ELSEVIER

Does Chocolate Intake During Pregnancy Reduce the Risks of Preeclampsia and Gestational Hypertension?

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PURPOSE: Chocolate consumption is associated with favorable levels of blood pressure and other cardiovascular disease risk markers. We analyzed a prospective cohort study to determine whether regular chocolate intake during pregnancy is associated with reduced risks of preeclampsia and gestational hypertension (GH).

METHODS: Subjects were recruited from 13 prenatal care practices in Connecticut (1988–1991). In-person interviews were administered at <16 weeks' gestation to ascertain risk factors for adverse pregnancy outcomes. Hospital delivery and prenatal records were abstracted to classify preeclampsia (n = 58), GH (n = 158), and normotensive pregnancies (n = 2351). Chocolate consumption (servings/week) during the first and third trimesters was ascertained at initial interview and immediately postpartum, respectively. Consumers of less than 1 serving/week comprised the referent group. Adjusted odds ratios (aORs) were estimated by the use of logistic regression.

RESULTS: Chocolate intake was more frequent among normotensive (80.7%) than preeclamptic (62.5%) or GH women (75.8%), and associated with reduced odds of preeclampsia (first trimester: aOR, 0.55; 95% confidence interval [95% CI], 0.32–0.95; third trimester: aOR, 0.56; 95% CI, 0.32–0.97). Only first trimester intake was associated with reduced odds of GH (aOR,0.65; 95% CI, 0.45–0.87).

CONCLUSIONS: These findings provide additional evidence of the benefits of chocolate. Prospective studies are needed to confirm and delineate protective effects of chocolate intake on risk of preeclampsia.
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KEY WORDS: Chocolate, Gestational Hypertension, Preeclampsia, Pregnancy.

INTRODUCTION

It is increasingly recognized that the pathophysiology of preeclampsia, a leading cause of infant and maternal morbidity and mortality worldwide, involves many of the same vascular and metabolic characteristics and risk factors for cardiovascular disease. Furthermore, accumulating evidence from long-term follow-up studies indicates that women with a history of preeclampsia face an increased risk of developing chronic hypertension, insulin resistance, and lipid abnormalities later in life (1–3). Large-scale clinical trials aimed at preventing preeclampsia in high-risk women have variously focused on antenatal administration of low-dose aspirin, calcium supplementation, and vitamins C and E, although none have proven effective (4–7).

Recent studies indicate that regular intake of chocolate, particularly dark chocolate, has beneficial effects on cardiovascular disease risk by lowering blood pressure, insulin resistance, serum triglycerides, vascular reactivity, endothelial dysfunction, oxidative stress, indicators of inflammation, and antiplatelet activity (8). Each of these physiologic features has been observed in preeclampsia, providing strong rationale to test for a protective effect of chocolate intake on risk of preeclampsia. To date, two published studies in which the authors used theobromine as a biomarker of chocolate intake have tested this hypothesis but reported conflicting findings (9, 10). Triche et al. (10) reported that regular chocolate consumption and greater levels of theobromine in cord blood have a protective effect against preeclampsia. In contrast, Klebanoff and colleagues (9) found no protective effect of increased theobromine in maternal serum collected after 26 weeks, but did not assess dietary chocolate consumption.

By using data from the Yale Health in Pregnancy Study, we addressed the following questions: (i) Is regular chocolate consumption during pregnancy associated with a reduced risk of preeclampsia and gestational hypertension? (ii) Do

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Selected Abbreviations and Acronyms

GH = gestational hypertension
BMI = body mass index
aOR = adjusted odds ratio
95% CI = 95% confidence intervals

the risks of preeclampsia and gestational hypertension vary by amount of chocolate consumed? (iii) Is the timing or pattern of chocolate consumption during the first and third trimesters of pregnancy associated with the risks of preeclampsia and gestational hypertension. The present study adds to the current literature by examining trimester-specific chocolate intake and considering gestational hypertension (GH) as an additional outcome in a large cohort study of expectant women.

