University of Alberta

Let's not Sugar-Coat it: Exploring Differences of Sugar Consumption Behaviours During Pregnancy Through Focused Ethnography

by

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Abstract

Excessive sugar consumption may adversely affect maternal and fetal health. This study explored influences on women's sugar consumption behaviours during pregnancy using focused ethnography. Fifteen pregnant women were interviewed and qualitative content analysis was used to inductively derive themes. Pregnant women increased their intake of sugars in an effort to achieve a compromise between meeting nutrition recommendations, lifestyle adjustments, physical symptoms, and cultural norms. Some women maintained their sugar intake compared to non-pregnancy as part of their dietary routine. Women who lowered their sugar intake had made a conscious decision and were motivated by personal and fetal health. Physical symptoms, lack of nutritional guidance, and social pressures were identified as barriers to achieving a diet low in sugars, while implementing dietary strategies guided by nutritional knowledge was a facilitator. This research provides important insights that may be used to design effective interventions to improve maternal health.

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List of Abbreviations

APrON - Alberta Pregnancy Outcomes and Nutrition

BMI – Body Mass Index

DRI – Dietary Reference Intake

EAR - Estimated Average Requirement

EWCFG – Eating Well with Canada's Food Guide

FFQ – Food Frequency Questionnaire

GDM - Gestational Diabetes Mellitus

HBM – Health Belief Model

hCG - Human Chorionic Gonadotropin

HEI - Healthy Eating Index

IOM - Institute of Medicine

NHANES – National Health and Nutrition Examination Survey

NVP – Nausea and Vomiting during Pregnancy

PBC - Perceived Behavioral Control

SSB – Sugar-Sweetened Beverages

SSQ – Sugar Screener Questionnaire

TBP - Theory of Planned Behaviour

NHANES - National Health and Nutrition Examination Survey

WHO – World Health Organization

Chapter 1: Introduction

1. Rationale

The Importance of Nutrition During Pregnancy

Nutrition is recognized as a modifiable determinant of a healthy pregnancy. Consuming adequate energy and nutrients can offer many health benefits to the mother including supporting appropriate weight gain, decreased pregnancy complications, and promotion of future wellbeing (Brown, Isaacs, Krinke, Murtaugh, & Sharbaugh, 2004). In addition, maternal diet is one of the primary determinants of growth and development of the fetus, influencing both immediate and future health of the child (Vause, Martz, Richard, & Gramlich, 2006). Therefore, adverse health consequences may arise if a pregnant woman does not follow health guidelines or meet nutrition recommendations. Improving women's ability to meet recommendations related to sugar intake during pregnancy is one health target that could result in appropriate weight gain, optimal development of the fetus, and ultimately improved health for both the mother and her offspring.

Added Sugars and Health

Within the diet, sugar is a general term that is used to describe mono and disaccharides including glucose, fructose, galactose, sucrose, maltose, and lactose. Sugars can be defined as either added to foods or naturally occurring in foods. Naturally occurring sugars are found in foods such as fruits, vegetables, and dairy products, and are part of a healthy diet as these foods also contain many essential nutrients (Johnson et al., 2009). Added sugars are those added to foods during processing or preparation and include white sugar, brown sugar, raw sugar, corn syrup, high- fructose corn syrup, malt

syrup, maple syrup, pancake syrup, fructose sweetener, liquid fructose, honey molasses, and dextrose (Institute of Medicine, 2005). Many foods high in added sugars offer little nutritional value compared to foods with natural sugars (Institute of Medicine, 2005).

Changes in food production and technology have contributed to alterations in food composition and have affected the availability of foods on the market shelf (Kennedy, 2006; Marriott, Cole, & Lee, 2009). For instance, high-fructose corn syrup (HFCS) was approved for use in foods in the 1970's and within 2 decades its consumption increased by more than 1000% (Bray, Nielsen, & Popkin, 2004). The intake of foods high in added sugar is concerning because it is often associated with excessive caloric intake, reduced diet quality, low micronutrient intake, and adverse effects on health (Johnson & Yon, 2010; Marriott, Olsho, Hadden, & Connor, 2010). Epidemiological studies have observed parallel increases in sugar consumption and weight gain in individuals (Gastrich, Bachmann, & Wien, 2007). There is evidence that intake of added sugars in quantities that exceed energy balance can induce dyslipidemia, insulin resistance and visceral adiposity; key features of the metabolic syndrome (Johnson & Yon, 2010; Stanhope & Havel, 2009). Therefore, sugar is a likely contributor to several chronic diseases including obesity, cardiovascular disease, and diabetes (Bray, et al., 2004; Johnson et al., 2009).

Effects of Sugar Intake on Pregnancy Outcomes

In pregnancy specifically, excess sugar consumption has been associated with increased risk of preeclampsia, gestational diabetes mellitus, and excessive gestational weight gain (Clausen et al., 2001; Zhang, Schulze, Solomon, & Hu, 2006; Olafsdottir, Skuladottir, Thorsdottir, Hauksson, & Steingrimsdottir, 2006). It has been proposed that

maternal intake of a diet that does not meet nutritional recommendations and is either low or excessive in various macro and/or micronutrients may contribute to permanent metabolic and physiological changes to the developing fetus, which can increase the offspring's risk of future chronic diseases (Barker, 1997). Therefore, lowering intake of added sugars by pregnant women could improve maternal and fetal health outcomes over the near and long-term.

Food Choice During Pregnancy

Many women make dietary changes during pregnancy and results from several studies suggest that some of these changes may undermine a woman's nutritional status. Recent studies assessing dietary intake in pregnancy have noted a trend toward unhealthy dietary patterns and excess gestational weight gain among pregnant women (Crozier, Robinson, Godfrey, Cooper, & Inskip, 2009; Wen, Flood, Simpson, Rissel, & Baur, 2010; Cohen, Plourde, & Koski, 2010). Studies also report that women consider nutrition and healthy eating to be more important during pregnancy than non-pregnancy (Begley, 2002; Copelton, 2007), however measurement of actual dietary intake suggests that diet quality does not significantly improve (Crozier, et al., 2009; Verbeke & De Bourdeaudhuij, 2007). Sugar consumption during pregnancy has not been extensively examined; however there is evidence that pregnant women frequently increase their intake of high sugar foods (Crozier, et al., 2009; Wen, et al., 2010).

Studies by both Anderson, Campbell and Shepherd (1995) and Begley (2002) found that although women may increase their nutritional knowledge about healthy eating during pregnancy, this may not translate into daily practice. Therefore, it is important to consider additional factors that may influence food choice during pregnancy that could

prevent women from implementing healthy dietary behaviours. For example, women often experience physiological changes that affect dietary behaviour, such as cravings for sweets and aversions to vegetables (Hook, 1978). In addition, socio-cultural norms influence women's attitudes and beliefs towards what is acceptable to eat during pregnancy and what is not, which may be just as important as physical factors (Baric & MacArthur, 1977; Copelton, 2007).

The study of food choice is complex. Despite the high prevalence of dietary changes during pregnancy, little research has focused on what women eat and the reasons behind dietary behaviours. Qualitative research methods will help us to understand why some pregnant women achieve a diet with low sugar intake, while others do not. In-depth investigation of how and why sugar consumption changes during pregnancy has important implications for successful knowledge translation and may assist efforts to reduce risks of pregnancy complications and future health threats.

2. Purpose

The purpose of this thesis was:

a) To acquire an in-depth understanding of how the experience of pregnancy influences sugar consumption using a qualitative methodology.

b) To understand the reasons why women do or do not meet recommendations for sugar intake during pregnancy from the perspectives of women themselves.

3. Research Questions

The research questions for this study were:

a) Why do women increase, decrease, or maintain their consumption of sugar during pregnancy?

b) What socio-cultural factors influence sugar intake during pregnancy?

c) What are the barriers and facilitators to consuming a diet low in sugar during pregnancy?

4. Objectives

The objectives of this study were:

a) To describe the experience of pregnancy and the influences on sugar consumption from the viewpoints of pregnant women.

b) To examine how pregnancy-related factors such as physical symptoms, social gatherings, and cultural beliefs impact sugar consumption.

c) To compare the experiences of pregnant women who have low sugar intake to pregnant women who have high sugar intake.

d) To develop an in-depth description of the norms, values, beliefs and attitudes that affect women's sugar consumption during pregnancy.

e) To gather information on women's dietary behaviours that will inform the development of interventions to improve maternal eating habits.

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Chapter 2: Literature Review

1. Importance of Pregnancy Nutrition

The dramatic rise in added sugar[1] consumption in North America over the past several decades is receiving heightened attention for its contribution to inappropriate dietary patterns and decreased health (Bray, Nielsen, & Popkin, 2004; R. K. Johnson et al., 2009). Lustig, Schmidt and Brindis (2012) persuasively argue that added sugars should be considered "toxic". While sugar itself is not a toxic substance, there is a concern about the consumption of excessive quantities, unnecessary calories, and displacement of more nutritious food choices. There is convincing evidence that the consumption of a diet high in sugar increases the risk of obesity, metabolic dysfunctions, and inevitably contributes to the development of chronic diseases such as diabetes and cardiovascular disease (Bray, Nielsen, & Popkin, 2004; Duffey & Popkin, 2008; R. K. Johnson et al., 2009). Although epidemiological research points towards a need for behavioral interventions to reduce sugar consumption, it is difficult to use this information to develop effective strategies. In order to increase the success of interventions and improve health in society, it is essential to understand why people choose to consume foods high in sugar and what influences shape dietary behaviours.

There is considerable ambiguity regarding recommendations for sugar consumption. The World Health Organization (WHO) has stated that individuals should limit their intake of free sugars to less than 10% of their total daily energy (WHO, 2003). Free sugars are those that are added to foods, in addition to a small amount of sugars that

[1] Added sugars are those added to foods during processing or preparation (e.g. high-fructose corn syrup, honey, molasses, white sugar, brown sugar) (Institute of Medicine, 2005)

occur naturally and are added to sweeten foods or beverages such as honey and syrups. The Institute of Medicine (IOM) offers a more lenient guideline that daily added sugar consumption should not exceed 25% of energy intake (Institute of Medicine, 2005). Analysis of the 2003-2004 National Health and Nutrition Examination Surveys (NHANES) indicates that the average consumption of added sugars in the United States accounts for approximately 17% of energy intake (Duffey & Popkin, 2008). The greatest sources of added sugars in the diet come from sugar-sweetened beverages (SSB) such as soda, fruit drinks and sweetened tea, in addition to desserts, including pies, cookies, and cakes (Duffey & Popkin, 2008; Vos, Kimmons, Gillespie, Welsh, & Blanck, 2008). A recent report using data from the Canadian Community Health Survey-Nutrition, estimated that the average intake of total sugar (natural and added combined) of the Canadian population was 110 grams (26 teaspoons) per day or approximately 21.4% of energy intake (Langlois & Garriguet, 2011). Although intake of added and natural sugars was not established, 30% of total sugar consumed was from natural sources such as fruit and vegetables and the rest from other dietary sources, especially beverages.

During pregnancy, a diet with adequate energy, an appropriate macronutrient distribution, and rich in micronutrients, is important to meet maternal and fetal energy and nutritional requirements (Williamson, 2006). To achieve this, pregnant women are recommended to follow *Eating Well with Canada's Food Guide (EWCFG)*, which includes adding 2-3 servings per day from each food group compared to non-pregnancy; increasing iron and folic acid intake through diet or supplementation; and increasing intake of water and other fluids (Public Health Agency of Canada, 2008; Health Canada, 2009). While adequate levels of all vitamins and minerals are important for a healthy

pregnancy, specific nutrients are often highlighted because they are involved in fetal development. These include: folic acid to reduce the risk of neural tube defects; calcium and vitamin D for bone development; iron to prevent maternal iron-deficiency anemia, which is associated with increased risk of low birth weight; and essential fatty acids for development of the brain, nervous system, and retina (Kaiser & Allen, 2008; Williamson, 2006). Inadequate nutrient intake that results from poor diet quality may contribute to adverse health. For example, a maternal diet that contains inappropriate amounts of macro and micronutrients increases the offspring's risk of abnormal birth weight, birth defects, and later adult diseases such as diabetes and heart disease (Fowles, 2004; Knudsen, Orozova-Bekkevold, Mikkelsen, Wolff, & Olsen, 2008). In the mother, diet quality during pregnancy can influence the risk of inappropriate weight gain and conditions such as anemia, preeclampsia, and gestational diabetes mellitus (Fowles, 2004). Therefore, finding strategies to help pregnant women achieve a nutritious diet may improve current and future health of the mother and her child.

2. Consequences of Excess Sugar Consumption During Pregnancy

Recommendations for macronutrient proportions and maximum sugar intake do not change during pregnancy (Health Canada, 2005). Health guidelines advise all women to limit consumption of foods high in sugar but they do not specifically guide women with respect to dietary sugar consumption during pregnancy (Health Canada, 2007). Carbohydrate quality and quantity are important aspects of the diet during pregnancy because the main source of energy for fetal growth is glucose derived from the mother (Clapp, JF, III, 2002). Maternal changes in blood glucose, including increased intake of foods high in sugar, can influence delivery of energy to the fetus, placental growth and

gestational weight gain in the mother (Clapp, JF, III, 2002). Excessive sugar intake may also contribute to insulin resistance and other metabolic dysfunctions that increase the risk of pregnancy complications, including GDM (Zhang & Ning, 2011; Chen, Hu, Yeung, Willett, & Zhang, 2009; Johnson & Yon, 2010).

Nutrient-Poor Diet

While there is no upper limit set that would lead to adverse outcomes, several studies have identified sugar as a specific dietary component that may contribute to low diet quality. Although pregnant women were excluded from the NHANES, data has shown that excess sugar consumption can influence dietary quality. Marriott et al. (2010) analyzed data from 2003 to 2006 and reported that micronutrient intake decreased for all age groups for each 5% increase in sugars above 10% of energy intake. Vitamins E, A, C, and magnesium were nutrients most likely to fall below the Estimated Average Requirement (EAR), which is the intake level predicted to meet the needs of 50% of individuals in a given group. Furthermore, approximately 20% of females aged 14 to 30 years old consumed more than 25% of their energy from added sugars, which was a higher proportion than males of the same ages. Similar results were seen in a Canadian report where women older than 19 years consumed significantly more sugar as a percent of daily calories than did men (Langlois & Garriguet, 2011).

There have been relatively few studies to date on the effects of sugar intake on diet quality during pregnancy. However, dietary changes during pregnancy often include increased consumption of sweets and reduced consumption of nutrient-dense foods such as vegetables and fish (Crozier et al., 2010). Some women may rely on supplements to meet nutritional requirements, but in a review of the effects of nutrition during

pregnancy, Barger (2010) suggested that "supplements are not a magic nutritional remedy". Barger believes that there is a need for further dietary assessment and counseling between clinicians and women because the importance of diet during pregnancy is often overlooked.

Excess Gestational Weight Gain

Maternal weight prior to pregnancy and weight gained during pregnancy are both important factors for fetal health. Canada has adopted guidelines from the IOM that suggests that optimal weight gain in pregnancy is based on a woman's pre-pregnancy body mass index (BMI) (Health Canada, 2010). For example, a woman who has a pre-pregnancy BMI in the underweight category (< 18.5 kg/m^2) is advised to gain between 12.5 and 18 kg while weight gain of 5 to 9 kg is recommended for an obese woman (BMI ≥ 30 kg/m^2) (Institute of Medicine, 2009).

Studies examining weight gain in pregnancy have revealed that few women meet the IOM recommendations. For example, approximately half of the participants in a study in Southampton, United Kingdom, gained above IOM recommendations during pregnancy (Crozier et al., 2010). In a retrospective study of Canadian women, Cohen et al. (2010) observed that the majority of women across all pre-pregnancy BMI categories exceeded recommended weekly rates of weight gain in spite of having received advice about appropriate weight gain during pregnancy from a health professional or educational resource. Furthermore, a large number of women are entering pregnancy overweight. Approximately one third of Canadian women begin pregnancy with a BMI of 25 kg/m^2 or greater (Health Canada, 2009). Begum et al., (2012) analyzed data collected prospectively on pre-pregnancy weight, weight gain during pregnancy, and postpartum

weight of women participating in the Alberta Pregnancy Outcomes and Nutrition study. A significant proportion of participants (71%) across all pre-pregnancy BMI categories exceeded recommended weekly rates of weight gain during pregnancy. In addition, women who were overweight or obese prior to pregnancy were more likely to gain weight above the recommendations with odds ratios of 5.5 and 6.5, respectively. Both rates of weight gain and total weight gained exceeding recommendations were associated with increased postpartum weight retention. Mothers who are overweight prior to pregnancy and/or who gain excess weight in pregnancy increase the risk of several health complications including gestational diabetes mellitus (GDM), preeclampsia, and delivering an infant that is large for gestational age (Henriksen, 2006). In addition, mother and child are both prone to obesity later in life (Crozier et al., 2010; Oken, Kleinman, Belfort, Hammitt, & Gillman, 2009).

