Adherence to Canada's Food Guide Recommendations during Pregnancy

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Abstract

Background: In Canada, pregnant women are typically referred to Canada's Food Guide (CFG), a set of national dietary recommendations designed to promote adequate nutrient intake. Pregnant women are also advised to gain weight within the Institute of Medicine guidelines, which differ by prepregnancy body mass index (BMI). However, CFG recommendations do not account for prepregnancy BMI and provide no guidance on "less healthy" (LH) foods.

Objective: The aim of this study was to score women's diets according to adherence to CFG recommendations and consumption of LH foods and to examine differences between these diet scores by prepregnancy BMI.

Methods: Participants enrolled in the APrON (Alberta Pregnancy Outcomes and Nutrition) prospective cohort study completed a 24-h recall in their second trimester ($n = 1630$). A score was created on the basis of each daily dietary CFG recommendation met, ranging from 0 to 9. The distribution of consumption (grams per day) of 8 LH food groups was given a score of 0 (none) or 1, 2, or 3 (representing the lowest, middle, or highest tertiles, respectively) and summed giving a total LH score of 0–24.

Results: There were few differences in CFG recommendations met by prepregnancy BMI status, although fewer women who were overweight or obese prepregnancy met the specific recommendation to consume 7–8 servings of fruit or vegetables/d than did those who were under- or normal weight (47% and 41% compared with 50% and 54%, respectively). Although differences were small, women who were obese prepregnancy had lower CFG scores ($\beta = -0.28$; 95% CI: -0.53, -0.02) and higher LH scores ($\beta = 0.45$; 95% CI: 0.04, 0.86) than did those who were normal weight.

Conclusion: The study results suggest that more attention may need to be paid to individualized counseling on dietary recommendations that take account of prepregnancy BMI. *Curr Dev Nutr* 2017;1:e000356.

Introduction

Optimal nutrition in pregnancy is vital for both limiting the risk of pregnancy complications for the mother and supporting the growth and development of the fetus (1, 2). To address this issue, many countries have developed specific national guidelines for diet during pregnancy (3–5). In Canada, pregnant women are typically referred to Canada's Food Guide (CFG), which makes recommendations about the number of daily servings of food groups, with the overall goal of promoting the consumption of adequate amounts of nutrients and calories needed to support a healthy pregnancy (4). Specifically, CFG recommends that pregnant women in the second trimester onward consume an extra 2–3 servings/d from any of the following food groups: fruit and vegetables, grains, meats and alternatives, or dairy and

alternatives, in addition to the dietary recommendations for non-pregnant women. CFG offers little directed guidance on the consumption of less-healthy (LH) foods, defined in CFG as "foods and beverages high in calories, fat, sugar or salt" other than stating that these foods should be "limited" (4).

In addition to providing adequate micronutrients, Health Canada also recommends following CFG in order to achieve healthy gestational weight gain (GWG) (6). GWG outside of recommended target ranges is associated with adverse outcomes for both the mother and infant during pregnancy and the postpartum periods (7–11). Recent studies in North America and Europe have shown that excessive GWG is more common than inadequate weight gain (7, 12). As a strategy to improve pregnancy outcomes for the mother and offspring, Health Canada adopted and disseminated the 2009 US Institute of Medicine (IOM) recommendations for GWG in 2010 (6). These evidence-based recommendations provide optimal ranges of total and weekly rates of GWG according to a woman's prepregnancy BMI category. Total GWG recommendations are as follows: 12–18 kg for underweight, 11.5–16 kg for normal weight, 7–11.5 kg for overweight, and 5–9 kg for obese women.

Promoting adherence to dietary guidelines in pregnant women with no known complications is challenging at a clinical level, because clinicians must help women balance their need for additional calories and specific nutrients with overall pregnancy weight gain. In addition, although the IOM GWG guidelines (6) differ according to prepregnancy BMI, in Canada the CFG recommendations are universal, with a tacit assumption that all women need to increase their food intake to meet the metabolic demands of pregnancy and fetal development from the second trimester onward. If women are expected to gain different amounts of weight during pregnancy, it would be necessary for their food intake to also differ according to their prepregnancy BMI status (13).

To the best of our knowledge, there are no published studies that have explored women's adherence to CFG recommendations during pregnancy, and whether adherence differs by prepregnancy BMI status. To address this gap, we examined data from a prospective cohort of pregnant women in Alberta, Canada (14), to *1*) create a simple score to examine their diets according to adherence to CFG recommendations during the second trimester of pregnancy and to create a second score to account for consumption of LH foods, *2*) examine factors associated with both CFG adherence and the consumption of LH foods, and *3*) examine these diet scores according to prepregnancy BMI status.

