



## Research report

# Food cravings and intake of sweet foods in healthy pregnancy and mild gestational diabetes mellitus. A prospective study<sup>☆</sup>

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## ARTICLE INFO

## Article history:

Received 8 June 2010

Received in revised form 14 September 2010

Accepted 15 September 2010

## Keywords:

Pregnancy

Gestational diabetes

Sweet food cravings

Sweet food intake

## ABSTRACT

Pregnancy is associated with increased sweet food cravings, but the relationship between sweet cravings and dietary intake remains uncertain. Gestational diabetes mellitus (GDM) is glucose intolerance first recognized during pregnancy. GDM may further perpetuate sweet food cravings and intake in pregnancy, although this has not been investigated. This study longitudinally assessed sweet food cravings across pregnancy in women who developed mild GDM ( $n = 15$ ), normal glucose tolerant pregnant women (NGT;  $n = 93$ ) and nonpregnant controls ( $n = 19$ ). Food frequency questionnaires and craving surveys were completed 3 times during pregnancy, and again during postpartum. While 55% of NGT women reported sweet cravings at 24–28 wk; this percentage fell significantly at term. Sweet cravings in these women coincided with higher reported sweet food and beverage intake. Only 40% of GDM women reported sweet cravings at 24–28 wk. However, at 34–38 wk, this subset of GDM women reported twice the frequency of sweet cravings than NGT women ( $12.1 \pm 2.8$  times/wk vs.  $5.9 \pm 1.0$  times/wk, respectively). Sweet cravings appear to be a feature of late pregnancy in GDM, but may not threaten dietary adherence in women with mild GDM. Future studies should investigate sweet cravings in women with more severe GDM.

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## Introduction

A food craving is defined as the intense desire or urge to consume a specific food (Kozlowski & Wilkinson, 1987; Pelchat, 1997; Weingarten & Elston, 1991), and 50–90% of pregnant women report food cravings at some point during their pregnancies (Hook, 1978; Pope, Skinner, & Carruth, 1992; Worthington-Roberts, Little, Lambert, & Wu, 1989). Food cravings typically arise late in the first trimester, peak during the second trimester then diminish as pregnancy progresses to term (Bayley, Dye, Jones, DeBono, & Hill,

2002; Pope et al., 1992). The most frequent cravings are dairy and sweet foods, including chocolate, fruit and fruit juice. Though not as common, pregnant women also report cravings for salty and savory foods (Bayley et al., 2002; Hook, 1978; Pope et al., 1992). Anecdotal reports of food cravings in pregnancy suggest that there is an increased need for energy or other nutrients such as calcium or sodium (Brown & Toma, 1986; Hook, 1978), but studies documenting these relationships are relatively sparse. One study in pregnant adolescents showed that those who craved sweets consumed more sugar and energy than those without sweet cravings (Pope et al., 1992). Another study examining food intake in the laboratory reported that pregnant women in the second trimester consumed more sweet foods (but not salty or savory foods) as compared to women at other stages of pregnancy (Bowen, 1992). Since most studies on food cravings in pregnancy are either retrospective or cross-sectional (Bayley et al., 2002; Hook, 1978; Pope et al., 1992), one objective of the present study was to prospectively monitor food cravings across healthy pregnancy in relation to overall dietary intake and specific food patterns, such as consumption of sweet foods.

The role of sweet food cravings in women who develop gestational diabetes mellitus (GDM) during pregnancy is unknown. GDM is defined as glucose intolerance, of variable severity,

<sup>☆</sup> These studies were conducted in partial fulfillment of the PhD by LMB and were performed at Saint Peter's University Hospital, New Brunswick, NJ. We thank Dr. Angela Ranzini and Elaine Vostrovsky for assistance with subject recruitment and screening. We gratefully acknowledge the assistance of Dr. Louis Amorosa (UMDNJ-Robert Wood Johnson Medical School) with study design and implementation, and Marian Lake (Saint Peter's University Hospital) with study implementation. Natalia Ullrich, Elizabeth Lutchman, Naveen Kommera and Raza Ahmed assisted in recruitment and subject testing. BJT and JCS designed the research; LMB conducted the research; LMB and SL analyzed the data; LMB, JCS and BJT wrote the paper; BJT had primary responsibility for final content; all authors read and approved the final manuscript.

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which is first detected during pregnancy (Metzger & Coustan, 1998). The exact pathophysiology of this disease is uncertain but probably involves a combination of pronounced insulin resistance at peripheral tissues and inadequate  $\beta$ -cell insulin secretion in response to the metabolic stress of pregnancy (Metzger, 2007). GDM occurs in ~7% of pregnancies in the U.S. and other developed countries, and is associated with an elevated risk of obstetric and perinatal complications, including increased fetal growth leading to more complicated labor and delivery, an increased rate of cesarean delivery, and fetal respiratory distress at birth (ACOG, 2001). GDM shares many of the same metabolic features as Type 2 diabetes mellitus (T2DM) and the dietary management of both diseases follows the same general principles (i.e. monitoring of overall energy intake, balancing macronutrient selection, and encouraging the consumption whole grains, fruits and vegetables). In contrast to T2DM, however, the dietary management of the pregnant diabetic is complicated by the nutritional needs of the developing fetus. A pregnancy complicated by GDM can be highly stressful, and compliance with traditional diet therapy is low and often fails (Langer, 2002). Thus, there is a need to develop better management strategies for this disease.

