalea’s Women Healthcare. If you decide to participate, you are free to not answer any question or withdraw at any time without affecting those relationships.
Contacts and Questions:

The researcher conducting this study is Jamila Madden. You may ask any question you have now. If you have a question later, you are encouraged to contact her at (xxx)xxx-xxxx. Her advisor is Dr. Jenice Rankins, contact information is (xxx)-xxx-xxxx.

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, you are encouraged to contact the FSU IRB at 2010 Levy Street, Research Building B, Suite 276, Tallahassee, FL 32306-2742, or 850-644-8633, or by email at humansubjects@fsu.edu.

You will be given a copy of this information to keep for your records.

Statement of Consent:

I have read the above information. I have asked questions and have received answers. I consent to participate in the study.

________________ _________________
Signature Date

________________ _________________
Signature of Investigator Date

APPENDIX C

DEMOGRAPHICS & ACTIVITY LEVEL SURVEY (DALS)

FORM 1: Demographics & Activity Level       Participant #:________________

Date:________________

Name: _______________________________________   Age: ______ Weeks Pregnant: ______

Pre-pregnancy Weight: ________ lbs.         Current Weight: ________ lbs.

Height: _____ ft ______ in       Race/Ethnicity: __________________________

Phone #: _________________________ Email: _______________________________________

Marital Status & Family
a. Which of the following best describes your relationship status? (Check one)

   Single ______

   Living with significant other (not married) ____

   Married_____

   Separated_____

   Divorced_____

   Widowed_____

b. Do you have any children? Y   or  N

   If yes, how old are they?________________________________________________________

Education Level

What is your highest level of education? (Check one)

   Middle or elementary school _____

   Some high school _____

   High school diploma or GED ___
Some college _____
Associate’s degree _____
Bachelor’s degree _____
Master’s degree or higher ______

Income Level

What is your annual household income? (Check one)

Less than $15,000 _____
$15,000-$29,000 _____
$30,000-$45,000 _____
$45,000-$60,000 _____
Over $60,000 _____

Medical Information

a. Check which kind of health insurance or medical coverage you have:

Private insurance _____
Medicaid____
I do not have health insurance or medical coverage____

Other (If other, describe) ________________________________

b. Have you ever had or do you now have a health or medical condition such as diabetes, hypertension, depression, epilepsy, etc? NO or YES

If yes, please describe:____________________________________________________

Pregnancy Related Information

a. How many babies are you expecting in this pregnancy? (Check one)

One_____
Two____
Three or more_____  
b. How would you describe your appetite? *(Check one)* GOOD ___ FAIR ___ POOR ____
c. Do you take any of the following supplements? (check all that apply)
Prenatal Vitamins/Multivitamins_____ Iron _____ Calcium _____ Folate _____
d. If you have children, have you breastfeed before? Y or N  
Do you plan on breastfeeding in your current pregnancy? Y or N  
e. Where do you get your nutrition information from? (check all that apply)  
Primary doctor______ Nurse_______ Dietitian______ Books/Magazines______  
Family_____ Friends_____ Other: ________________________________  
f. To what percent do you comply with the nutrition information given to you? *(Circle one)*  
100% of the time 75% of the time 50% of the time 25% of the time 0% of the time  

Activity and Schedule  
a. How many **days per week** do you participate in activity such as walking, dancing, gardening, or other exercise? *(Circle one)*  
0-1 days/wk 2-3 days/wk 4-5 days/wk 6-7 days/wk  
b. When you do participate in activity, **how much time** do you spend in these activities? *(Circle one)*  
10-20 minutes 20-30 minutes 30-60 minutes 60 + minutes  

**Additional Questions**  
a) Who is/are your support system? (circle all that apply)  
Spouse/Partner Children Parents Other relatives Friends  
Other ________________________________
b) Do you often run out of money or food stamps to buy food? (circle one)

YES  or  NO  or  SOMETIMES
APPENDIX D

EATING HABITS SURVEY (EHS)

FORM 2: Eating Habits

Participant #:______________

Date:______________

Recall your current diet based on the nutritional recommendations given to you during pregnancy. Check the phrase that best represents the amount you consume for each category.