Weight gain is a complex process, however it is clear that sugar consumption can contribute to excess gestational weight by promoting a positive energy balance. In non-pregnant women, intake of sugar, particularly in beverages, is associated with positive energy intake, increased body weight, and obesity (R. K. Johnson & Yon, 2010; Malik, Schulze, & Hu, 2006). Olafsdottir et al. (2006) reported similar findings in pregnancy where increased consumption of sweets significantly predicted excess gestational weight gain with an increased odds ratio of 2.52. Furthermore, data from the Stockholm Pregnancy and Weight Development Study showed that women who had a higher interest in sweets during pregnancy gained 1 to 2 additional kilograms more than women who did not have interest in consuming sweets (Ohlin & Rossner, 1996).

While dietary intake is one of the key factors affecting gestational weight gain, very little is known about the determinants of maternal food choice during pregnancy. Siega-Riz et al. (2004) state, "Information is lacking concerning pregnant women's perception about eating and gaining weight, what they actually eat, how consumption and exercise relate to weight gain, and how psychosocial factors influence these behaviours during pregnancy". Ensuring a healthy diet that meets dietary recommendations during pregnancy can help women gain appropriate gestational weight. This will have a positive impact on maternal and fetal health with potential to decrease rates of obesity in the future.

Preeclampsia

Preeclampsia is defined as pregnancy-induced hypertension with proteinuria and is a risk factor for maternal complications such as caesarean section, acute renal dysfunction, and rupture of the placenta (Brown, Isaacs, Krinke, Murtaugh, & Sharbaugh, 2004). The health of the child may also be affected because preeclampsia is associated with growth restriction and respiratory distress syndrome (Brown, et al., 2004). Clausen et al. (2001) examined women's diet during the first half of pregnancy (n=3133) using a food-frequency questionnaire (FFQ) and its relationship to preeclampsia. They found that women who consumed more than 25% of total energy from sucrose were 3.6 times more likely to develop preeclampsia. They also noted that women with a more severe case of preeclampsia had a 2-fold higher daily mean intake of sucrose (100g/d vs. 49 g/d) compared to women without preeclampsia. The main source of sucrose in the diets of these women was from soft drinks, accounting for 68% of intake. The authors speculate that elevated blood glucose levels and hyperlipidemia due to excess sugar consumption,

in addition to the metabolic changes of pregnancy that promote insulin resistance, could result in endothelial dysfunction leading to increased risk of preeclampsia.

Gestational Diabetes Mellitus

Current research also suggests that maternal diet prior to and/or during pregnancy may contribute to the development of GDM. GDM is classified as hyperglycemia first recognized during pregnancy (Canadian Diabetes Association, 2008). A prospective study that assessed women's diets prior to pregnancy determined that a Western dietary pattern including high intake of sweets and desserts was associated with a relative risk of 1.63 for developing GDM (Zhang, Schulze, Solomon, & Hu, 2006). Another prospective study conducted by Chen et al. (2009) found that regular consumption of sugar-sweetened cola (5 servings/week) before pregnancy increased the risk of developing GDM by 22%. Similar results have also been reported in an animal study where pregnant rats were fed a 50% fructose diet and consequently developed hyperglycemia, elevated levels of triglycerides, and produced offspring that were also hyperglycemic (Jen, Rochon, Zhong, & Whitcomb, 1991). A maternal diet high in sugar may add further stress to the metabolic changes of pregnancy and potentially contribute to insulin resistance or impaired secretion that may lead to GDM (Chen, Hu, Yeung, Willett, & Zhang, 2009). Women who develop diabetes during pregnancy are at increased risk of several adverse pregnancy outcomes, including macrosomia, delivery complications, in addition to future development of diabetes and the metabolic syndrome in the mother and baby (Canadian Diabetes Association, 2008).

Future Health and Disease

The work of Dr. David Barker and others has generated great interest in the relationship between the environment during fetal development and the occurrence of chronic diseases in adulthood. The hypothesis known as "fetal origins of adult disease", suggests that the environment to which a fetus is exposed to *in utero* during critical periods of development, can have long-lasting effects on the offspring's health (Barker, 1997). Environmental factors include the maternal diet, because aspects of maternal dietary intake may be transmitted to the fetus through the mechanism of "programming" where the fetus undergoes permanent physiological adaptations that increase disease risk in adulthood (de Boo & Harding, 2006). It is important to recognize that nutrition in pregnancy may affect not only the first generation of offspring, but also future generations (de Boo & Harding, 2006).

Both under-nutrition and over-nutrition during fetal development can result in modifications to fetal growth and organ development. For example, studies of famine during the "Dutch Hunger Winter" in the Netherlands at the end of the Second World War found that fetal exposure in early gestation to maternal intake of <1000 calories per day was associated with increased prevalence of coronary heart disease during adulthood (Painter, Roseboom, & Bleker, 2005; de Boo & Harding, 2006). However, research is shifting now to examine the effects of over-nutrition, since this state is becoming increasingly common.

Animal studies of over-nutrition where female rats are fed a palatable obesogenic diet high in fat and sugar have found adverse effects on the offspring, including hyperphagia, increased adiposity, hypertension, and altered glucose homeostasis (Nivoit

et al., 2009; Samuelsson et al., 2008). Research conducted by Bayol et al. (2007, 2009) examined the effects of a maternal "junk food" diet that was high in fat, sugar and salt in a rat model. Offspring had an increased preference for junk food, increased body weight, hyperphagia, and had decreased ability to generate muscle force.

Several studies have examined the relationship between maternal diet, weight gain in pregnancy, and infant outcomes. Phelan et al. (2011) assessed dietary intake of women in early pregnancy using a FFQ and observed that women who consumed more sweet foods and beverages as a percentage of their total caloric intake incurred an increased risk of having an infant with higher weight for age. In overweight and obese women, an association was found between increased intake of sweets as a percentage of energy and macrosomia in their infants, with an odds ratio of 1.1; these infants also had a higher infant weight for age at 6 months compared with infants born to women with normal pre-pregnancy weight. Furthermore, the effect of dietary sugar remained after adjusting for gestational weight gain, revealing that maternal dietary patterns can impart lasting effects on child weight even when maternal weight gain is within normal recommendations. Crozier et al. (2010) examined the association between women's pregnancy weight gain and their child's body composition at birth, 4 years, and 6 years. The authors found that children born to women who gained gestational weight above the IOM guidelines had a greater fat mass at all time points in the study. Cnattingius et al. (2011) conducted a study using the birth information of a cohort of mothers and their first child. Data were collected through the Swedish Medical Birth Register and examined the relationships between mother's birth weight, her weight as an adult, and the birth weight of her offspring. Mothers who were born either small or large for gestational age had an

increased risk of being overweight and obese as an adult. This was also associated with an increased risk of giving birth to a child that was also large for gestational age. Therefore, higher infant birth weight is associated with increased risk of childhood obesity and obesity as an adult, with generational implications.

Obesity has serious health consequences and is associated with the development of insulin resistance, elevated triglycerides, and high blood pressure (Jung, 1997). These metabolic problems are associated with increased risk of diabetes, heart disease, and even some cancers. "Fetal origins" research suggests the possibility of using a preventative approach to improving the health of future generations by targeting nutrition during pregnancy. It is evident that maternal over-nutrition should be addressed; however few studies have examined the external factors leading to over-nutrition, including personal and socio-cultural nutrition norms during pregnancy. Studies that advance our understanding of the factors that facilitate or undermine women's ability to achieve a healthy diet that meets recommendations for macro and micronutrients during pregnancy and avoid excess consumption of added sugars and fats will help to design appropriate and effective interventions aimed at improving maternal health.

3. Dietary Trends of Pregnant Women

Recent studies show that many women do not adhere to recommendations for a healthy diet and frequently increase their consumption of foods high in sugar during pregnancy. In a Canadian study, Pick et al. (2005) analyzed 4-day food records of healthy women of childbearing age, including a sample of pregnant women at 20-38 weeks gestation. Nutrient content and overall quality of the diet were assessed using computer software and the United States Department of Agriculture Healthy Eating Index (HEI),

which measures adherence to United States national guidelines and was adapted in this study for pregnancy nutrition recommendations. Diet quality for 79% of the pregnant women was described as "needing improvement". In addition, pregnant women did not have adequate intakes of dietary nutrients that are important for pregnancy, including calcium, iron and folate; however, supplement intake was not included in the nutrient analysis. A study in Southampton, United Kingdom, assessed dietary changes of women before and during pregnancy and found that women modified their diet to meet to some dietary recommendations, such as reducing caffeine intake, but intake of several high-sugar foods including cakes, sweet spreads, confectionery, hot chocolate drinks, puddings, cream, and soft drinks, increased (Crozier, Robinson, Godfrey, Cooper, & Inskip, 2009) A cross-sectional study by Wen et al. (2010) assessed dietary behaviours of women (n=409) in later pregnancy who were having their first child using an interview survey consisting of questions about food intake. Results showed that few women reported meeting vegetable (7%) and fruit (13%) intake recommendations and that 38% consumed more than 1 cup of soft drinks daily.

There are few analyses of diet that address the impact of sugar on nutrient intake during pregnancy. However, in Germany, Thiele et al. (2004) reported that pregnant women had lower indexes of diet quality due to increased consumption of fat and sugar. Intakes of vitamins and minerals were no better when compared to non-pregnant females. Furthermore, Cuco et al. (2006) found that women who had a 'sweetened beverages and sugar' dietary pattern during the majority of pregnancy, consumed fewer fruit, vegetables, roots and tubers.

4. Factors Affecting Food Choice in Pregnancy

Changes in dietary intake should be a part of all pregnancies. A pregnant woman does not need to add any extra calories during the first trimester of pregnancy, but during the second trimester an additional 340 calories is required and a further 452 calories are needed in the third trimester (Health Canada, 2009). Current Canadian guidelines suggest that all individuals should consume a variety of items from all of the food groups; however, pregnant women should increase the daily servings from the food groups by 2 to 3 to ensure adequate nutrient intake (Health Canada, 2007). Requirements for iron and folic acid greatly increase during pregnancy and are often difficult to meet through dietary intake, therefore supplements are recommended (Health Canada, 2009). To protect the health of the fetus, pregnant women are also advised to abstain from alcohol intake; limit caffeine intake to no more than 300mg per day (slightly less than 2 cups of coffee); and avoid foods associated with bacterial contamination such as raw fish, undercooked meat, and unpasteurized cheese (Public Health Agency of Canada, 2008). Physical, cultural, psychosocial, attitudinal, and knowledge changes are some of the factors that guide specific modifications to usual dietary habits. Depending on the extent of these changes on food intake, nutrient intake may also change significantly and may or may not meet current recommendations for a healthy pregnancy.

Physical Symptoms

During pregnancy, the mother experiences physiological adaptations that are often associated with physical side effects such as cravings, an altered sense of taste and/or smell, nausea, vomiting and aversions. While these symptoms do not affect all women, they are known to impact some dietary habits depending on the prevalence and severity of the conditions and the woman's dietary beliefs.

Cravings

Food cravings are not specific to pregnancy but this phenomenon is frequently reported as a reason for dietary change during pregnancy (Gendall, Joyce, & Sullivan, 1997; Hook, 1978; Pope, Skinner, & Carruth, 1997). A craving is described as an intense desire for a particular food (Gendall, et al., 1997; Hill, 2007). During pregnancy, 61-85% of women report cravings. This trend tends to peak in the second trimester (Belzer, Smulian, Lu, & Tepper, 2010; Tepper & Seldner, 1999) where the most commonly reported craved foods include fruit, dairy, and sweet foods such as ice cream, chocolate, sweets, and juice (Bayley, Dye, Jones, DeBono, & Hill, 2002; Belzer, et al., 2010; Hook, 1978; Tepper & Seldner, 1999).

Cravings often result in greater consumption of particular foods (Bayley, et al., 2002; Belzer, et al., 2010; Hook, 1978). Because these foods are generally energy dense and likely to have a low nutrient density, individuals who experience cravings are more likely to have higher caloric intake and a subsequently higher percentage of energy from carbohydrates than individuals who do not have cravings (Christensen, 2007). For example, Pope, Skinner & Carruth (1992) reported that pregnant adolescents who craved sweets had a higher intake of sugar and energy than the pregnant adolescents who did not crave sweets. The impact of regularly consuming foods to satisfy cravings on essential nutrient intakes during pregnancy is not well known. However, as previously mentioned, the study by Marriott et al. (2010) indicates that added sugar intake in non-pregnant adults is inversely associated with intake of several essential nutrients, especially vitamins E, A, C, and magnesium. This suggests that pregnant women who consume

larger amounts of sweet foods in response to cravings may be at increased risk for inadequate nutrient intake.

The cause of food cravings remains unclear but research suggests physiological, cognitive, and environmental influences may all play a role. A common belief is that cravings occur due to a biological prompt to fulfill a nutritional need of the mother or the fetus (Schwab & Axelson, 1984). However, Hook (1978) also explored this idea and concluded that cravings were not the result of an underlying change in nutritional requirements because the requirement for protein also increases during pregnancy, but cravings for meat and eggs are rarely reported. Hormonal changes may also play a role as estrogen and progesterone levels change significantly during pregnancy and are known to influence weight and food intake regulation in non-pregnant women (Rosso, 1988).

Mood has also been suggested as a trigger for cravings. In studies of non-pregnant humans, boredom, stress and anxiety are more common in individuals who experienced cravings (Hill, Weaver, & Blundell, 1991; Rogers & Smit, 2000). Serotonin in the brain is released after consuming high sugar foods, providing feelings of pleasure (Corsica & Spring, 2008). Thus, it has been suggested that cravings reflect the desire for a positive, mood improving experience with particular foods creating positive reinforcement for consumption (Hill & Heaton-Brown, 1994).

Consuming a food due to a craving during pregnancy may be influenced by cognitive factors such as attitudes and beliefs around food cravings. Schwab and Axelson (1984) interviewed 60 pregnant women about dietary changes they had made in the pregnancy, in addition to experiences of cravings and aversions and the reasons women attributed to these occurrences. Beliefs reported by women concerning the causes of their

own and other's cravings, included the nutritional need of the mother/fetus (26.7%) and various physiological affects (21.6%). A large proportion of participants (50.0%) associated cravings with personal beliefs. For example, women reported that "cravings are for 'forbidden or restricted foods'; 'unusual foods'; 'an indication of the gender of the fetus'; 'if a women thinks that she will have cravings, then she will'. Identifying a food choice as a craving may also be a way to justify food choices and make sense of behaviour (Rogers & Smit, 2000). Because commonly craved foods such as ice cream or chocolate are considered indulgences that should be consumed with restraint, the notion of a craving could reflect a socially acceptable explanation for eating such foods (Rogers & Smit, 2000).

Environmental influences may also play a role in cravings. For example, whether an individual is hungry or not, the sensory effects of food items such as sight and smell can illicit a craving (Christensen, 2007). Food availability is another factor that may influence food choice during pregnancy. Interestingly, earlier studies of dietary change in pregnancy report fewer cravings for sweets than is observed in more recent studies. In 1956, a radio program produced by the British Broadcasting Corporation (BBC) asked female listeners to describe their experience of cravings during pregnancy. From the 514 letters received by the BBC, 991 different cravings were identified and grouped into categories (Harries & Hughes, 1958). The most frequently reported foods were fruit (261), and cooked and raw vegetables (105); however, cravings for sweet items such as confectionery (79) and cold treats such as ice cream (17) were less common. Similarly, in 1961, Taggart published preliminary results of a study examining food habits women make during pregnancy and reported that cravings for "sweets and chocolates were

mentioned occasionally". Since the 1970's, as the availability and prevalence of sugar and HFCS has increased, so has the prevalence of cravings for sweet items during pregnancy. For example, in 1978, Hook conducted a retrospective study of 250 women about dietary changes during pregnancy. The most commonly craved foods reported by the women were ice cream (18.4%), chocolate (15.6%), fruit (12.0%) and sweets and candy (11.6%); fewer women reported craving vegetables (6.0%). This trend parallels the increased sugar consumption in non-pregnant populations that has been reported by Popkin and Nielsen (2003) and Nielsen, Siega-Riz, and Popkin (2002). It is possible that cravings for high sugar foods and beverages have increased, in part, due to the increased availability of added sugars in the diet.

In summary, researchers still do not have a firm understanding of how food cravings are initiated or why cravings are specific for different types of food. Several studies have expressed difficulty in defining and measuring cravings due to their subjective nature (Christensen, 2007). For instance, Gendall et al. (1997) conducted a study on a random sample of non-pregnant women to determine what impact the definition of a craving had on the prevalence of reporting a food craving. A high proportion of non-pregnant women reported experiencing food cravings (58%); however, when the definition was listed as 'strong cravings' with specific criteria, only 4% were included. Furthermore, the relationship between behavioral and cognitive characteristics of cravings requires more investigation. As cravings occur in all individuals, it is unclear why they have a greater impact on diet during pregnancy. Investigation of the reasons for food choice during pregnancy and the motivations for satisfying cravings during pregnancy may lead to further understanding of this phenomenon.