Methods

Study design and population

The Alberta Pregnancy Outcomes and Nutrition (APrON) study is a prospective cohort study that followed women during pregnancy and postpartum and their infants, with an overarching goal of assessing the impacts of nutrition on pregnancy-related outcomes. Participants were recruited through advertisements in the media and in physicians' offices in Calgary and Edmonton, Alberta, between May 2009 and November 2012. Women aged ≥16 y and at <27 wk of gestation were eligible for inclusion. Women were excluded if they were unable to answer questions in English or if they planned to move out of the region during the timeline of the study. Women who provided written informed consent were invited to attend a study center once in each trimester after enrollment and once postpartum at ∼3 mo after delivery. More detailed descriptions of participant recruitment and study protocols have been published elsewhere (14). Research ethics board approval for the APrON study was obtained from the Health Research Ethics Boards at the University of Alberta and the University of Calgary.

Procedure

Upon enrollment, participants completed questionnaires including information on prepregnancy weight, age, parity, marital status, ethnicity, family income, and education. Questions on demographic characteristics were adapted from the 2004 Canadian Community Health Survey (15). At each study visit, trained staff measured participants' weight to the nearest 0.01 kg (Healthometer Professional 752KL) and height to the nearest 0.001 m (Charder HM200P Portstad Portable Stadiometer). Prepregnancy BMI was calculated by using self-reported prepregnancy weight and measured height. BMI (in kg/m^2) values were classified as underweight (<18.5), normal weight (18.5 to <25), overweight (25 to <30), or obese (≥30). The self-reported highest weight during pregnancy was recorded at the postpartum visit to calculate total GWG.

Dietary assessment

For the purpose of this study, only dietary data collected in the second trimester were used, because the CFG pregnancy-specific recommendations are relevant from the second trimester onward. Each woman completed one 24-h recall in her second trimester. During the recall, women were asked to report every food and beverage that they had consumed during the previous day, including details concerning cooking methods, location and time of eating, and food brand names. To prompt accurate recall, the multi-pass method was used. Portion sizes were estimated with the aid of pictures. Information from the recalls was converted to intakes of nutrients and foods as grams per day.

Calculating CFG scores

Intakes of the foods included in each of the recommendations were summed and categorized according to CFG recommendations as follows: total fruit and vegetables, green vegetables, orange vegetables, total grains, whole grains, total dairy, reduced-fat milk, and meat and alternatives. A score of 1 was given for each of the following daily recommendations that were met: 7–8 servings of fruit and vegetables, making ≥1 serving of fruit and vegetables a green vegetable and ≥1 serving of fruit and vegetables an orange vegetable, 6–7 servings of grain products, making ≥3–4 servings a whole-grain product, 2 servings of milk or alternatives, choosing reduced-fat milk, and 2 servings of meat and alternatives. Details of the scoring system are presented in **Table 1**. For women aged <19 y (*n* = 21), a score of 1 was given for the consumption of 3–4 servings of milk and alternatives, which is the recommendation for the age group of 16–18 y. An additional score of 1 was given when a woman of any age reported the consumption of an extra 2–3 servings of any food group, as per pregnancy-specific recommendations. Scores were summed to

TABLE 1   Method for calculating the CFG adherence score[1]

CFG recommendation	Score	
	Not meeting recommendation	Meeting recommendation
7–8 servings fruit and vegetables/d	0	1
≥1 vegetable is an orange vegetable	0	1
≥1 vegetable is a dark-green vegetable	0	1
6–7 servings grains/d	0	1
≥3–3.5 servings of grains are whole grains	0	1
2 servings milk and alternatives/d	0	1
Choosing reduced-fat milk	0	1
2 servings meat and alternatives/d	0	1
Include 2–3 extra servings from any food group	0	1

[1] The total for each recommendation was summed to give an overall score that directly relates to the number of CFG recommendations being met. A score of 0 represents none of the recommendations being met, a score of 1 represents meeting one of the recommendations, and a score of 9 represents meeting all 9 of the quantifiable recommendations. CFG, Canada's Food Guide.

produce a total score between 0 and 9 for each woman, where 9 represented meeting all of the daily food-group recommendations for a pregnant woman from her second trimester onward. A binary approach to creating the score was adopted due to its ease of interpretation and transferability to other studies of adherence to national dietary guidelines. There were 4 dietary CFG recommendations relating to frequency of food consumption that could not be scored because we used a single 24-h recall as our dietary assessment tool, and it was not possible to quantify statements such as "often." These included the following: "choose whole fruits and vegetables more often than juice," "have 30–45 mL vegetable oil," "choose meat alternatives such as beans and tofu often," and "have 2 portions of fish per week."