4. Folate

___I never take folate

___I never or rarely eat fruit

___I eat 1-2 servings per day

___I eat 2-4 servings per day

___I am unsure

5. Iron

___I never take iron

___I never or rarely eat vegetables

___I eat 1-3 servings per day

___I eat 3-5 servings per day

___I am unsure

6. Calcium

___I never take calcium

___I never or rarely eat grains

___I eat 1-5 servings per day

___I eat 6-11 servings per day

___I am unsure
Meal Patterns

How many **days per week** do you: *(Circle one for each question)*

- Eat Breakfast? 0-1 days/wk 2-3 days/wk 4-5 days/wk 6-7 days/wk
- Eat Lunch? 0-1 days/wk 2-3 days/wk 4-5 days/wk 6-7 days/wk
- Eat Dinner? 0-1 days/wk 2-3 days/wk 4-5 days/wk 6-7 days/wk
- Eat Fast Food? 0-1 days/wk 2-3 days/wk 4-5 days/wk 6-7 days/wk

How many **times per day** do you: *(Circle one for each question)*

- Eat sweets and/or salty snacks? 0-1 times/day 2-3 times/day 4-5 times/day 6-7 times/day
- Drink Water? 0-1 times/day 2-3 times/day 4-5 times/day 6-7 times/day
- Drink 100% juice? 0-1 times/day 2-3 times/day 4-5 times/day 6-7 times/day
- Drink soda or sweetened drinks? 0-1 times/day 2-3 times/day 4-5 times/day 6-7 times/day

1. How many times a day do you usually eat?
   ______ # meals per day ______ # snacks per day

2. Are you concerned about your eating habits? YES or NO

3. Check the type of milk you drink most often:
   Whole 2% ____
   1% Non—fat/Skim____
   Soy____
   Other types of milk (chocolate, etc.)____
   Rarely drink milk____
   Never drink milk____
   Other____________________

4. Do you ever eat any of the following? *(Circle all that apply)*
   Raw Milk  Sprouts  Soft Cheeses (Camembert, Brie, Blue-Veined or Mexican Style Cheese)
   Cold Deli Meats  Cold Hot Dogs  Raw Fish or Shellfish  Unpasteurized Fruit Juice
5. What things, other than food, do you eat? *(Circle all that apply)*

Ice  Dirt Clay  Cigarette Butts  Paint Chips  Laundry Starch  Cornstarch

Other: _______________________________________________

6. What motivates you to comply with your nutrition recommendations?

7. Are there any barriers preventing you from meeting all your nutrition recommendations?
APPENDIX E

24 HOUR DIET RECALL INTERVIEW

24 Hour Recall Phone Script & Template

--“Hello Ms.__________, I am going to ask you to tell me everything you ate and drank during
the last 24 hours. I will ask questions to get the most accurate food intake possible. I will
compare your food intake with a food guide that includes all the nutrients and energy you need
for a healthy pregnancy. Please be sure you tell me everything you ate or drank, even the small
things like butter, salad dressings, cream, and candies, so I can run the most accurate dietary
analysis”

STEP 1 QUESTIONS—INTERVIEWER MAKES A QUICK LIST OF FOODS

-- What was the first thing you ate or drank after you woke up yesterday?

--What was the next thing you ate or drank after that? (Repeat at least twice)

--What was the last thing you ate in this 24 hour period?

STEP 2—PROBE FOR FORGOTTEN FOODS & ADD TO QUICK LIST

-- Did you have any snacks yesterday?

--What beverage did you drink with this meal?

--Do you use cream or sugar in your drink?

--Did you spread anything on your bread, biscuit, or muffin?

--Did you add butter or margarine to the potato or vegetables you ate?

--Did you eat tortillas, pieces of bread or rolls with your meal?

STEP 3—TIME AND OCCASION

-- What time did you eat this meal?

--When did you eat next?
--Was there a special occasion on this day?

STEP 4—DETAILED DESCRIPTION OF FOODS EATEN

-- *About how much did you have of*.... [Interviewer list off foods on quick list]

-- Did you bake, broil, boil or fry the ______?

-- How did you flavor the_______ you ate?

-- Do you pan fry or deep fry your ________?

-- How much butter did you add in the______?

-- “Thank you for your time, and I will be calling you same time tomorrow for today’s dietary recall.”
## 24 Hour Recall Template

### Participant #:____________

### Date: ______________

**DAY_____**

<table>
<thead>
<tr>
<th>Food Consumed</th>
<th>Servings/Portions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast</td>
<td></td>
</tr>
<tr>
<td>Lunch</td>
<td></td>
</tr>
<tr>
<td>Dinner</td>
<td></td>
</tr>
<tr>
<td>Snacks</td>
<td></td>
</tr>
<tr>
<td>Beverages</td>
<td></td>
</tr>
</tbody>
</table>
REFERENCES


BIOGRAPHICAL SKETCH

“Transformation is not a future event, but a present activity. Si se puede!”

Jamila Mercedes Madden was born in Riverside, California, and has lived in Southern California most of her life. She achieved two bachelor’s degrees, in African American Studies from UC Irvine, and Nutrition Sciences from Kaplan University. She chose to pursue her MS and a dietetic internship at Florida State University. She hopes to pursue a career as a clinical registered dietitian for women and infants.

One of her favorite books is The Souls of Black Folk by W.E.B. Dubois, her favorite television show is Charmed, and her favorite genre of music is neo-soul. Her favorite pastimes are cuddling with her dog Piper, singing, playing the guitar, working out, traveling and living life to the fullest.