Changes to Taste Perception

Pregnant women commonly report changes to the way certain foods taste and smell. From self-reported data, Nordin et al. (2004) found that 76% of women experienced abnormal smell and/or taste perception during pregnancy, which may be attributed to hormonal changes. Studies examining taste perception in pregnancy have reported that women prefer more intense flavors, particularly salt, compared to non-pregnant women, but reported no differences in sweet preferences (Bowen, 1992; Brown & Toma, 1986). Tepper and Seldner (1999) and Dippel and Elias (1980) both reported that pregnant women had a lower preference for sweetness compared to non-pregnant women. Interestingly, salt cravings during pregnancy are not as common as sweet cravings (Bayley, et al., 2002; Belzer, et al., 2010; Hook, 1978); therefore, factors other than an alteration to the senses may be affecting intake of sweet food.

Nausea, Vomiting and Aversions

Symptoms of nausea and vomiting during pregnancy (NVP) are experienced by 72-89% of women, often during the first trimester, and are particularly common in Western countries (Chan et al., 2011; Kallen, Lundberg, & Aberg, 2003; Latva-Pukkila, Isolauri, & Laitinen, 2010; Lee & Saha, 2011). The cause of NVP is unknown; however studies show a correlation between increased human chorionic gonadotropin (hCG) and the presence and severity of NVP (Lee & Saha, 2011). Maternal characteristics such as younger age, higher weight and multiparity have been associated with increased risk of NVP (Kallen, et al., 2003).

There is evidence for an association between aversions and nausea and/or vomiting during pregnancy, providing evidence that some aversions may develop as a

conditioned response (Bayley, et al., 2002; Crystal, Bowen, & Bernstein, 1999). Aversions typically result in decreased intake of particular foods and are experienced by about 55% of women during pregnancy, sometimes lasting until close to term (Bayley, et al., 2002; Pope, et al., 1997; Rifas-Shiman et al., 2006). Aversions during pregnancy are typical for foods with strong odors and are frequently reported for foods such as coffee, vegetables, and meat including fish, poultry and eggs (Bayley, et al., 2002; Hook, 1978)

Physical symptoms that decrease food intake, such as NVP and aversions, may make it difficult for women to follow a healthy diet throughout pregnancy. NVP can result in reduced appetite, decreased food consumption and lower nutrient intakes (Latva-Pukkila, et al., 2010; Watson & McDonald, 2009). Pregnant women may be compelled to alter their consumption of foods in order to decrease illness. Dietary recommendations to relieve NVP include consuming foods/beverages with ginger, toast or crackers, and regular small meals, in addition to avoiding foods that exacerbate symptoms (Davis, 1996; Latva-Pukkila, et al., 2010). Using 3-day food records, Latva-Pukkila et al. (2009) found that women with NVP consumed less meat and fewer vegetables than woman without NVP. Although total calorie intake was similar in women with and without NVP, those with NVP consumed a higher proportion of carbohydrates, more sugar and sweets, and more sucrose as a percentage of energy intakes. These changes persisted throughout pregnancy, even though NVP typically ends around the 16th week of gestation (Davis, 1996).

Cultural and Psychosocial

Food choices during pregnancy are influenced by cultural and psychosocial factors that have been described for non-pregnant women. Nag (1994) reviewed the

literature on traditional beliefs about food and pregnancy in India including the concept of balancing 'hot' - harmful (e.g. meat) and 'cold' - beneficial (e.g. milk) foods. Since pregnancy is considered a 'hot' state in Indian culture, it is thought that women should consume more 'cold' foods during pregnancy. Beliefs explored also concerned the amount of energy from food that women should consume. For example, 'eating down' is the idea that women should eat less during pregnancy to limit infant size and ease delivery (Nag, 1994). Socio-demographic characteristics are also shown to influence the dietary behaviours of pregnant women. Inadequate nutrient intake during pregnancy is more common in women who are younger, less educated, of lower socio-economic status, have a higher BMI and have more children (Northstone, Emmett, & Rogers, 2008; Rifas-Shiman, Rich-Edwards, Kleinman, Oken, & Gillman, 2009; Watson & McDonald, 2009).

Attitudinal

Dietary behaviours of pregnant women are often influenced by attitudes towards food and the pregnancy itself. Conway, Reddy and Davies (1999) examined the effect of dietary restraint prior to pregnancy on dietary intake and weight gain during pregnancy in a sample of 74 Caucasian pregnant women. Participants in this study completed a pregnancy and weight gain attitude questionnaire, a retrospective questionnaire of pre-pregnancy dietary restraint and weight control behaviours, and 7-day weighed food diaries. More than half of the women who reported restrained eating practices prior to pregnancy gained gestational weight above the recommended range and were more likely to have a negative attitude towards weight gain in pregnancy. The authors propose that pregnancy acted as a release from dietary restraint, which, for some women, resulted in

over-eating or a "sense of loss of control" over food habits. The study by Anderson, Campbell and Shepherd (1993) examined the differences in personal factors between non-pregnant women and women in early pregnancy, including an assessment of attitudes towards healthy eating. A positive intention for health behaviours was found in both groups; however, a stronger relationship between intention, attitude, and norms were seen in the pregnant women, revealing that pregnant women may be more responsive to social pressures and behavioural beliefs when making dietary changes.

Knowledge

Knowledge about specific nutrition recommendations for pregnancy has been shown to impact maternal dietary intake and behaviours. A study in Belgium found that the major differences in food choices between pregnancy and non-pregnant women were due to pregnant women avoiding foods that may be harmful to their pregnancy and are consistent with guidelines for safe food practices in pregnancy such as avoiding alcohol, raw meat, raw vegetables, and raw fish (Verbeke & De Bourdeaudhuij, 2007). Pope et al. (1997) conducted a study of dietary change in pregnant adolescents and noted that participants who made healthier choices had more knowledge of the beneficial effects of nutrients on their baby. This was highlighted as increasing dairy products for calcium. Similarly, lack of knowledge may also have consequences for diet during pregnancy, as Strychar et al. (2000) found that women who gained insufficient or excess weight in pregnancy were less knowledgeable about the importance of meeting nutritional recommendations.

Similar to non-pregnant women, increased nutrition knowledge may not translate into improved food behaviors. For instance, Anderson et al. (1995) conducted a study that

examined the effects of nutritional education on pregnant women's knowledge, attitudes and behaviours about healthy food choices. Participants were matched for socio-demographic characteristics and assigned to either an intervention group, which received nutrition education material from a program called 'Food for Life', or to a control group that received routine antenatal education. Analysis of the 4-day food records kept by all participants showed that there was no significant difference in nutrient intakes between the intervention group and control group. There appears to be a lack of understanding as to why women follow certain nutrition recommendations during pregnancy and not others. Deeper understanding of the motivators for dietary change, including changes in attitudes and beliefs, has been cited as an area requiring more research that could benefit health care professionals working to improve diet during pregnancy (Begley, 2002; Pope, et al., 1997).

5. Qualitative Research of Dietary Behaviours during Pregnancy

Exploring the reasons behind human behaviour is central to qualitative research, which makes it a particularly useful methodology for exploring health and nutrition phenomena. The individual's perspective can reveal important insights into eating behaviours that may subsequently result in changes to nutritional status (Devine & Olson, 1992). Therefore, this research may be used to help plan effective nutrition interventions, improve relationships between individuals and health care professionals, and develop strategies to overcome nutrition barriers (Harris et al., 2009; Begley, 2002).

Life-Course Perspective

A "life-course" approach is one framework that has been used in the qualitative literature to understand food choices at different times across the lifespan. This approach

suggests that past events and experiences accumulate over time to influence the present context (Wethington, 2005). Life transitions, trajectories, and timing, are core concepts that shape decision-making behaviours, offering insight into current and future health practices (Devine, Connors, Bisogni, & Sobal, 1998). Trajectories are the attitudes, beliefs, and actions that are assembled throughout life and are shaped by former events. Major events in an individual's life may result in a life transition that can alter the direction of trajectories. The timing of events in a person's life is also important to consider as environments are constantly changing. For example, age during pregnancy.

Szwajcer et al. (2007) used the life-course approach to explore the impact of pregnancy (a life transition) on nutrition-related behaviours. Interviews were conducted with women who were pregnant or planning on having a child, and participants were sampled with the purpose of varying age, education, and socioeconomic status. All participants recognized the importance of nutrition during pregnancy; however, the degree of nutrition awareness was characterized by the source of motivation. For instance, women who were driven by concern for the child followed nutrition guidelines most closely and took the fewest risks. Furthermore, many of the participants who were having their second child had already experienced a change in trajectory direction since having their first child and had already incorporated a healthy diet as a postpartum habit. These findings suggest that targeting early experiences within the life-course can impact present and future health behaviours.

Weight Gain

Several qualitative studies have examined attitudes, beliefs and values around health behaviours during pregnancy. The perception of gestational weight gain has

figured prominently in many of these studies. Johnson, Burrows and Williamson (2004) and Clark et al. (2008) both used interviews and phenomenological approaches to examine the experience of pregnancy-related body changes. These studies revealed that women felt a decreased social pressure about their weight and dietary restriction. Dieting practices are common in non-pregnant women and research shows that women who restrain eating prior to pregnancy are less likely to meet weight gain recommendations during pregnancy (Conway, et al., 1999). Further qualitative studies are needed to understand how relaxed attitudes toward weight gain in pregnancy may affect women's food choices during pregnancy.

Dietary Behaviours

During pregnancy, women often acquire new values and motivations for implementing nutrition information. Szwajcer et al. (2007) interviewed women in different stages of pregnancy as well as women aiming to become pregnant, and reported that the value of nutrition increased for women because they felt more responsible for food choices that protect the health of the baby. Another study using pregnant women's narratives found that women associate the concept of 'good mothering' with healthy eating habits (Copelton, 2007). Participants reported making dietary changes for the benefit of the baby by consuming foods that were healthy but not enjoyed, or by giving up potentially harmful foods or substances, such as caffeine. Women may also be motivated by social pressures to conform to certain health behaviours, particularly by health professionals or family members (Anderson et al., 1993).

Qualitative research has been used to provide insight into why women do not implement nutrition guidelines during pregnancy. Begley (2002) examined dietary

change in a descriptive qualitative study using focus groups with 90 women who were pregnant or planning to be pregnant. The women in this study were asked to reflect on their food choices and the connection to health during pregnancy. Women reported that they were more concerned about eating a healthy diet during pregnancy, but several barriers were identified that prevented them from meeting nutrition recommendations and/or a healthy diet in pregnancy. These barriers included: "nutrition which was just one of a range of health issues women were dealing with when pregnant; a lack of knowledge and advice received on what are good nutrient intakes for pregnancy; the promotion of listeria awareness was seen as giving food a negative connotation; general practitioners were identified as lacking nutrition knowledge and having limited time to discuss nutrition; and printed educational materials did not contain sufficient detail". Similarly, Athearn et al. (2004) conducted focus groups to understand the acceptance of food safety guidelines by pregnant women. Many of the participants did not make all of the recommended changes due to personal preferences, no previous experience of food-related illness, and many participants expressed only a moderate concern for food safety practices.

Qualitative Methods

There are several types of methods that can be used in qualitative research, which frame how the research is thought about and how it is conducted in order to generate knowledge (Nicholls, 2009). While one method is not superior to another, it is essential to choose a method that will provide the best answer to the research question(s) and will guide the study to produce reliable results (Swift & Tischler, 2010). There are a number of different methods of inquiry and variations that are used in qualitative research; the

most common include phenomenology, grounded theory, ethnography, and discourse analysis (Nicholls, 2009; Swift & Tischler, 2010). While methods may share similar strategies of data generation and analysis, the research question, philosophical undertones, and end result set them apart. For example, phenomenology examines the structure of an individual's experience while discourse analysis focuses on the use of language (Starks & Trinidad, 2007). As qualitative research in the field of nutrition grows, attention to methodological cohesion (congruence between the research question, theoretical position, research strategy, and method) is required in order to ensure logical and trustworthy research (Mayan, 2009).

6. Summary

Pregnancy has been identified as a time of significant life-transition and is therefore viewed as a time to promote health with a significant potential impact for the future (Anderson, 2001). Quantitative and qualitative research has established that women experience biological, social, and cultural changes during pregnancy that have implications for dietary changes. However, there is little qualitative research regarding how pregnancy influences intake of specific dietary components, such as sugar. Further research about how women experience changes associated with pregnancy and how these changes impact food choices may be the first step to improving dietary behaviours and potential health outcomes.

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Chapter 3: Methods

1. Qualitative Research

I believe qualitative research offers the best approach to address the research questions posed in this study. Qualitative research asks why and how; rather than what, where, and when; which are core components of quantitative research (Janesick, 2004). In qualitative research, knowledge is derived inductively to understand the meanings that people attach to experiences in every day life (Creswell, 2007). Examining language, perception, and patterns inherent in participant's behaviours can lead to understanding why such behaviours occur (Janesick, 2004). Therefore, qualitative research can reveal in-depth information that may not be obtained through quantitative research.

Qualitative Methods

Qualitative methods are strategies of inquiry that guide the research process (Starks & Trinidad, 2007). Different methods lead to different findings because they direct how the researcher investigates the phenomenon of interest (Swift & Tischler, 2010). Common methods used in qualitative research include grounded theory, phenomenology, and ethnography.

Grounded theory is concerned with explaining people's actions with the goal of developing a theory that is grounded in participant experiences (e.g. How do women with gestational diabetes cope?) (Swift & Tischler, 2010). Phenomenology studies the "lived experience" of an event, situation, experience, or concept (e.g. What is it like to have a craving?) (Hancock, 1998; Starks & Trinidad, 2007). The end result of a phenomenological study is a thorough description of the "essence" or core characteristics

of the event or experience (Starks & Trinidad, 2007). The goal of ethnography is to examine how culture influences the way people organize their lives in a way that makes sense to them (e.g. What is the culture of prenatal classes?) (Spradley, 1979). However, the definition of culture in this sense is not limited to just ethnicity or a defined geographical location. Instead, it may be expanded to include individuals who are related through a common experience, like pregnancy (Nicholls, 2009).

In choosing a method, the researcher should consider how suitable it is for the phenomenon of interest, the research question, and the desired result (Starks & Trinidad, 2007). Grounded theory was originally considered for this study due to an interest in women's patterns of dietary behaviours. However, the goal of the study is to achieve an in-depth understanding of the entire pregnancy experience and the influences on dietary behaviours. To achieve the desired results, social and cultural underpinnings of pregnancy were important considerations.

2. Focused Ethnography

Focused ethnography was chosen as the best approach to investigate sugar consumption during pregnancy and to describe culture from the participant's point of view within the context of everyday life (Spradley, 1979). Norms, values, attitudes, and beliefs are important aspects of culture and are central to understanding dietary behaviours. Investigating how these aspects change during pregnancy and the impact they have on dietary change is important for clinical practice and for developing tools to assist pregnant women in achieving a healthy diet.

Focused ethnography differs from traditional ethnography in that it examines a problem within a specific aspect of society. In this study, the focus is on understanding

sugar consumption during pregnancy. Focused ethnography is also characterized by a shorter time frame and smaller sample size relative to traditional ethnography. The large quantity of data generated and the in-depth analysis of this data, compensate for the shorter time frame and smaller sample size (Knoblauch, 2005).

3. Study Design

The current study is a component of a larger project called Sweet Moms at the University of Alberta. The purpose of Sweet Moms is to examine the effect of sugar on maternal and fetal health by conducting both human and animal studies. Epidemiological, clinical, and qualitative approaches are being used to examine the effects of excess sugar intake on maternal and offspring health and to create strategies for future interventions that will target healthy eating in pregnancy. The qualitative component benefits the study's purpose because it reveals the reasons why women meet, or do not meet, sugar recommendations. This will foster the development of educational resources to guide women's sugar consumption behaviours.

Recruitment

Sweet Moms participants were recruited from prenatal clinics, pregnancy care centers, other family medicine practices, and shops selling maternity or baby products. Posters and pamphlets (Appendix A) were distributed in local hospitals, maternity clinics, child daycare facilities, shopping centers, grocery stores, churches, community centers, and libraries. Research assistants provided in-person information and pamphlets about the study at prenatal classes. A website (www.sweetmoms.ca) was developed in order to support recruitment and to provide additional information to the public; online advertisements were posted on social networking websites. The inclusion criteria for

Sweet Moms was: being pregnant, over the age of 16, able to read and write English, and living in Edmonton or a surrounding area.

All of the participants in the present study were recruited from the Sweet Moms project. When giving consent to participate in Sweet Moms, women were asked if they would like to take part in an optional interview. Women were considered for the interview if they were in their third trimester of pregnancy as this allowed for women to reflect on experiences and sugar consumption behaviours throughout the entire pregnancy. Inclusion criteria for the interview also included being nulliparous, in order to capture pregnancy as a novel experience. Previous research has shown that women having their first child experience greater nutrition awareness, more prominent body image concerns, and have higher needs for nutrition information than women in their second pregnancy who may feel more experienced and independent (Szwajcer, Hiddink, Koelen, & van Woerkum, 2007; Szwajcer, Hiddink, Koelen, & van Woerkum, 2005). Women with different socio-economic status and ethnic backgrounds were included to gain insight into different perspectives and experiences. Study participation was limited to women who were in good health with no major pregnancy complications in order to keep the sample homogenous. In addition, all potential participants were met in-person first to gage whether or not they would be a 'good informant'. This is someone who shows strong interpersonal skills and an interest in talking about her experiences (Spradley, 1979). Five women were selected for interviews, but were ultimately excluded from the study; two of these women gave birth before the interview could be conducted and three appeared shy or uninterested in the project when met in person.