Our laboratory has been studying the role of sweet taste preference in GDM. We previously demonstrated that women with this disease showed a higher taste preference for moderately sweetened dairy drinks than did healthy pregnant women (Tepper & Seldner, 1999). In a separate analysis of the same cohort of women studied here, we confirmed these earlier findings and demonstrated that this exaggerated preference for sweet taste emerged late in pregnancy (at 34–38 wk gestation) in GDM, but was absent at this same time-point in healthy pregnancy (Belzer, Smulian, Lu, & Tepper, 2009). Thus, the second objective of the present study was to determine if sweet cravings were also a feature of late pregnancy in GDM and whether sweet cravings were related to dietary intake of sweet foods. Understanding the relationship between cravings and intake of sweet foods is of considerable clinical importance since excess energy intake (as sweet drinks and snacks) is typically discouraged in diet therapy for GDM (American Diabetes Association, 2007).

## Methods

### *Subjects and recruitment*

Healthy pregnant and nonpregnant women, 18–45 yr of age, were recruited from the Women's Ambulatory Clinic at Saint Peter's University Hospital, New Brunswick, NJ. Recruitment was carried out and data were collected on a continuous, rolling basis over a 3-yr period. Both normal weight (body mass index [BMI] = 19.8–24.9 kg/m<sup>2</sup>) and overweight (BMI = 25.0–30.0 kg/m<sup>2</sup>) women were included. Since a major risk factor for GDM is overweight prior to pregnancy (Jovanovic-Peterson & Peterson, 1996), we oversampled overweight pregnant women in order to obtain a sufficient number of women who would later develop GDM. Exclusion criteria for all women included pre-existing major medical conditions (including Type 1 or T2DM), chronic hypertension or impaired renal function, GDM in a previous pregnancy, and use of medications that interfere with taste or appetite (Schiffman, 1991). Nonpregnant women had to be weight stable during the 3 mo prior to the study, not following dietary restrictions (e.g., weight-loss or low-sodium diets), have regular menstrual cycles, and be free of disordered eating (Garner, Olmsted, & Polivy, 1983). The study was approved by the Institutional Review Boards of Rutgers University, Saint Peter's University Hospital and the Robert Wood Johnson Medical School of the University of Medicine and Dentistry of New Jersey. All

subjects gave written consent and received monetary compensation for their participation.

### *Study design*

A prospective study design was used in which pregnant women were enrolled at 16–20 wk gestational age, before their GDM status was known. They were studied during three sessions during pregnancy (at 16–20 wk, 24–28 wk and 34–38 wk gestation) and during one session at 6–10 wk after delivery. A small number ( $n=7$ ) of pregnant women entered the study at 24–28 wk gestation, which was when their first prenatal visit occurred. Consequently, data from these women were not included in the data collection at 16–20 wk gestation. Nonpregnant controls were tested at similar intervals as the pregnant women. The study design is shown in Fig. 1.

All pregnant women are routinely screened for GDM at 24–28 wk gestation using a 1-h, 50-g oral glucose challenge. Women with a positive screen (glucose >140 mg/dL) undergo a 3-h, 100-g oral glucose tolerance test to confirm their diagnosis (Carpenter & Coustan, 1982). Thus, women who developed GDM during the course of this study were identified at 24–28 wk gestational age. Also, women with GDM were referred to nutritional counseling at the time of their diagnosis and received diet therapy until the end of their pregnancies. A diabetic exchange diet plan was followed (American Diabetes Association, 2008), which incorporated carbohydrate control within the context of sufficient calories, protein and fat for optimal maternal health and fetal growth. Women counted and recorded their carbohydrates daily (both type and amount), and overall dietary adherence was assessed on a weekly basis by the dietitian at the clinic. Women without GDM received standard nutritional guidance for pregnancy.

As part of the study protocol, two additional 50-g glucose challenge tests were administered; one at 34–38 wk gestation and one at 6–10 wk postpartum. Nonpregnant women underwent a total of three, 50-g glucose challenges at the same time intervals as the pregnant women. Blood samples were assayed for serum glucose and insulin using standard methods described previously (Belzer, 2008).

### *Food cravings*

Food cravings were assessed by questionnaire (Weingarten & Elston, 1991). The questionnaire asked whether or not the participant experienced food cravings in the week prior to the session (yes/no), and if yes, to report the first, second and third strongest craving, and to specify the frequency of each craving. Based on our previous experience (Tepper & Seldner, 1999), we changed the response interval of the original questionnaire from the last "month" to the last "week" to better capture dynamic changes in appetite in pregnancy. Data collection in this study began well after 12 wk gestational age, when reported frequency of nausea and/or food aversions decline, and cravings begin to emerge (Bayley et al., 2002).

Diet information was collected using a food frequency questionnaire that was previously validated against 3-d diet records for energy intake ( $r=0.87$ ) and used in our previous study in GDM (Tepper & Seldner, 1999). The questionnaire estimates the number of standard servings consumed daily, weekly or monthly for 141 common foods or food groups. Foods common in Latino households also were included on the questionnaire.

### *Procedures*

All sessions were conducted the morning, following a 10-h overnight fast, in a private room adjacent to the Women's Ambulatory Clinic. Each session began with sensory evaluations

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