MATERIALS AND METHODS

We conducted an ancillary study within the Yale Health in Pregnancy Study cohort to identify risk factors for preeclampsia, which required detailed reviews of all prenatal and medical records belonging to subjects who were noted to have evidence of high blood pressure in the parent study (11). These studies were approved by the Yale University Human Investigation Committee.

Study Design and Population

The Yale Health in Pregnancy Study is a prospective cohort study of expectant women who had their first prenatal visit between April 5, 1988, and December 31, 1991, and planned to deliver at the Yale-New Haven Hospital. The study was originally designed to assess the influence of environmental tobacco smoke exposure on fetal growth and preterm delivery. Details of study methods have been described previously (11, 12). Subjects were recruited from 11 private obstetric practices and two health maintenance organizations. Exclusion criteria included diabetes mellitus, non-English speaking, ⩾16 weeks' gestation, or previous study participation. A total of 3591 women screened eligible for the initial interview, which had to be completed before 16 weeks' gestation. A total of 2967 (83%) women completed the interview; the remaining subjects either refused to participate (16%) or could not be reached for an initial contact (1.4%). The current analysis is restricted further to subjects who had singleton deliveries and hospital delivery records available for abstraction by research staff (96%) to facilitate accurate classification of three outcome groups: preeclampsia, GH, and normal blood pressure.

The initial study interview was conducted in-person before 16 weeks' gestation by trained interviewers. The interview was usually conducted at the subject's home and took approximately 1 hour to administer. The interviewers obtained information on maternal demographics, medical and reproductive history, height, prepregnancy weight, antenatal smoking, alcohol, caffeine, and chocolate consumption, occupational factors, and exercise habits. Subjects also completed a postpartum interview, usually conducted in person at the hospital within the first few days of delivery, to obtain information on exposures during the seventh, eighth, and ninth gestational months. Study abstractors were trained to carefully document chart notations of increased blood pressure for all subjects because of the link between preeclampsia and the parent study's primary outcomes.

Classification of Hypertension in Pregnancy

To achieve accurate and consistent case definitions of preeclampsia and GH, we conducted a supplementary review of all prenatal and hospital delivery records for the 415 (15%) participants who had some indication of elevated blood pressure during pregnancy based on hospital chart reviews or in-person interviews. The abstractors recorded blood pressure readings, urine protein values, laboratory test results, and other signs and symptoms of preeclampsia. On the basis of this review, women were assigned to one of the following categories in accordance with current criteria from the American College of Obstetricians and Gynecologists: (i) no hypertension (n = 98); (ii) chronic hypertension (n = 73); (iii) GH (n = 158); (iv) preeclampsia (n = 58); (v) superimposed preeclampsia (n = 14); and, (vi) uncategorized hypertension or unknown hypertension status (n = 14). Women with HELLP syndrome (n = 13) were coded as superimposed preeclampsia or preeclampsia, according to the presence or absence of chronic hypertension.

The present analysis includes subjects with a final diagnosis of GH, preeclampsia, or normotensive during pregnancy. GH was defined as systolic blood pressure ⩾140 mmHg or diastolic blood pressure ⩾90 mmHg after 20 weeks' gestation on two or more occasions at least 6 hours apart with no evidence of proteinuria. Preeclampsia was defined as GH with proteinuria (ie, two or more dipstick readings of ⩾1+ or a 24-hour urine collection of ⩾300-mg protein). The comparison group had no indication of high blood pressure during pregnancy (n = 2324). All subjects who underwent chart review because they had a notation of elevated blood pressure were excluded from the comparison group, including the 98 with a final classification of "no hypertension."

Assessment and Classification of Chocolate Intake

Average weekly consumption of chocolate drinks and foods was assessed by two questions included on both the initial interview (covering months 1–3) and the postpartum