Purposeful Sampling

Selection criteria for participants were necessarily based on their ability to contribute to the study of sugar consumption during pregnancy (Patton, 1990). Therefore, sampling strategies were chosen according to the research questions: 1) Why do some women increase, decrease, or maintain their intake of sugar during pregnancy? 2) What are the barriers and facilitators faced by women to regulate or control their sugar intake? Participants were purposefully sampled using a maximum variation approach to select women with opposing intakes of added sugars (Creswell, 2007). This was accomplished by developing a sugar-screener questionnaire (SSQ) that was distributed to all participants in the Sweet Moms study (Appendix B). This questionnaire asked women to report the portion size and frequency of consumption of common high-sugar foods and to provide information on their general intake of sugar. Estimates of daily added sugar consumption were calculated and participants were placed into categories of high (>80g/d), moderate (60-80g/d), or low (<60g/d) added sugar intakes (Appendix C).

Participants who were classified as having 'moderate' intakes of added sugar were recruited early in the study. After the first 5 interviews, only women who fell into the categories of 'high' or 'low' added sugar intake were selected in order to provide more breadth of information in order to answer the study's research questions. Sampling for this study continued during the interviews until data saturation was achieved and additional interviews did not provide any new data (Creswell, 2003).

Setting

Interviews were scheduled via email or telephone to set up a place and time to meet. Several of the interviews were conducted at the University of Alberta in the Clinical Research Unit; however, interviews also took place in other locations including

homes and workplaces if these were more convenient for the participant. Data generation commenced in June 2011 and the last interview was conducted in January 2012.

Ethical Considerations

Informed consent for Sweet Moms was obtained before completing any measurements or questionnaires. For women participating in the interview portion of the study, a separate information letter and consent form was provided to outline the additional objectives and purpose of the research, as well as, ethical considerations (Appendix A). Participants were/are identified by number in order to maintain confidentiality. Anonymity of the participants was ensured by removing all identifying information (names, places) from the data. Ethical approval was obtained for Sweet Moms and the present study from the Human Research Ethics Boards at the University of Alberta.

4. Data Generation

Demographics

As part of the Sweet Moms study, participants completed a demographic and background questionnaire that collected information on age, marital status, education, income, ethnicity, in addition to pregnancy information (e.g. nausea and vomiting, physical activity, medical conditions). To calculate pre-pregnancy body mass index (BMI), women were asked about their weight prior to pregnancy and a research assistant measured their height. Sugar intake information was collected for all Sweet Moms participants using the SSQ.

Interviews

Interviews were the principal method used to generate data. Interviews are one of the most common methods used in qualitative research as they can provide a thorough understanding about a person's experiences, perceptions, and beliefs (Janesick, 2004). One-on-one interviews were conducted in-person. Each appointment began with a review of the study purpose, interview process, and ethical considerations. Sessions lasted approximately 40 to 60 minutes and were audio recorded. A mock interview, conducted prior to any actual interviews, helped determine the amount of time needed and was used to refine the questions.

Interviews were semi-structured; meaning that a basic framework of open-ended questions was created but the conversation was directed by the participant's responses (Appendix D) (Pope, Ziebland, & Mays, 2000). The framework was based on the research questions and a review of the literature. Interview questions were adapted for successive sessions based on previous responses. The major topics of interest in exploring sugar intake during pregnancy included social situations, dietary changes, physical symptoms (e.g. cravings, aversions), and interactions with other people.

As suggested by Spradley (1979), participants were asked a combination of structural and descriptive questions. Descriptive questions included "grand tour" questions (What is a craving like?); example questions (What's an example of when someone told you what to eat?); and experience questions (Tell me about your experience of being pregnant at the bar). Structural questions were directed towards how information is organized by the participant, often by using terms already mentioned during the interview (What are some of the ways you 'balanced' your sugar intake?) (Spradley, 1979). Additional probing questions were asked throughout the interview in order to

elicit more information or to clarify answers (You said your husband helped you to eat healthy, tell me more about that.). Active listening was practiced during the interviews and personal interpretations of the participant's responses were often 'sent back' to the participant to confirm or clarify with further explanation (So planning healthier snacks ahead of time was a facilitator to eating less sugar?) (Kvale & Brinkmann, 2009).

Effort was made to dismiss preconceptions and judgments while interviewing participants. Adams (2010) suggests that researchers should act in a professional manner and control the urge to express their own opinions and views, even when the participant provides an answer that is disapproving to the researcher. Interviews were conducted with awareness that the purpose was to allow the participants to express their own thoughts and feelings and not those assumed or implied by the researcher (Pope, Ziebland, & Mays, 2000). Therefore, leading questions and directive comments were avoided.

Additional Data Generation

Additional notes were taken during and immediately after the interview to record information on non-verbal behaviours, which were later added to the transcripts (e.g. participant would point to or touch her stomach when talking about the baby). As suggested by Janesick (2004), a reflective journal was kept by the researcher to record thoughts, assumptions, impressions about the research experience, questions that arose during analysis, and potential theories. A journal entry was made after interviewing each participant to document similarities and differences from previous interviews, impressions of their experience, and potential questions for the next interview.

Data Management

Transcription was completed shortly after each interview by listening to the audio and typing the interviews word for word into Microsoft Word (Version 12.3.3, 2008). A key was created for transcribing to show where words were spoken louder, softer, or with emphasis (Appendix E). Comments were added from the audio and interview notes for additional context (e.g. laughter, sarcasm, silence). All personal identifiers were removed from the transcripts and women were assigned a code to ensure confidentiality. Transcripts were reviewed for accuracy by re-listening to the audio while following the typed document. The transcripts, journal entries and all other additional notes, were entered into computer documents and organized using the qualitative data management software ATLAS.ti (Version 6.2.27, 2011). All data were kept on a password-protected computer.

5. Data Analysis

Analysis began early in the study and continued simultaneously with the process of generating data (Pope, Ziebland, & Mays, 2000). After each interview was transcribed and analyzed, previous transcripts were reviewed to determine if data had reached saturation. New findings from each analysis were incorporated and tested in subsequent interviews, deepening the level of analysis throughout the research process. Data became saturated after 13 interviews. During the remaining 2 interviews, themes and relationships between categories remained.

Content Analysis

Qualitative content analysis was used to analyze the interviews. This is described as a process for making valid inferences from the data in order to increase understanding

and gain new insights about the phenomenon (Elo & Kyngäs, 2008). Data analysis began with re-reading the transcript to become familiar with the data. On the hardcopy of the transcript, key words and phrases were highlighted line-by-line with analytic notes recorded in the margins.

Coding and Categorization

Coding is a means of segmenting the data into smaller pieces by identifying key concepts and underlying patterns in the data (Kvale & Brinkmann, 2009). This process was conducted using ATLAS.ti. Initially, codes were created based on words and ideas within the data (also known as open coding). Line by line, important words and phrases were identified and labeled. At first, codes were broad and generic to help make sense of the data (e.g. craving), and more abstract codes were developed as the analysis progressed (e.g. dealing with social pressures) (Hammersley & Atkinson, 1995). With each new concept that appeared, previous data were reviewed to add additional codes where appropriate.

As the coding process continued, categories were created that linked together the relationships between codes and ideas within the data. To assist in the development of categorization, data were reorganized by grouping together related codes rather than by chronological order. Using Microsoft Excel 2008 (Version 12.3.3), a data matrix was made to summarize data and to compare and contrast the experiences of each participant (Roper & Shapira, 2000). Title headings in the spreadsheet were: sugar intake (high/low/moderate), summary of experience, positive or negative impacts on sugar intake, important quotes and key words. The final categories were ones that reoccurred frequently in the interviews and were central concepts in answering the research

questions (Glaser, 1978). A summary was then written for each category, which was then reviewed for homogeneity (Mayan, 2009).

Memos

Memos are free-style notes the researcher uses to record his/her own thoughts and interpretations (Glaser, 1978). This strategy is used to "assist the researcher in making conceptual leaps from raw data to those abstractions that explain research phenomena in the context in which it is examined" (Birks, Chapman, & Francis, 2008, pg. 68). In this study, memos were written constantly throughout the research process. Notes were kept in regards to emerging concepts, puzzling information, contradictions, and to help formulate codes, categories, and themes. An example of a memo written during analysis:

> This participant says that pregnant women should not be "eating for two" - yet she keeps mentioning that she has "increased her portion sizes", like when she talks about eating ice cream once a week instead of once per month now that she is pregnant. Perhaps a social change to the language used in society, but women continue the same dietary behaviour?

Theming

Themes are relationships between the codes, categories, and the larger patterns woven throughout the data that make up the "cultural scene" (Spradley, 1979). With ongoing analysis of the interviews, developing themes were incorporated into following interview questions. This helped to identify patterns between participants and to confirm or reject emerging concepts (Kvale & Brinkmann, 2009). Hammersley and Atkinson (1995) state that theorizing involves moving between ideas and the data and identifying relationships; "ideas are used to make sense of the data, and data are used to change our

ideas" (pg. 159). Ideas do not simply 'emerge' from the data, instead the researcher draws on existing knowledge of the phenomenon, experiences in the field, and the analytic work completed throughout the research process (Hammersley & Atkinson, 1995). These resources are important for making sense of the data, but are not used to impose interpretations or prejudgments on the data.

Rigor

Rigor refers to the reliability and validity of research that creates trust in the findings and results (Thomas & Magilvy, 2011). While other terms have been created to distinguish validity and reliability in qualitative research, "they are less likely to be valued or recognized as indices of rigor" (Morse et al., 2002, pg. 14). In this study, rigor was assessed using the traditional quantitative terms; however, their meanings have been redefined to reflect the inherit differences of a qualitative study (Mayan, 2009). In qualitative research, validity is the accuracy with which the findings represent the data and the applicability to similar situations (Mayan, 2009). Reliability transpires from the replication of concepts and common experiences throughout the data (Mayan, 2009).

To ensure rigor, verification strategies (Morse et al., 2002) were employed throughout the research process. The verification strategies used included: ensuring investigator responsiveness, assessing methodological cohesion, appropriate participant sampling and inclusion, concurrent data collection and analysis, thinking theoretically and theory development based on observations and findings (Appendix F). Additionally, an audit trail was kept to establish accountability by recording the details of the research process and analysis decisions. Findings were reviewed and critiqued by colleagues in lab group presentations. Comments from women in the lab group who had previously been

pregnant indicate that their own experiences resonated with the results and interpretation found in the study subjects and this was used to confirm the research process and analysis decisions. Meetings with other qualitative researchers were held throughout the project to discuss the research process, methods and findings.

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Chapter 4: A Qualitative Exploration of Sugar Consumption Behaviours During Pregnancy

1. Introduction

During pregnancy, a nutritious diet is important for optimal health of the mother and the fetus. Excess sugar consumption is one factor that may characterize an unhealthy diet since high intakes of sugary foods generally provides excessive calories and displaces healthier foods that contain important macro and micronutrients (Johnson & Yon, 2010). Sugar intake is associated with increased risk of preeclampsia, gestational diabetes mellitus, and excess gestational weight gain in the mother (Clausen et al., 2001; Chen, Hu, Yeung, Willett, & Zhang, 2009; Olafsdottir, Skuladottir, Thorsdottir, Hauksson, & Steingrimsdottir, 2006). Any of these conditions can result in increased risk of pregnancy complications, perinatal morbidity and mortality (Williamson, 2006). Research on fetal programming has also demonstrated that early exposure to excess nutrition may result in permanent metabolic and physiological changes in the fetus that can increase the risk of future chronic diseases (Barker, 1997). While studies confirm that many pregnant women do not adhere to recommendations for a healthy diet (Crozier, Robinson, Godfrey, Cooper, & Inskip, 2009; Wen, Flood, Simpson, Rissel, & Baur, 2010) or appropriate gestational weight gain (Cohen, Plourde, & Koski, 2010), research that improves our understanding of the barriers and facilitators to achieving a healthy diet is required for the development of effective interventions to improve maternal health.

Everyone is advised to limit consumption of foods and beverages high in added sugar (Health Canada, 2007), which are those that are added to foods during processing, preparation, or at the table (R.K. Johnson et al., 2009). The World Health Organization

specifically recommends that added sugars as well as natural sugars from honey, syrup, and fruit juices, should account for no more than 10% of total daily energy (WHO, 2003). Generally, in Canada and the United States, non-pregnant individuals' consumption of sugar typically exceeds recommendations (Duffey & Popkin, 2008; Langlois & Garriguet, 2011). Sugar intake has not been extensively studied during pregnancy, however there is evidence that pregnant women increase their consumption of high sugar foods and beverages such as sweet spreads, cakes, puddings, soda, and other sugar-sweetened beverages (Crozier, et al., 2009; Wen, et al., 2010). Several studies suggest that women are aware of their health and the importance of sound nutritional practices during pregnancy (Anderson, 2001; Szwajcer, Hiddink, Koelen, & van Woerkum, 2007); however, women may have difficulty applying nutrition knowledge to their own dietary behaviours (Begley, 2002).

Physical symptoms, lack of resources, and changes to socio-cultural norms are all reasons cited by women who do not apply dietary changes that result in optimal nutrition. Nausea and aversions often result in decreased consumption of meat and vegetables, while cravings for sweets are associated with increased sugar and energy intake (Latva-Pukkila, Isolauri, & Laitinen, 2010; J. F. Pope, Skinner, & Carruth, 1992). Lack of information, skills and guidance of nutrition during pregnancy are barriers to implementing healthy eating behaviours (Begley, 2002). Pregnancy is also associated with new health norms that direct what is, or is not, socially acceptable to eat (Baric & MacArthur, 1977; Copelton, 2007).

Food choice includes a diverse and dynamic range of factors that are context-specific (Rozin, 1980). Deeper understanding of the personal, cultural and social

prompts for dietary changes are needed in order to improve the nutritional status of pregnant women. This research can then inform the development of effective interventions for improving dietary behaviours during pregnancy. Specifically, knowledge of how and why sugar consumption changes during pregnancy is important for providing appropriate guidance to achieve a healthy diet. The purpose of this study is to explore 1) why women increase, decrease, or maintain their consumption of sugar during pregnancy, 2) what socio-cultural factors influence sugar intake, and 3) the barriers and facilitators to consuming a diet low in sugar.

2. Methods

Focused ethnography was deemed to be the most appropriate way to address the research questions and the study goals. This qualitative strategy was well suited to the examination of the specific problem of sugar consumption within the culture of pregnancy from the participant's point of view.

Study Background

This qualitative study is part of an ongoing project called *Sweet Moms* at the University of Alberta, Edmonton, Canada. Using a mixed methods approach, the purpose of Sweet Moms is to examine the influence of sugar on maternal and fetal health. Participants for Sweet Moms were recruited from prenatal clinics, pregnancy care centers, other family practices, a study website, and shops selling maternity or baby products. Participation was limited to pregnant women 16 years of age or older, able to read and write English and living in Edmonton or a surrounding area. Participants completed a demographic questionnaire that asked them to report age, number of previous pregnancies, weeks gestation, marital status, education, household income,

ethnicity, smoking in the household, and alcohol consumption. Among other dietary assessment measures, participants completed a sugar-screener questionnaire (SSQ) regarding the portion size and frequency of consumption of common high-sugar foods to estimate added sugar intake.

Women in the third trimester of their first pregnancy who consented to an interview were considered for the present study. Ethical approval was obtained from the Human Research Ethics Boards at the University of Alberta. Confidentiality was ensured by removing all personal identifiers from the data.

Data Generation

Sampling

For this study, participants were purposefully selected from the Sweet Moms study. Using maximum variation sampling, pregnant women were recruited who had low (<60 g/d), moderate (60-80 g/d), and high (>80 g/d) intakes of added sugar as determined by the SSQ. Variation in sugar intake behaviours was sought in order to investigate why some women are able, or not able, to meet sugar recommendations.

Interviews

Data was generated using semi-structured interviews that were conducted in-person at the University of Alberta, or, for convenience reasons, in locations closer to the participant (e.g. home or workplace). Interviews lasted from 40 to 60 minutes, were audio-taped, transcribed verbatim, and reviewed for accuracy. Interview notes and a journal were kept to provide additional context and record analytic notes. All data was organized using the qualitative computer program ATLAS.ti (Version 6.2.27, 2011).

A framework of open-ended questions was used during the interview that asked participants about dietary change, social situations, physical symptoms (e.g. cravings, aversions), and interactions with others during pregnancy. Specifically, the women were asked how these experiences influenced their food choices and consumption of foods high in sugar (Table 4.1). After each interview, questions were rearranged or reformatted to improve clarity and to investigate new findings and potential themes. Probe questions were also used to clarify or gain more descriptive information (e.g. "Tell me more" or "What do you mean by that?"). Sampling of participants ceased after 15 interviews when the data was saturated and no new insights or patterns were found (Creswell, 2003).

Data Analysis

Using qualitative content analysis, data generation occurred concurrently with analysis (C. Pope, Ziebland, & Mays, 2000). To begin data analysis, the transcripts were re-read and analytic notes were recorded. Using an inductive approach, codes were created from the data and research questions. Transcripts were coded line-by-line to label important key words, phrases and concepts. After each interview, previous data was reviewed to add new codes where appropriate. Initially coding was generic and concrete (e.g. a craving). Then, as analysis progressed, more analytic codes were created (e.g. consuming sugar for comfort). Categories were developed to establish meaningful relationships between codes. To facilitate this process, a data matrix (Roper & Shapira, 2000) was constructed using Microsoft Excel (Version 12.3.3, 2008) to compare and contrast between experiences and patterns of behaviour between participants with high and low sugar intake. A written summary was prepared for each category to ensure homogeneity (Mayan, 2009). Analysis then focused on theorizing and identifying the

'threads' that linked categories and key concepts together in all of the interviews (Morse & Field, 1995).

To ensure rigor, verification strategies were employed throughout the research process. As suggested by Morse et al. (2002), these included investigator responsiveness, methodological coherence, appropriate sampling, concurrent data collection and analysis, thinking theoretically, and theory development. An audit trail was also used that documented analytic findings and decisions. Findings were reviewed during meetings with colleagues and other researchers to provide feedback as themes were being developed.

3. Results

Demographics

Fifteen interviews were conducted between June 2011 and January 2012. The average age of participants was 29, ranging from 21 to 36 years old (Table 4.2). Overall, most women were married, Caucasian, had a higher education, and reported household income greater than $70,000 Cdn. However, women who were single, low socio-economic status, and of a different ethnicity were also included in the study. Added sugar consumption varied between approximately 33 to 160 grams per day.

Perceptions of Sugar

At the start of each interview, the women were asked to describe sugar. Some women listed foods such as candy, sweets, juice, ice cream, and chocolate; while others described two different types of sugar: natural and refined. None of the women could give an exact recommendation for sugar intake, but many stated that sugar should be consumed in moderation as part of a healthy diet. When the women were asked to

elaborate, answers were often vague and included subjective responses such as “not overdoing it”, “eat once in a while”, and “a little bit is ok”.

Participants believed that sugar could affect health in general, but few women could describe how. Gestational diabetes was mentioned as one reason to be concerned about sugar intake during pregnancy. Women felt more concerned about their diet and sugar intake shortly before being tested for gestational diabetes, but after clearing the test, they felt “home free” with no further reason to monitor sugar intake. Some participants also mentioned that they would think more about their sugar intake if they were not in the correct range for gestational weight gain. Participants discussed the importance of nutrition during pregnancy and the responsibility they had for making healthy food choices for the baby. However, the majority of women did not perceive sugar as having a specific, immediate threat to their baby’s health. Therefore, attitudes were mainly neutral towards sugar intake. When discussing consumption of high sugar foods, one participant stated, “it may not be the healthiest thing – it’s also not the most unhealthy thing you can have”.

Research Question 1: Why do women increase, decrease, or maintain their consumption of sugar during pregnancy?

Increase: Compromises

The experience of pregnancy resulted in dietary compromises to adjust to nutritional recommendations, physical symptoms and lifestyle changes. Many women increased sugar consumption as a result of these compromises.

Compromises for Dietary Changes

Participants discussed the importance of meeting specific nutritional recommendations. However, in order to make dietary changes to meet these recommendations, several women increased their sugar intake. For example, some participants focused on increasing calcium and fluid intake during pregnancy; however, it was necessary that any addition to the diet still appealed to the women's taste preferences. For instance, preferring chocolate milk over plain milk, or juice over water. In addition, the women perceived their diet to be healthy as long as certain dietary changes were made, particularly increased intake of milk, vegetables and fruit. As long as these dietary guidelines were met, women did not perceive added sugar intake as having a negative impact. Decreasing or eliminating caffeine was another important dietary change that women made. Beverages such as sodas and juice were popular replacements for coffee because the participants perceived sugary beverages as providing "energy" or a "jolt". Eliminating alcohol from the diet was discussed as an easy dietary change to make; however, in order to maintain social inclusion, several women substituted alcohol with a sugary beverage such as juice, soda or a non-alcoholic margarita because it made them still feel "special" or "in the loop" with their peers, whereas drinking water was "boring".

Compromises for Physical Symptoms

Common physical symptoms of pregnancy include cravings, increased appetite, nausea, and fatigue; these commonly result in dietary compromises that increase sugar intake. Although not experienced by all women, cravings are commonly reported for high sugar foods such as candy, ice cream, and cookies. Cravings are often viewed as a significant component of the experience of pregnancy and women are likely to seek out

and consume the craved food. Furthermore, several participants stated that they did not have pregnancy cravings, yet used the word 'craving' when they talked about consuming high sugar foods. Participants also shared how increased appetite resulted in less control over eating behaviours. Onset of hunger became a stronger drive for food choice than making healthy choices, as one participant stated, "I think the biggest thing is just what is easily accessible to you. If something has high sugar in it and you're hungry, it doesn't matter if it's unhealthy or not, right?"

Nausea was often the first barrier to healthy eating that was experienced during pregnancy and several women compromised their nutritional choices for a feeling of well-being. For example, one participant said, "I never feel sick after a Freezie. Ya it's a good choice – I'm fine with that!". Sugar-sweetened beverages such as juice, ginger ale, and other carbonated beverages, were frequently used to ease nausea. While some women were able to return to their regular dietary patterns when symptoms subsided, other women were affected for the remainder of their pregnancy because nausea disrupted their non-pregnant healthy eating routine. Several of the participants also felt that they consumed more sweets during pregnancy due to increased fatigue. Eliminating caffeine, sleeping difficulties, and dealing with nausea left women feeling low in energy so healthy choices were often traded for more convenient options. Women described consuming more snack foods that were easily accessible such as a granola bar, sugary cereal, or chocolate bar. Sugar was also perceived as a source of energy so women often consumed foods such as soda, candy, or chocolate, for a "boost".

Compromises for Lifestyle Adjustments

Women who experienced more stress during pregnancy commonly increased the intake of foods high in sugar. Participants discussed the financial concerns of planning for a child, anxiety about the ability to be a good mother, lack of social support, and sometimes just an overall sense of worry. Pregnancy created a challenge in dealing with stress, as prior strategies like exercise, a glass of wine, or a cigarette were no longer available. Therefore, consuming foods high in sugar became a new outlet for stress and a source of comfort. Participants were also affected by pregnancy-related changes in mood and emotional states. 'Emotional eating' was a new phenomenon for some women during pregnancy that resulted in increased consumption of high sugar foods. For example, one woman said, "Once I got pregnant it was, 'Oh I'm going to eat six chocolate bars today 'cause that'll make me feel better!'"

Changes to social activities also influenced women's eating behaviours. Some women found that social activities shifted from those that were physically based to food-related and sedentary. For example, one participant mentioned that her friends did not invite her to play Frisbee anymore; instead they would go for ice cream. Several women discussed changes to social activities due to feeling fatigued, changes in relationships with peers, or feeling uncomfortable in venues that sold alcohol. These women spent more time at home and less time out socially which contributed to eating out of boredom. These foods were often convenient snack foods such as candy, cereal and ice cream. One of the women with high sugar intake stated:

> I think that's one of the things that generates emotional eating or boredom eating, because I'm used to being out and seeing people and now I'm home, often by myself. I like T.V., but I watch way more than I should. So then I just eat things

because there's nothing else to do. It's sad. It sounds really sad. But ya, eating to fill time.

Maintain: 'Something that I've always done'

When asked about sugar intake, some participants shared how their consumption remained the same. These women consumed a high amount of sugar before and during pregnancy so it was part of their dietary routine and considered as a "normal" amount. Sugar was not viewed as part of their definition of a healthy diet or a necessary change for pregnancy. One participant with high sugar intake stated, "It's something that I've always ate, so I feel people don't feel like I've changed my diet to eat for two, or to give in to cravings. It's just something I've always done." Despite consuming a high amount of added sugars, these women perceived that their diet was healthier in pregnancy due to the addition of fruit and vegetable servings, which "balanced" their choices of foods high in added sugars.

Decrease: Sugar 'doesn't serve' you or your baby

Participants who made a conscious choice to decrease sugar when they became pregnant talked about avoiding sugar as part of a healthy diet that would benefit their baby and themselves. These women had a strong understanding of the link between nutrition (including sugar intake), gestational weight gain, and health. Prior to pregnancy, consuming high sugar items was not a great concern because the women felt like they had more control over their weight gain through calorie restriction or physical activity. However, during pregnancy, these participants were more concerned about how dietary choices affected weight gain. One participant stated, "You're never taking it off! So if

you put on a couple pounds, like a couple of extra pounds – sorry, you're *stuck* with them for 9 months!"

Food choices were also motivated by health-related values. The women commonly prioritized nutritious choices first to facilitate growth and development of the baby. Limiting sugar intake was also part of these women's definition of a healthy diet in general and this contributed to personal well-being. When talking about high sugar foods, one woman with low sugar intake said, "A lot of empty carbs, you know, candies and chocolates – it doesn't serve you. It honestly doesn't serve you".

Research Question 2: What socio-cultural factors influence sugar intake?

Cultural norms played an important role in the women's perceptions of what is acceptable to consume during pregnancy. Participants' sugar consumption behaviours were influenced by personal and social expectations of cravings for sweets, indulgence, and increased food intake during pregnancy.

Cravings were a major topic of interest and a source of amusement to the pregnant women, especially when discussed with others. Several women talked about their own expectations regarding cravings when they first found out they were pregnant. One woman with high sugar intake stated, "I tried the whole ice cream thing", where she had purchased ice cream in anticipation of craving it during her pregnancy. She also kept cookies and granola bars in her house because, "I'm going to want that tomorrow morning, I can feel it". Similarly, another woman did not experience any cravings until she impulsively bought candy at the grocery store. She stated,

> I just tried one and it was really, really, really good. Then I was like, yup, I'm going to keep eating these! Then I actually went back to the store a couple times and bought more…I didn't realize they were cravings!

In contrast, women with low intakes of sugar described cravings differently with expressions such as: "desperate for a specific item", "it was a full body craving", "encompasses your thoughts". One of these women compared her experience with those of her peers in this quote:

> When women say 'Oh my god I'm craving double stuffed Oreos or Doritos' or whatever, I just sort of question what's really kind of going on there because I think that a lot of times it's just an excuse. The women who loved pregnancy I think were the ones that that statement will also be followed by the statement, 'I felt like I could eat whatever I wanted' and that sense of entitlement.

Beliefs about cravings were often related to the perception of the body requiring a specific nutrient. Some women made statements such as "you crave what you need" or "it is just what my body is telling me". For example, one participant felt that the reason she craved ice cream was because she needed calcium. Since these women were increasing sugar intake to fulfill a perceived physiological need, this behaviour was viewed with a positive attitude.

Both high and low consumers of sugar talked about consuming high sugar items that they had restricted prior to pregnancy. The women often made comments during the interview such as, "I've allowed myself", "I'm not as strict as before", or "I let myself have more". Even when the women were aware of nutrition guidelines and recommendations for energy consumption they felt like they had "a right to do more".

They no longer felt inhibited when consuming high sugar foods because it was expected during pregnancy and no one would comment on such behaviour. One of the women mentioned that her coworkers even expressed jealousy towards her dietary lenience during pregnancy. This attitude was often discussed in accordance with gestational weight gain. Prior to pregnancy, women restricted high calorie foods to prevent weight gain, however this concern disappeared for some women during pregnancy. For instance, one woman with high sugar intake said:

> I was more conscious of my weight before and now with pregnancy you're somewhat conscious, because you don't want to gain too much, but you certainly give yourself a lot more leeway, because you can. It's those few months in your life where it's ok if you gain weight. Nobody cares! Nobody will mention anything. So I definitely allow myself more treats.

Participants often justified their attitude and unhealthy eating habits with the temporality of pregnancy. One participant said, "Well I only have nine months of this…like, it's not going to happen once we actually have baby". Some women felt that they should take advantage of being pregnant and perceived it as "the one time when you can indulge a bit more".

Several participants described being treated differently by others during pregnancy and the visibility of their state made them feel like "public property". Women were often subject to the comments of other people, particularly regarding views of what she should be eating or not. While food choices such as drinking coffee received criticism, women rarely received comments on consuming high sugar items; in fact, it was often encouraged. During the interviews, the women described situations where they

experienced verbal and non-verbal pressure to consume high sugar items or to eat more than they wanted to.

> If there were cookies in the office they were brought to me three times versus everybody once - why wouldn't you have more? Even if you didn't want them, but then they are there, then you eat them, you know? Ya, peer pressure to over do it.

Participants also discussed how their eating behaviours were influenced by their partner. This depended on his personal eating habits, level of support, and knowledge of nutrition. Some women discussed that their partner was a negative influence when he did not share the same nutritional values and they felt tempted by his unhealthy food choices. Many of the men would also offer high-sugar treats as a way to comfort the participant. Other women discussed how their partner was "taking advantage" of the pregnancy by encouraging the purchase and consumption of high sugar treats. In contrast, some of the women's partners had a positive influence. These men often expressed interest in the woman's food choices and made an effort to support healthy dietary habits. Some of the women also described feeling self-conscious about consuming high sugar items in front of their partner if he had healthy eating habits.

Research Question 3: What are the barriers and facilitators to consuming a diet low in sugar?

Barriers

Physical symptoms, lack of nutritional support, and social pressure to make unhealthy choices were identified as barriers to achieving a diet low in sugar. As previously discussed, cravings for sweets, fatigue, and increased appetite were the major physiological challenges that prevented women from achieving a healthy diet. While

these symptoms are deemed unavoidable, the women felt that they would have benefited from specific strategies to make healthier choices while experiencing these symptoms during pregnancy.

Advice from health care professionals was highly regarded by participants. The women discussed making the changes that were mentioned by physicians, such as taking a multivitamin or increasing intake of fruit and vegetables. However, the women received little to no guidance in regards to sugar intake during pregnancy. Some participants indicated that they assumed that if a recommendation was not mentioned it was because it was not important. For example, one participant described her relationship to health care providers: "They just kind of said, like, if we're concerned, then you can be concerned, but we're not concerned."

Women also discussed how proper weight gain during pregnancy was a major focus during medical appointments, yet there was little information provided on how to meet recommendations through nutrition and dietary choices. Those women with high sugar intake often felt that if they had received more nutritional support at the beginning of pregnancy they could have had a more positive experience and maintained a diet low in sugar, which may have helped them to meet weight gain recommendations.

> So now I'm 45 pounds, I know some people end up much more than that, but it's depressing. So if there had been a way to be ten pounds less at this point, I would feel better. So I think that that discussion has to happen at the beginning. Otherwise it's just too late to do anything about it…. I could have gained less weight if I paid more attention to what I ate but because the challenging part for

me was the first trimester and the beginning of second, it's too late to go back now and lose what I gained then.

Social support was also identified as a way to assist healthy dietary changes. Participants felt that their partner would be the best source of support since they eat the most meals together and he also has an interest in the health of the baby. Participants also felt that their partner could have a positive influence by being a role model for healthy eating, increasing participation in meal preparation, and suggesting healthier choices. The women also expressed a need for more support from their peers and coworkers through discussions about healthy food choices, rather than conversations about cravings and indulgences.

> There could be some discussion about it! I just don't think there is a lot of positive discussion about what's required. I mean really the discussion that we have is you could probably eat this whole table, or what are you craving. The answer for me was always neither of those things, like I didn't have weird cravings. I didn't have an urge to eat tons of food all the time. That wasn't the problem. It's just there's no discussion about what choices you make and why and what kind of thing you can do to make better ones. I think inherently most people know the answer to that question, but it's easy to ignore when there is nobody talking to you about it.

Although the women had intentions of making healthy food choices, many found it difficult to resist social pressures to eat high sugar foods. Women often felt that people expected them to indulge and to eat more in social settings due to misconceptions of dietary needs during pregnancy. Other people often told them: "you can eat whatever you

want because you're pregnant", "you'll lose the weight afterwards, it's not that big of a deal", "that's not a big enough piece of cake - your baby wants some". Even if the women did not agree with the perceptions of others, they often gave in to expectations in order to be polite or to feel socially included.

Facilitators

Women who had a diet low in sugar during pregnancy created healthy dietary strategies to adjust to physical and social changes. These strategies were facilitated by increased nutritional knowledge and awareness of how a nutritious diet was associated with the health of the mother and her baby. One of the strategies used by the women who met the recommendations for sugar consumption during pregnancy was to plan for physical discomforts by preparing healthy choices in advance. For example, to accommodate increased appetite these women carried healthy snacks with them (e.g. fruit, vegetables, soy beverage) so that they were less likely to rely on convenience foods and make impulsive purchases. They prepared meals when they were feeling well in order to avoid preparation when they were feeling nauseous or fatigued. Finding suitable alternatives for high sugar items was another facilitator. For instance, one of the participants did not enjoy the taste of plain water so she added fruit slices to it. At social events, another participant substituted alcohol with sparkling water, but used a wine glass to feel more included in her peer group.

Participants who decreased dietary sugars during pregnancy focused their attention on acquiring nutrient-rich foods first by replacing items high in sugar with healthier alternatives. For example, substituting ice cream with plain yogurt and fruit. One of the participants shared how she would consume something healthy first before

indulging in a craving. This strategy was guided by her goal to ensure that her baby received important nutrients before making an unhealthy food choice for herself. Another participant mentioned that she would combine a nutritious item with a sweet craving, such as oatmeal with brown sugar on it.

Experiencing pressure to indulge in high sugar items was very common among all participants. One woman who made a conscious decision to lower her sugar intake during pregnancy was able to resist social pressures by informing people that her decision was for the health of her baby. She would also make a point to teach others about the importance of nutritious food choices during pregnancy.

> I'd just be like 'no, like I'm really trying to eat healthy'....When you tell people, you're like well the doctor said in the first trimester you're only supposed to eat like an extra apple a day, they are like, 'Are you serious? That's it?'

4. Discussion

This study examined sugar consumption behaviour during pregnancy from the perspectives of pregnant women. Both individual and social factors affected the women's sugar consumption behaviour and these in turn were influenced by cultural norms.

Beliefs and Attitudes

Women who increased sugar intake made compromises in an effort to balance and achieve a compromise between meeting nutrition recommendations, their physical symptoms, and lifestyle adjustments that they made during pregnancy. Women in the study who maintained sugar consumption behaviours into pregnancy did so through habit. Women who decreased sugar intake made a conscious decision that was influenced by concern for maternal and fetal health and based on knowledge of the impact of

unhealthy choices, including the consumption of high sugar items.

The Theory of Planned Behaviour (TBP) proposes that behavioural intentions are guided by attitudes towards the behaviour, subjective norms and perceived behavioural control (PBC) (Ajzen, 1991). Attitudes are formed by evaluating the positive or negative effect of the behaviour and are a function of personal beliefs regarding the expected results. Subjective norms are described as the perceived social pressures to act on certain behaviours and the desire to conform to social expectations. PBC is the individual's belief regarding his/her capability to perform the behaviour, which is related to the availability of resources.

This theory can be applied to the present study to help understand why women altered or maintained sugar consumption during pregnancy. Attitudes appeared to be important in determining sugar consumption behaviours, as the women who decreased sugar intake believed that this would have a positive effect on their pregnancy. Participants who increased sugar consumption during pregnancy did not perceive sugar to be a positive or a negative influence on health; however, indirect benefits included social inclusion, pleasure, and comfort. While some participants experienced pressure from their partner to monitor sugar consumption, the majority of the women experienced social pressure to indulge and over-consume foods that were high in sugar during pregnancy and would conform to these norms. PBC of the women who increased sugar intake may have been influenced by their lack of professional guidance about sugar intake during pregnancy and inadequate knowledge about the effects of sugar intake on health. Connor and Armitage (1998) expanded on the TPB to include past behaviour as a predictor of present behaviour. This may help to explain why some women maintained high sugar

intake during pregnancy, because their previous dietary patterns predicted their sugar consumption during pregnancy.

While the TBP is helpful in portraying the importance of attitudes and beliefs in determining sugar intake, the complexity of this behaviour during pregnancy requires further consideration. Pregnancy may add additional variables that are not included in the TBP, as women may experience opposing attitudes towards the same behavior. For example, they might consider health as important for the baby while they themselves experience a desire for enjoyment or comfort. The TBP is often more successful in predicting specific behaviours than general ones (Baranowski, Cullen, & Baranowski, 1999). Compared to a behaviour change such as quitting smoking, reducing sugar consumption requires multiple behaviours, such as increased awareness of sugar intake, reading nutrition labels to determine foods high in sugar, and finding suitable alternatives. Numerous foods contribute to sugar consumption behaviours, and attitudes may be different for certain foods or eating situations.

Dietary Compromises

In this study, women increased sugar consumption by making compromises for dietary, personal, and social changes during pregnancy. Women who had a low sugar intake during pregnancy created strategies that were influenced by their values regarding maternal and fetal health and awareness of how sugar intake may affect these values.

Previous qualitative studies have developed a model of food choice where people form a "personal food system", which is described as the ways people construct food choices by considering personal values within a multitude of influences (Connors, Bisogni, Sobal, & Devine, 2001; Furst, Connors, Bisogni, Sobal, & Falk, 1996). These

values are the set of considerations people weigh when making a food choice that guides and motivates dietary behaviour (Connors, et al., 2001). Connors et al. (2001) suggest that there are five main values that include taste, convenience, cost, health and social relationships. For each individual these values vary in importance and their relative strength may be different for specific eating situations. In a study that examined the influences on grocery shopping decisions, Furst et al. (1996) found that people developed personal food systems that included negotiations and behavioral strategies. Negotiations are the considerations involved in making a food choice when values conflicted (e.g. health vs. convenience). Strategies simplified the food process and often became part of a person's routine. Strategies were shaped by individual patterns and rules within a larger food system that could be applied to many different food choices.

Similar results were found in this study, as women created a new "personal food system" by making compromises and creating strategies to adapt to changes experienced during pregnancy. The values involved in making food choices may be reorganized during pregnancy as women acquire nutritional knowledge and experience physical and social changes. For some women, consumption of high sugar foods is a way to satisfy several values, particularly comfort, convenience, enjoyment, social acceptance, taste, and even health in certain situations. For example, women who disliked milk but regarded calcium as important, compromised by consuming chocolate milk and thereby satisfied values for health and taste. Furthermore, cultural norms of consuming sweets during pregnancy may have influenced the acceptability of these food choices to the women.

Socio-Cultural Norms

Participant's food choice during pregnancy was directed by culturally embedded beliefs that affect the women's personal beliefs and attitudes as well as other's behaviour towards them. The consumption of high sugar foods and beverages was influenced by personal and social expectations of sweet cravings, indulgence, and increased food intake.

Relaxed social pressure of weight maintenance and aesthetics during pregnancy is a common theme in the literature, particularly among women who were classified as restrained eaters before pregnancy (Clark, Skouteris, Wertheim, Paxton, & Milgrom, 2009; Conway, Reddy, & Davies, 1999). This attitude was also seen throughout interviews and participants thus felt less inhibited in consuming calorie-dense foods high in added sugar.

As seen in the interviews and in previous studies, perhaps the most important nutritional norm during pregnancy is the expectation that the mother will place the needs of the baby first (Bondas & Eriksson, 2001; Copelton, 2007). However, consuming a healthy diet with moderate intake of sugar is a general norm that applies to everyone, not just women during pregnancy. Compared to specific pregnancy norms (e.g. avoiding alcohol), consuming foods high in sugar may not associated with immediate consequences for non-conformity (Baric & MacArthur, 1977). Furthermore, when high sugar foods are identified as cravings during pregnancy, women are excused from nutritional norms due to the perception that poor nutritional choices are out of the woman's control (Copelton, 2007).

Barriers and Facilitators

Participants indicated that the major barriers to meeting sugar recommendations

during pregnancy included physiological factors (e.g. fatigue, cravings, appetite), social pressures, and lack of support from health professionals, peers, family members and the woman's partner. Facilitators employed by the women with low sugar intake in achieving a healthy diet consisted of making healthy food choices part of a regular routine and developing strategies to deal with physical symptoms and social changes. These strategies were guided by nutrition knowledge and attitudes towards personal health and the health of the baby.

This study confirms previous findings seen in the literature that cravings, nausea, fatigue, and stress are physical barriers to achieving a healthy diet during pregnancy. Although not specific to pregnancy, cravings are commonly reported by pregnant women, especially for sweet items such as ice cream, sweets, chocolate, and fruit juices (Hook, 1978; J. F. Pope, et al., 1997). A large proportion of women experience nausea and vomiting during pregnancy and women with these symptoms are likely to consume less meat, vegetables and more likely to consume carbohydrates (Latva-Pukkila, et al., 2010). Hurley et al. (2005) found that pregnant women who experienced more stress and anxiety during pregnancy consumed more fats, oils, sweets, and snack foods. Additionally, women who reported greater fatigue were more likely to report increased consumption of calorie-dense/nutrient-poor foods, and less folate. While physical symptoms of pregnancy cannot be prevented, providing women with strategies for dealing with these barriers can guide women towards a healthier diet. For example, when craving sweets, Brody (2003) suggests that women substitute foods that have similar qualities as the craved food, but are a more nutritious choice (e.g. instead of soda, have mineral water mixed with fruit juice).

Previous studies have shown that social support during pregnancy from a partner or other people can facilitate healthy behaviour changes. Olson and Strawderman (2003) found that low social support during pregnancy was associated with ~3 lbs (1.4 kg) higher weight gain than women with average or high support. In a study that examined the relationship between social support and health behaviours in a sample of low-income pregnant women (n=101), participants identified partners, peers and family members as positive influences on the initiation of healthy eating behaviours by providing support, advice, and information, or having conversations about the pregnancy (Schaffer & Lia-Hoagberg, 1997). A study examining the influence of social support on behaviours among Latino women during pregnancy and postpartum, found that the opinions of husbands and female relatives influenced women's beliefs and motivations of healthy behaviours, including diet (Thornton et al., 2006). Therefore, including partners and/or family members in nutrition interventions, may be a way to increase the success of achieving a healthy diet during pregnancy.

Insufficient advice from health care professionals has been identified in previous studies as a barrier to initiating dietary change, similar to the results reported here. Begley (2002) conducted focus groups with pregnant women and women planning a pregnancy and reported that women perceived physicians as the major source for important nutrition information, yet physicians often had limited knowledge and time to provide dietary advice. However, pregnant women often cite health care professional's advice as a reason for making a health behaviour change (J. F. Pope, et al., 1997). Furthermore, Anderson, Campbell and Shepherd (1993) found that pregnant women were more likely to be motivated by social pressure from physicians and family members than by increased

knowledge about diet and nutrition. Health professionals may be one group who could provide more guidance to pregnancy women about sugar consumption during pregnancy, so that women may be less likely to rely on social and cultural influences.

Another barrier to achieving a healthy diet may be that women are more knowledgeable about specific recommendations for pregnancy than about general nutrition guidelines. Pregnant women are more likely to adhere to smoking, alcohol, and food safety guidelines, than to changing their intake of fruit and vegetables (Crozier et al., 2009). A study by Fowles (2002) conducted in the United States found that only 10% of women in the third trimester of pregnancy could correctly identify the recommended number of servings for food groups in the Food Guide Pyramid. Pregnancy is commonly referred to as an ideal time for improving women's nutrition knowledge and behaviours because women are highly motivated and open to receiving information (Anderson, 2001; Szwajcer, et al., 2007). However, nutrition guidance and strategies from trusted sources are required in order to take advantage of this opportunity.

As seen in the study by Falk, Bisogni and Sobal (1996), focusing on one value is a method people use to simplify food choices and make healthy dietary changes. Value for the health of the baby is frequently reported as a motivator for food choices during pregnancy (Copelton, 2007; J. F. Pope, et al., 1997). Therefore, identifying personal motivators may be a key component for implanting healthy behavioural changes. However, Croghan (2005) suggests that long-term dietary changes may be sustained if motivators are about the personal gain of the women themselves rather than the baby's health.

Implications for Practice

Figure 4.1 shows a model of the influences on sugar consumption during pregnancy. The model consists of four major factors involved in women's compromises during pregnancy including meeting nutrition recommendations, physical symptoms, lifestyle adjustments, and conforming to socio-cultural norms. Beliefs; attitudes; and resources such as skills, time, and knowledge; manage the balance of food choices. Additional variables may be incorporated into the model to identify strategies to help women achieve a healthy diet that meets sugar recommendations (Figure 4.2). As previously discussed, these variables should address individual and socio-cultural factors in addition to satisfying personal values (e.g. taste, manage relationships). Examples of strategic variables from this research include increased involvement by health care providers, social support, and addressing dietary and lifestyle changes. Health practitioners can use this model to develop a nutrition intervention to target healthy eating behaviours and to improve maternal health.

Strengths and Limitations

A major strength of this study is that the influences on sugar consumption are investigated in-context, not in isolation, from the women's own perspectives. Although the sample size may be considered small compared to quantitative studies, this allowed for development of an in-depth understanding, which was a higher priority for this study. Information generated from women who varied in sugar consumption was sought in order to find common themes within experiences of pregnancy. In addition, women from across a range of demographic characteristics were included to reflect a wide range of perspectives. This allows for generalization of the findings to other women who may

have similar experiences of initiating or maintaining dietary changes in pregnancy. Results from this study may not apply to women who develop complications during pregnancy such as gestational diabetes or preeclampsia as this may create a different experience for dietary changes with unique barriers and facilitators.

5. Conclusion

This research describes individual, social, and cultural factors that influence women's sugar consumption behaviours during pregnancy. Personal beliefs and attitudes, in addition to resources, are important to consider when developing strategies to help women achieve a healthy diet. While there is a large variability in dietary behaviours among women during pregnancy, understanding the common experiences that contribute to suboptimal nutrition is key to developing successful interventions to improve maternal health.

The 'life-course perspective' suggests that important events, or 'transitions' in people's lives may lead to changes that continue throughout later periods of the life course (Wethington, 2005). Pregnancy is an important transition in a woman's life that creates an opportunity for changes in dietary habits extending postpartum. While other pregnancy-related dietary changes (e.g., avoiding alcohol and caffeine) are often temporary, targeting sugar intake may be a dietary change with potential to last beyond pregnancy.

Table 4.1: Major Interview Topics and Sample Questions from an Interview Framework

Topics	Sample Interview Questions
Dietary change	Since becoming pregnant, what changes have you made in your diet and why?
	Tell me about how your sugar intake has changed since becoming pregnant?
Social situations	How has your lifestyle changed since becoming pregnant?
	How did being pregnant affect what you ate/drank during social outings?
	Tell me about any social situations during pregnancy where you felt like you ate more sugar than you normally would?
Physical symptoms	Where there any physical changes you experienced during pregnancy that influenced your consumption of high sugar foods?
	Tell me about any cravings you had during pregnancy.
Interactions with others	Tell me about any experiences where someone influenced your decision to eat something high in sugar.
	How have the people closest to you during pregnancy influenced your food choices?
	What nutrition information have you received from your health care provider?

Table 4.2: Participant Characteristics

Characteristic	N = 15
	Mean(Range)
Maternal age	29 (21-36)
Pre-pregnancy body mass index (kg/m^2)	25.1 (20.7-37.7)
Added sugar intake (grams/day)	76.0(33-160)
	n
Marital Status	
Married	10
Common-law	3
Single	2
Education	
High school	1
Trade	4
Post-secondary	10
Household Income	
<20,000	1
20,000-39,999	2
40-69,999	1
>70,000	10
Prefer not to answer	1
Ethnicity	
Caucasian	13
South Asian	1
Chinese	1
Smoking	
Never smoked	9
Used to smoke, quit before pregnancy	4
Used to smoke, quit when found out pregnant	1
Currently smokes	1
Alcohol	
Never consumed alcohol	3
Quit before pregnancy	2
Quit when found out pregnant	10

Figure 4.1: A Model of the Factors that Influence Women to Increase Sugar Intake During Pregnancy

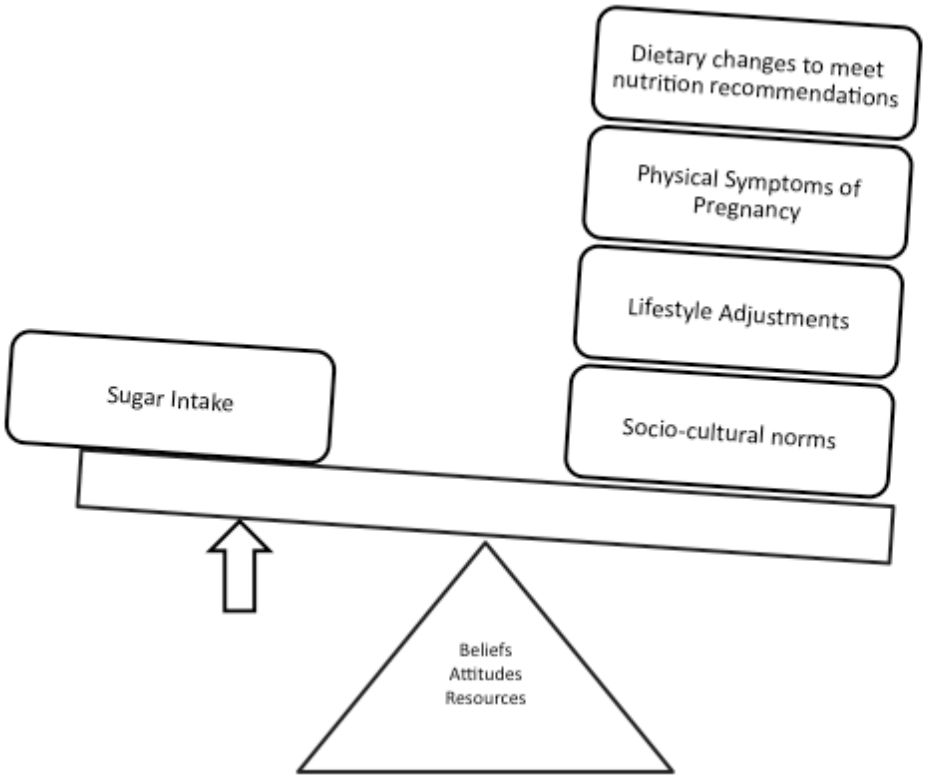
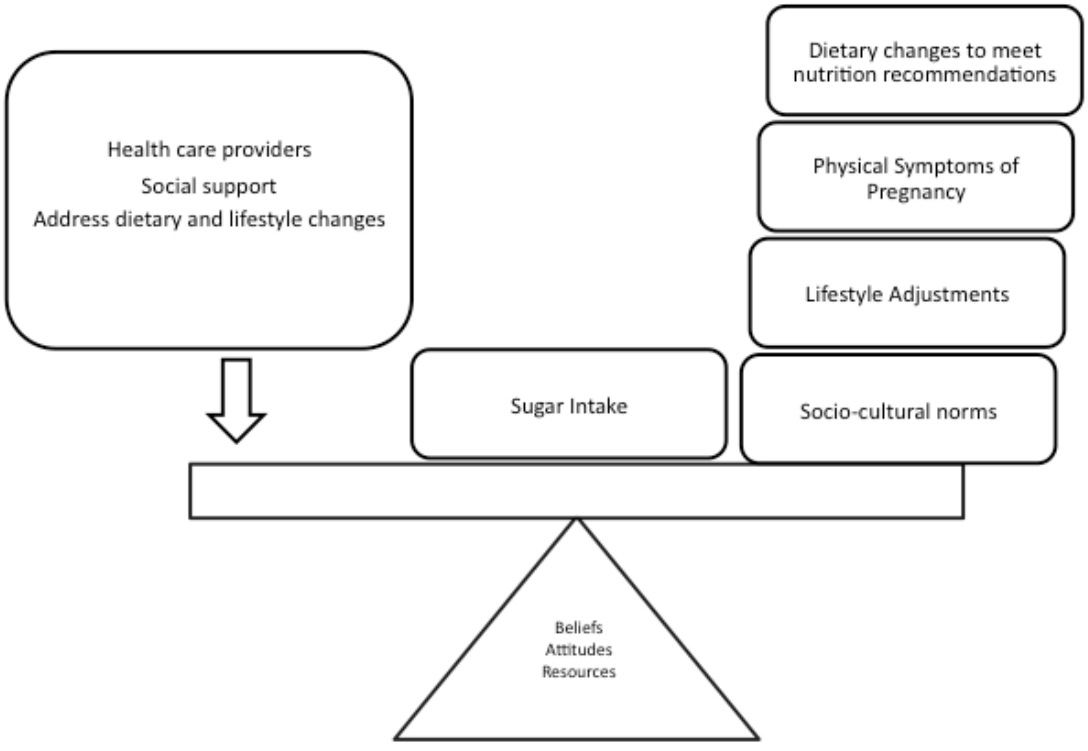


Figure 4.2: A Model of Intervention to Lower Sugar Consumption During Pregnancy



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Chapter 5: Discussion and Conclusions

1. Research Implications

This study contributes meaningfully to our understanding of food choices and sugar consumption during pregnancy. It identifies several factors that may deter women from achieving a diet that meets nutritional recommendations during pregnancy. Physical and lifestyle changes that are part of pregnancy present challenges to optimal nutrient intake and play a role in women's sugar consumption behaviour. Cultural ideals of pregnancy significantly affect the attitudes and beliefs of women within their social network, in turn affecting the way women construct meaning attached to high sugar foods and beverages. Results from this study underline the fact that several factors affecting food choice during pregnancy are integrated and that these factors should be examined from a holistic perspective and not in isolation. For example, craving is a physical factor but psychological and social components interact with cravings and the combination of these factors play a role in deciding food choices.

Few studies have reported successful interventions in changing pregnant women's health behaviours. In a systematic review, Campbell et al. (2011) conducted a meta-analysis of 5 controlled clinical trials of interventions that used diet, with or without a physical activity component, to prevent excess weight gain in pregnancy. When the results from the studies were combined, the interventions had no significant effect on gestational weight gain compared to participants in the control groups. Widen and Siega-Riz (2010) conducted a review of the literature on pregnancy nutrition, gestational weight gain, and resources for health care professionals. Many of the intervention studies mentioned in this review had little or no effect on women's adherence to weight gain

guidelines during pregnancy. Although pregnancy has been reported as a time when women are more aware of nutrition, increasing awareness may not be sufficient to initiate dietary change (Anderson, Campbell, & Shepherd, 1995). The present study identifies several barriers and facilitators to meeting dietary recommendations around sugar intake that occur during pregnancy. Understanding the determinants of food choices and the challenges women face in achieving a healthy diet is an important step to support appropriate behavioural changes.

Social modeling is an important influence on food choices (Contento, 2011). Thus, women who improve dietary habits during pregnancy may become role models to other pregnant women, their partner, and perhaps their future children (Anderson, 2001). Encouraging women to moderate sugar intake may lead to lasting changes beyond pregnancy. This could have important on-going implications since guidelines about sugar intake are not specific to pregnant women. This opportunity to improve health behaviours of women and potentially others in their social network, should be considered more thoroughly by health care providers (Anderson, 2001; Barger, 2010).

2. Recommendations for Practice

The goal of this research was to understand the influences on women's sugar consumption behaviours during pregnancy and the barriers and facilitators to controlling sugar intake. The in-depth information collected in this study, from the point of view of pregnant women themselves, has significant implications for knowledge translation. Findings from this study may be used to assist health care professionals in providing appropriate nutritional guidance to pregnant women and to assist in the development of intervention studies that will improve maternal diet and health outcomes. The increased

understanding of food choices that contribute to poor diet quality during pregnancy provided by this research can inform several possible recommendations for practice, including:

a) Provide specific dietary strategies to implement pregnancy nutrition recommendations
b) Address attitudes and beliefs of pregnant women regarding nutrition and sugar intake
c) Consider dietary changes within social contexts of pregnancy
d) Individualize dietary recommendations to the pregnant woman
e) Increase involvement of health care professionals in providing nutritional advice to pregnant women
f) Initiate nutrition counseling in early pregnancy

a) Provide specific dietary strategies to implement pregnancy nutrition recommendations

Women require knowledge of specific guidelines in order to achieve sugar intake recommendations. They need to be able to understand nutrition labels and identify foods and beverages that are high in added sugar. However, previous studies have reported that increased nutritional knowledge was not strongly associated with behaviour change in pregnancy. For example, Jones, Housman and McAleese (2010) found that 95% of pregnant women reported knowing that a nutritious diet was important and 89% were aware of the guidelines for weight gain, yet only 49% of women reported eating recommended servings of fruits and vegetables and 59% reported gaining an appropriate

amount of weight. While nutritional information can help inform dietary choices is it not sufficient to bring about behavioural change.

In this study, women with a low intake of added sugar developed strategies during pregnancy to maintain a healthy diet and limit their sugar intake. This included replacing, modifying or eliminating high sugar foods and/or beverages. These strategies were guided by nutritional knowledge and driven by motivators such as personal and fetal health. Similarly, Fowles, Hendricks, and Walker (2005) conducted interviews to identify healthy eating strategies used by low-income women during pregnancy. These women had knowledge of the importance of nutrition, received social support, prepared foods that differed from their family members, and ate more meals prepared at home. Further research is required on the specific practices women employ to make healthy dietary changes and the resources required to maintain changes during and after pregnancy. As suggested by Fowles and Fowles (2008), a community peer-to-peer program where pregnant woman can exchange ideas and strategies for making healthy choices may be beneficial.

b) Address attitude and beliefs of pregnant women regarding nutrition and sugar intake

The Health Belief Model (HBM) may be useful in understanding the women's sugar consumption behaviours described in this study. This model suggests that behaviours are influenced by personal beliefs concerning susceptibility to health threats and perceptions of benefits versus costs (Rosenstock, Strecher, & Becker, 1988). In order for health-related actions to occur, pregnant women should be counseled about the

potential adverse consequences of excess added sugar intake to personal health and to the health of their baby, the benefits of decreasing sugar relative to the perceived psychological/social/physiological costs, and how to enhance self-efficacy in choosing a diet that is low in added sugars. Informing women about scientific evidence that food choices made during pregnancy can potentially impact their own health, the health of their baby, and perhaps future generational health (Barker, 1997), is one step that may help to address women's disregard for making unhealthy choices. However, knowledge needs to be paired with practical strategies that address other aspects of the HBM or the Theory of Planned Behaviour to translate to effective behaviour changes.

In a prospective study, Claesson et al. (2008) compared total gestational weight gain among obese pregnant women who either participated in a behavior change intervention group or a control group that did not receive this intervention. Those in the intervention group gained less weight and weighed less at a postnatal checkup (10-12 weeks postpartum) than the control group. The intervention consisted of motivational interviews conducted in early pregnancy, assessment of nutrition knowledge, information about the consequences of food choices, and encouragement to exercise, in addition to weekly one-on-one sessions with a midwife that focused on weight management and supportive discussions. Motivational interviewing may have played a key role in the success of behaviour change and should be considered for future interventions. This client-centered approach focuses on a person's own values and concerns in resolving ambivalence (Rubak, Sandbaek, Lauritzen, & Christensen, 2005). This approach may be particularly useful in an intervention to decrease sugar consumption because women may experience ambivalence towards consuming high sugar foods during pregnancy. For

example, consuming foods high in added sugar is an enjoyable behaviour, but at the same time, potentially detrimental to personal and fetal health.

c) Consider dietary change within social contexts of pregnancy

In this study the attitudes and perceptions of pregnancy by women were shaped by social and cultural factors, which consequently influenced food choices. Participants commonly viewed pregnancy as a temporary period of time where indulging in previously restricted food choices and increasing sugar intake was socially acceptable. In other qualitative studies, 'pregnancy as a time of change' is a common theme that women use to justify unhealthy food choices (Campbell, Johnson, Messina, Guillaume, & Goyder, 2011; Copelton, 2007). Furthermore, in the present study, perceptions of pregnancy held by the women's partners, friends, and family members also influenced participants' sugar consumption behaviours. Many women described conforming to social pressures to consume high sugar foods and make unhealthy choices.

The systematic review by Campbell et al. (2011) found no significant effect of controlled clinical trials of interventions for weight management during pregnancy. However, the authors also included an analysis of qualitative studies and suggested that future interventions may be more effective by including findings from such studies, with particular attention to social attitudes and beliefs about pregnancy. As seen in the present study, foods and beverages high in added sugar are highly associated with the experience of pregnancy within social contexts. Addressing barriers to achieving a healthy diet during pregnancy; in addition to socially bound perceptions of food, nutrition and weight; may be key to successfully influencing behavioural change.

In order to assist pregnant women in achieving sugar intake recommendations, health care professionals may have a role to play in advocating for low sugar intake. Public health campaigns could also be mounted to raise public awareness of the importance of a healthy diet during pregnancy. In the study by Olson (2005), women who participated in a program that promoted healthy dietary intake during pregnancy adopted positive dietary changes that lasted up to 2 years postpartum. This positive change included an increase in the consumption of fruits and vegetables as well as regular consumption of breakfast. The authors speculate that the increase in national and local campaigns during the time of the study may have had an influence on the women's nutritional knowledge and of the importance of nutritional changes to long-term health at a time when they were impressionable.

Nutrition counseling should also help to dispel some of the cultural beliefs associated with sugar intake, particularly the idea that pregnancy is a time to indulge in high calorie foods/beverages. Increasing women's awareness of social influences and working toward solutions that could be used to overcome pressures to consume unhealthy foods may help women to make better dietary choices. One cultural value discussed by women in this study that may override women's dietary choices for high sugar items is caring for the health of the baby. Therefore, highlighting the immediate influence that maternal food choices may have on the developing baby and mother could be an important factor in initiating dietary change.

d) Individualize dietary recommendations to the pregnant woman

Pregnancy is a unique experience for each woman that is often characterized by changes in food preferences, and dietary behaviours. Strategies that promote healthy eating and low intake of added sugars may be more acceptable and effective if they relate specifically to a woman's diet and her personal experience of pregnancy. For example, addressing individual barriers to healthy eating such as physical discomforts or coping with personal or social stressors. This may assist in reducing the "information overload" that was often discussed in the interviews. "Information overload" was seen as a common barrier to implementing healthy dietary changes where women felt overwhelmed by the amount of information they were exposed to during pregnancy.

The sugar-screener questionnaire (SSQ) used in this study may be a useful tool for monitoring which foods and beverages contribute to high added sugar intake in a pregnant woman's diet. Health professionals could follow up on the questionnaire by assisting women to make dietary changes by targeting intake of specific foods, rather than providing general nutrition advice. Participants in this study expressed a need for information regarding what they *should* eat, rather than just a list of foods to avoid. Food preferences were also an important part of women's food choices during pregnancy and should be considered when recommending dietary changes.

e) Increase involvement of health care professionals in providing nutritional advice to pregnant women

During the interviews, the women often discussed making dietary changes because of a recommendation by a health care professional. However, they felt that nutritional information received minimal attention and usually concentrated on single

recommendations such as increase fruit and vegetables or take a multivitamin. Health professionals play an important role in the provision of credible and trustworthy information. Studies show that women also acquire nutritional information from books, the internet, magazines, websites, and other people, which may not be reliable sources of accurate information (Jones, et al., 2010; Szwajcer, Hiddink, Koelen, & van Woerkum, 2005). Furthermore, some women do not seek nutritional information during pregnancy because they expect to receive information from health professionals (Szwajcer, et al., 2005).

While the women in this study felt that overall dietary advice received was inadequate, several participants stated that health professionals discussed the importance of supplements. One of the women interviewed considered multivitamins to be a "quick fix" that compensated for unhealthy dietary choices. Supplements are often necessary for optimal vitamin and mineral intake but women should be encouraged to focus on dietary choices and the additional healthy benefits of food components including fiber and protein.

Participants also expressed that gestational weight gain was a major focus of health professionals but that dietary guidance to achieve weight gain within the appropriate range was lacking. Similarly, in a study that assessed health knowledge and behaviours of pregnant women, Jones et al. (2010) found that participants had sufficient knowledge about weight gain guidelines during pregnancy but did not have enough dietary information. Women in the present study felt that their physician did not discuss nutrition with them because their weight gain was within the recommended range. However, women may still meet gestational weight gain guidelines while consuming an

unhealthy diet that is high in sugar and/or nutrient poor (Fowles, Hendricks & Walker, 2005). Thus, all women should receive nutrition counseling, even when weight gain is within the accepted parameters. In addition, nutrition counseling should underscore the importance of a healthy diet during pregnancy as well as the relationship between weight gain and pregnancy outcomes. This was identified as a facilitator for women who decreased sugar intake during pregnancy in this study.

Furthermore, additional research on the advice women receive from health care providers is needed. For instance, what barriers do health care providers encounter in providing nutritional advice and what are effective information delivery strategies. Barger (2010) suggests that health care providers may feel inept in providing nutritional advice or lack the ability to target behaviour change. In addition, appointments are often time-limited and therefore focused only on immediate issues.

Screening tools, such as the SSQ used in the Sweet Moms study, could be developed to assist health care providers. In this study, the women who maintained high sugar intake during pregnancy perceived their diet as healthy and their sugar intake as normal. Therefore, a standard dietary assessment could be useful. Health professionals could also consider involving family and/or friends in nutritional counseling to increase social support. Social support is positively associated with behaviour change (Croghan, 2005). Furthermore, as suggested by Lewallen (2004), perhaps the time a woman spends waiting for an appointment could be used to address nutritional information and behaviours.

f) Initiate nutrition counseling in early pregnancy

Participants in this study discussed the need for nutritional support at the beginning of pregnancy and the importance of continued feedback about diet. Previous studies have shown that women are often more motivated and receptive to make behavioural changes during early pregnancy (Piirainen, Isolauri, Lagstrom, & Laitinen, 2006; Szwajcer, et al., 2005); therefore, the first trimester may present the best opportunity to target health behaviours and perceptions of pregnancy. Nutrition counseling at the start of pregnancy could help to facilitate an appropriate weight gain pattern throughout pregnancy and potentially decrease risks of gestational diabetes and abnormal infant birth weight (Fowles & Gabrielson, 2005; Hedderson, Gunderson, & Ferrara, 2010). In addition, pregnancy guidelines suggest that weight gain be minimal in the first trimester (Health Canada, 2010), which could be an optimal time to discuss healthy eating without worrying about weight gain.

The first trimester should not be the only time that nutrition is addressed however. Szwajcer et al. (2007) found that nutritional awareness often becomes more relaxed during later pregnancy when women find out that their child is developing properly and they begin to focus on work and other aspects of life again. Women, in consultation with health care professionals, should be asked to reflect on their dietary intake patterns throughout pregnancy as they encounter new physical symptoms and social pressures.

3. Recommendations for Further Research

Continued research is needed in order to identify methods of supporting the maintenance of healthy behaviour changes during, as well as after pregnancy. Additional investigation into what women eat and their motivations toward food choices can help improve maternal health. A particular focus on psychosocial factors could be very

beneficial in explaining food choices and eating behaviours. During pregnancy, women deal with a multitude of changes that require adaptation. While many women in the present study increased sugar consumption to adjust to pregnancy-related changes, more research is required on how to best guide women to make healthier food choices. For example, women require effective strategies to alleviate their increased stress or their emotions during pregnancy that do not involve increasing intake of foods high in added sugars.

Health professionals may require additional resources in order to successfully influence women's sugar consumption behaviours. These resources need to go beyond brochures and pamphlets. Participants in the study by Begley (2002) and Szwajcer et al. (2005) reported that brochures and pamphlets often lack in-depth information and do not motivate women to make dietary changes. Other means of providing information and motivating women to make dietary changes are therefore needed.

4. Conclusion

This study revealed that many women increase sugar intake in an effort to balance a variety of physical, social and cultural changes that accompany pregnancy. We have termed this process "making compromises". Facilitating the development of personal strategies to assist women in making healthier food choices while managing social pressure, physical discomforts and lifestyle challenges is warranted. Such strategies should be guided by nutritional knowledge, dietary awareness, and internal motivations for change along with improved self-efficacy to engage in the desired behaviours required to make healthy food choices and limit sugar intake to levels recommended. In addition, social support from the women's partner, family members and peers may be

important for the initiation and maintenance of behaviour changes. The major implication from this research is the need for health practitioners to further understand the personal and cultural influences on sugar consumption during pregnancy, which often limits women's ability to achieve a healthy diet. This information will contribute to knowledge of health behaviours during pregnancy and help to guide dietary behaviours in this population.

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Appendices

Appendix A: Participant Recruitment

sweet moms

Help researchers learn how **sugar** intake during **pregnancy** may affect the health of moms and their babies

Become a Sweet Mom Today!

Your <u>one time</u> only participation would involve:

- Questions about food intake
- Height and weight measurements
- Urine sample

If you, or someone you know, is **pregnant** and interested in taking part in our study, please contact us for more information!

Phone: **(780) 492-4182**
Email: sweetmoms@ales.ualberta.ca
Website: **www.sweetmoms.ca**

sweet moms

Become a Sweet Mom Today!

What Is Sweet Moms?

Sweet Moms is a research study from the University of Alberta.

The goal of the Sweet Moms study is to learn how sugar intake during pregnancy may affect the health of moms and their babies.

We need your help to answer these questions!

University of Alberta
Edmonton·Alberta·Canada

Who Can Volunteer?

Any pregnant woman 16 years of age or older who can read and write in English can volunteer!

What Is Involved?

Sweet Moms volunteers will be asked to complete:

- Food Questionnaires
- A Health Background Questionnaire
- Height and Weight Measurements
- A Urine Sample

How Long Will It Take?

Only 1 appointment will be needed to complete the study. It should take most women no more than 2 hours.

What's In It For Me?

Participating in Sweet Moms is an easy and satisfying way to give back to your community and help women in Alberta, Canada and all over the world have healthier pregnancies.

Contact Us!

Phone: 780-492-4182
Email: sweetmoms@ales.ualberta.ca
Website: www.sweetmoms.ca

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sweet moms

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INFORMATION SHEET

Sweet Moms Interview

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Purpose:
The objective of this study is to learn about sugar intake during pregnancy. The results of the study may be presented to parent groups, health professionals, food producers, day cares, and school boards. Our findings may improve the health and wellness of women and the health of their baby.

Methods:
Participants will be interviewed for approximately 45 to 60 minutes. The interview will be audio recorded and transcribed.

Voluntary Participation
You have the right to refuse this invitation to participate or to refuse to answer any of the questions asked during the interview. You are also free to stop the interview at anytime or request that we withdraw your information (transcripts, audio recording) up until a week after the interview, by providing researchers with a written request that data be destroyed.

Confidentiality
The consent forms, transcripts and any information you provide will be kept in a locked filing cabinet. Your privacy and identity will be kept confidential and your name will not be used (an alias will be used). All information contained in our summaries will be anonymous and any report published as a result of this study will not identify you by name, address or any other personal information.

The interview details and study information you provide will only be accessed by the researchers and will be kept locked in a secure research area. The study database will be stored on a computer drive protected by a password.

Analysis
Audio recordings will be typed into transcript format, removing all identifying information.

Benefits:
This study may or may not have any direct benefits for you.

Risks:
It is not expected that being in this study will harm you. However, if you would like to speak to someone after the interview, you may contact either of the graduate student or supervisor identified above.

In the event that you suffer injury as a result of participating in this research, you will not be compensated in any way by the funder, the University of Calgary, Calgary Health Region, the University of Alberta, Capital Health Region, Alberta Health Services, Covenant Health, or the Researchers. You still have all your legal rights. Nothing said in this consent form alters your right to seek damages.

Withdrawal from the study:
If you chose to withdraw from the study, the audiotape and any transcripts that have been made will be destroyed immediately. You are free to withdraw up until a week after the day of your interview.

Thank you very much for taking part in this study.

If you have any further questions related to this research, please contact:
Dr. Rhonda Bell **780-492-7741**

If you have any concerns about any part of the study, please contact:
Health Research Ethics Board office, University of Alberta **780-492-9724**

University of Alberta

CONSENT FORM

Sweet Moms Interview

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Supervisor:
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Please circle your answers:

Do you understand that you have been asked to be in a research study?	*Yes*	*No*
Have you read and received the Information Sheet?	Yes	No
Do you understand the benefits and risks involved in taking part in this study?	Yes	No
Have you had an opportunity to ask questions and discuss this study?	Yes	No
Do you understand that you can quit taking part at any point during the interview?	Yes	No
Do you understand that you can withdraw at any time during the data collection part of the study and that any comments that you provided up to that point will not be used?	Yes	No
Has confidentiality been explained to you?	Yes	No
Do you understand who will have access to the data collected?	Yes	No
Do you understand that the interviews will be audio-recorded and transcribed?	Yes	No
Do you understand that you have up until a week after the day of your interview to withdraw what you have shared in the interview?	Yes	No

If you have further questions regarding the research, please contact the individuals listed above.

This study was explained to me by: _____

I agree to take part in this study.

_____ _____
Signature of Research Participant Date (dd/mm/yyyy)

_____
Printed name

Appendix B: Sugar Screener Questionnaire

Study ID: _____

Sweet Moms - Sugar Screener

Instructions: This questionnaire will ask you for information about your current diet. Answer each question as best as you can. If you are not sure, please estimate as a guess is better than leaving a blank. You may fill in the answers with an 'x' or by filling in the circle.

You may use the following 'handy' portions to help with portion sizes:

A fist of cupped hand = 1 cup

Handful = 1-2 oz. of snack food

Thumb tip = 1 teaspoon

How often have you consumed the following beverages during the past <u>week</u>? *For example, if you drank 2 cups of chocolate milk on two different days last week, you would fill in the circle for 4 times per week.(Note: If the item was sugar free and made with Artificial Sweetener, please leave the circle blank)*

	Serving Size	None	1 time/ week	2 times/ week	3 times/ week	4 time/ week	5 times/ week	6 times/ week	7 times/ week	More than 7 times/ week
BEVERAGES										
Chocolate Milk	1 Cup	○	○	○	○	○	○	○	○	○
Hot Chocolate, Flavoured Cappuccinos, Frappuccinos, Sweetened Coffee Drinks	1 Cup	○	○	○	○	○	○	○	○	○
100% Apple Juice	1 Cup	○	○	○	○	○	○	○	○	○
100% Fruit Juice (Orange, Grapfruit, Peach)	1 Cup	○	○	○	○	○	○	○	○	○
Sugar Sweetened Drinks (Lemonade, Iced tea)	1 Cup	○	○	○	○	○	○	○	○	○
Regular Pop	1 Can (355ml)	○	○	○	○	○	○	○	○	○
Sports Drinks (Powerade, Gatorade)	1 Bottle (591 ml)	○	○	○	○	○	○	○	○	○
Slurpees/Slushies	Small (12 oz)	○	○	○	○	○	○	○	○	○
Milkshakes	Small (12 oz)	○	○	○	○	○	○	○	○	○
Fruit Smoothies	Small (12 oz)	○	○	○	○	○	○	○	○	○
Meal Replacement Drinks (Ensure, Boost, Carnation Breakfast)	1 Can/Bottle (8 oz)	○	○	○	○	○	○	○	○	○

On average, how often have you consumed the following foods during the past <u>week</u>? *For example, if you ate 2 cups of ice cream on 2 different days, you would fill in the circle for 4 times per week. (Note: If the item was sugar free and made with Artificial Sweetener, please leave the circle blank)*

	Serving Size	None	1 time/ week	2 times/ week	3 times/ week	4 time/ week	5 times/ week	6 times/ week	7 times/ week	More than 7 times/ week
FOODS										
Ice Cream, Frozen Yogurt, Sorbet, Sherbet, Flavored Ices	1 Cup	○	○	○	○	○	○	○	○	○
Freezies, Popsicles	1 (120 mL)	○	○	○	○	○	○	○	○	○
Jam, Jelly	1 Tbsp	○	○	○	○	○	○	○	○	○
Honey	1 Tbsp	○	○	○	○	○	○	○	○	○
High-Sugar Cereals (Corn-pops, Fruit-Loops, etc.)	1 1/4 Cup	○	○	○	○	○	○	○	○	○
Flavored Yogurt	3/4 Cup	○	○	○	○	○	○	○	○	○
Dried Fruit	1/4 Cup	○	○	○	○	○	○	○	○	○
Canned Fruit in Syrup	1/2 Cup	○	○	○	○	○	○	○	○	○
Chocolate Bar, M&M's, Smarties, Chocolate Chips	1 Bar (50g)	○	○	○	○	○	○	○	○	○
Candies (Jujubes, Wine-gums, etc.)	10 Pieces (50g)	○	○	○	○	○	○	○	○	○
Cookies	1 (3"Diameter)	○	○	○	○	○	○	○	○	○
Granola Bar (Special K, Nature Valley, Quaker)	1 Bar (35g)	○	○	○	○	○	○	○	○	○

	Serving Size	None	1 time/ week	2 times/ week	3 times/ week	4 time/ week	5 times/ week	6 times/ week	7 times/ week	More than 7 times/ week
FOODS										
Meal Replacement bar (Slimfast, Powerbar, Cliff)	1 Bar (56g)	○	○	○	○	○	○	○	○	○
Cake, Brownie	1 Piece of Cake/Brownie (1/8 of an 9" Cake)	○	○	○	○	○	○	○	○	○
Pie, Fruit Crisp, Cobbler, Strudel	1 Slice of Pie (1/8 of a 9"	○	○	○	○	○	○	○	○	○
Donut, Sweet Rolls, Danish, Pop-Tart	1 (60g)	○	○	○	○	○	○	○	○	○
Pudding, Custard, Jello	1/2 Cup	○	○	○	○	○	○	○	○	○
Fresh Fruit	1/2 Cup or 1 Small Whole Fruit	○	○	○	○	○	○	○	○	○
Sweet Muffin, Dessert Bread	1 Muffin/Slice of Bread	○	○	○	○	○	○	○	○	○
Condiments (Ketchup, Sweet and Sour Sauce, etc.)	1 Tbsp	○	○	○	○	○	○	○	○	○

Appendix C: Sugar Screener Questionnaire Background

Questionnaire Design

The purpose of the sugar-screener questionnaire (SSQ) was to estimate the average natural, added, and total sugar intake of pregnant women in the Sweet Moms study. The SSQ asked participants to report the frequency of consumption of common sugar-containing foods and beverages during the previous week. The foods and beverages on the questionnaire were selected based on the Sweet Moms food-frequency questionnaire (FFQ) and studies that examined dietary intake, including sugar consumption (Storey et al., 2009; Popkin & Nielsen, 2003; Marriott, Olsho, Hadden, & Connor, 2010). Two dietitians from the Sweet Moms research team reviewed the questionnaire for completeness and accuracy.

Initially, the SSQ asked participants to report the serving size and number of servings eaten per month of the listed foods and beverages. However, after conducting a pilot test at a University of Alberta seminar, this format received low compliance and participants reported that the design was confusing. The questionnaire was reformatted to ask participants about dietary intake during the past week to make it easier to recall foods and beverages consumed. In addition, a serving size was listed next to each food or beverage that was consistent with *Eating Well with Canada's Food Guide* where applicable (Health Canada, 2007). A 'handy portion guide' was also added to the questionnaire to help participants estimate servings using their own hands and an example was provided to guide participants. A second pilot test was completed at a University eating area with greater success than the first questionnaire design.

Estimating Intake of Added Sugars

Total sugar content for most foods and beverages were obtained from Health Canada's Nutrient File database, 2010 version (Health Canada, 2010). For other items not listed in the database, information was collected from manufacturers of those food products (e.g. 'Boost' meal replacement drink), or by calculating the sugar content in a common recipe for the item (e.g. slurpee). If a number of different brands or types of a particular food were available, an average was calculated (e.g. chocolate and vanilla pudding). Foods categorized as containing mainly natural sugars were fruit, dried fruit, fruit juices; the remaining items were grouped as sources of added sugars.

In order to purposefully sample participants for interviews, categories were created to divide participants into low, moderate, and high, added sugar intakes. However, this presented a challenge as sugar intake in pregnancy has not been extensively studied. No studies were found that examined average sugar consumption of pregnant women or the effects of sugar on nutrient intake or health during pregnancy. In addition, Canadian surveys of non-pregnant individuals do not include estimates of added sugar intake since there is currently no adequate nutrient database that contains information about natural and added sugars.

The cut-off for low sugar intake was based on the World Health Organization recommendation of consuming less than 10% of energy intake from free sugars (WHO, 2003). On average, non-pregnant women require approximately 2000 calories per day (Health Canada 2011) and pregnant women require an additional 452 calories per day during the third trimester (Health Canada, 2009). For a total calorie intake of 2452 calories, women consuming less than 10% of their energy from added sugar would have a

sugar intake of approximately less than 60 grams of added sugars per day. Therefore, women with added sugar intakes below 60 grams were classified as having a low sugar intake.

The Canadian Sugar Institute estimates that added sugar intake in Canada accounts for approximately 10-13% of total energy (Canadian Sugar Institute, 2011). Pregnant women who had estimates of added sugar between 60 and 80 grams were classified as having moderate sugar intake (approximately 10-13% of energy intake). High sugar intake was defined as consuming more than 80 grams of added sugars per day, which is approximately 13% of calorie intake for pregnant women in their third trimester. In addition, Marriott et al. (2010) showed that micronutrient status decreased as added sugar intake increased above 10% of total energy intake in non-pregnant individuals.

Limitations

A limitation of the SSQ is that one week may not be representative of usual intake, especially if there is variation in foods and beverages consumed among seasons (e.g. eating more ice cream in the summer). In addition, although the foods are listed for the participant, answers still rely on the participant's ability to estimate how much and how often they consumed a particular item over a period of time. Another limitation is that the cut-offs used to define low, medium and high added sugar intakes were the same for all women regardless of individual energy requirements. For example, a participant who exercises during pregnancy may have a greater calorie allowance than was assumed, so the percentage of energy coming from added sugar would be over-estimated. For the purpose of the present study, the SSQ was an appropriate method to use because the

intention was to rank and classify participants, however, the questionnaire may lack validity in assessing actual intake of dietary sugars.

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Appendix D: Sample Interview Framework

Participant Interview 01

1. How would you describe sugar?

2. Tell me about your diet since becoming pregnant and if the amount of sugar in your diet has changed.

3. How has pregnancy affected your social life and the food choices you make while you are out with friends?

4. What physical symptoms have you experienced during pregnancy that have affected your food choices - particularly foods high in sugar? (e.g. nausea, cravings, aversions)

5. How have the people that you would consider the closest to you during your pregnancy influenced your intake of high sugar foods or beverages?

6. What nutrition advice did you receive from health care providers?

7. What are some factors that might make it difficult to decrease sugar in your diet during pregnancy?

8. What are some factors that would help you to decrease sugar in your diet?

9. Are there any other factors that you can describe that affect your food choices and the amount of sugar you eat during pregnancy?

10. Is there anything else you would like to bring up today before we finish the interview?

Appendix E: Transcription Key

P	Participant
I	Interviewer
<laughter>	Laughter while speaking or after talk
<other emotion>	Another emotion while speaking or talking
#word#	Uncertain hearing
WORD	Louder/emphasized word
word	Softer word than normal
<*Italics*>	Transcriber's description, not transcription
(?)	Missing information due to inability of transcriber to hear
…	Pause
(cough)	Other noises or interruptions

Appendix F: Verification Strategies

Investigator Responsiveness	Responsiveness to the research was employed as described by Morse et al., (2002, pg. 14): "it is essential that the investigator remain open, use sensitivity, creativity and insight, and be willing to relinquish any ideas that are poorly supported".
Methodological Cohesion	Methodological cohesion was implemented by establishing congruence between elements of the study (research question, philosophical assumptions, method) (Mayan, 2009).
Appropriate Sampling	To enhance the generalizability of findings, participants were purposefully selected to provide in-depth information in answering the research questions. Although the participants had unique experiences of pregnancy, similar concepts surfaced from these experiences.
Concurrent data collection and analysis	Consistently collecting data and analyzing helped to highlight what information was known and what needed further investigation (Morse et al., 2002).
Thinking Theoretically	By verifying emerging ideas in new and previously collected data, theoretical thinking was employed (Morse et al., 2002). Therefore, assumptions about the importance of particular details were avoided, until seen throughout the data.
Theory Development	For theory development, the experiences of the participants were linked together through abstract concepts consistent within the data (Morse et al., 2002).