Calculating the LH food score

CFG recommends "avoiding less-healthy food," but given that no specific recommendations for serving sizes of LH foods exist in CFG, our procedure for scoring their consumption differed from that created for the CFG score. To classify LH foods, we grouped foods from the 24-h recall into the following groups: high-energy soft drinks, chips, fries, puddings and desserts, candy and chocolate, cakes and cookies, pancakes and waffles, and hot chocolate. These food groups were chosen because they have previously been identified as energy-dense, nutrient-poor foods (16). Distributions of intakes (grams per day) for each of the 8 food groups were divided into tertiles. For each of the 8 LH food groups, a score of 0 was given for no consumption, a score of 1 was given if women were in the lowest third for consumption, a score of 2 if in the middle third for consumption, and a score of 3 if in the highest third for consumption. Scores from the 8 LH food groups were summed to give an overall LH diet score of between 0 and 24, where a score of 0 represented the intake reported by a woman who did not consume any foods from the 8 LH food groups and a score of 24 represented the intake of a woman who was in the highest tertile for the consumption of all 8 of the LH food groups.

GWG

Total GWG was calculated by subtracting prepregnancy body weight from the highest body weight during pregnancy (both measures were self-reported). In cases in which participants did not

report their highest body weight, we calculated total GWG by using the highest measured weight in the third trimester (n = 248; 12%).

Statistical analysis

For adherence to IOM GWG guidelines, within each prepregnancy BMI group, women were categorized as "below" if they gained less than the lower limit of the recommended amount of total weight, "met" if they gained within the recommended weight range, or "above" if they exceeded the upper limit of the recommended amount of weight gain. Mean ± SD CFG and LH scores were evaluated by prepregnancy BMI status. Proportions of women who consumed the recommended number of servings of each food group included in CFG stratified by prepregnancy BMI were calculated. Proportions of women meeting any of the 9 dietary recommendations, stratified by prepregnancy BMI, were calculated. Linear regression models were used to assess characteristics associated with both CFG and LH scores. Models were mutually adjusted for the other exposures of interest, and $P < 0.05$ was considered significant. All of the analyses were carried out by using Stata version 14.0 (StataCorp) (17).

Results

A total of 2189 women were recruited to the APrON study. For the purposes of this study, we included 1630 women with term, singleton pregnancies who had complete dietary, demographic, and prepregnancy weight data. Baseline characteristics stratified by prepregnancy BMI are presented in **Table 2**. The majority of women had attained a university-level education (71%), were married or cohabiting (96%), and had a yearly household income of >$100,000 (58%). Just over half of the women were pregnant with their first child (56%) and very few smoked during pregnancy (1%). In total, 26%, 40%, 71%, and 66% of women who were underweight, normal weight, overweight, and obese prepregnancy exceeded GWG guidelines, respectively.

In this group of pregnant women, CFG scores ranged from 0 to 8, with a mean ± SD score of 3.2 ± 1.6, indicating that few women came close to meeting CFG daily dietary recommendations. Women with a normal prepregnancy BMI had marginally higher

TABLE 2 Characteristics of participants with complete diet, weight, and demographic data by prepregnancy BMI[1]

Characteristics	All (n = 1630)	Underweight (n = 56)	Normal weight (n = 1056)	Overweight (n = 343)	Obese (n = 175)
Maternal age at enrollment, y	31.3 ± 4.3	28.8 ± 4.2	31.3 ± 4.3	31.8 ± 4.4	31.2 ± 4.3
Maternal education, n (%)					
Less than university	477 (29)	20 (36)	264 (25)	117 (34)	76 (43)
University or higher	1153 (71)	36 (64)	792 (75)	226 (66)	99 (57)
Marital status, n (%)					
Married/cohabiting	1565 (96)	51 (91)	1015 (96)	333 (97)	166 (95)
Single/divorced/separated	64 (4)	5 (9)	40 (4)	10 (3)	9 (5)
Annual household income,[2] n (%)					
<$39,999	117 (7)	9 (16)	73 (7)	21 (6)	14 (8)
$40,000–$69,999	212 (13)	9 (16)	124 (12)	49 (14)	30 (17)
$70,000–$99,999	354 (22)	10 (18)	222 (21)	75 (22)	47 (27)
>$100,000	930 (58)	26 (46)	624 (59)	196 (57)	84 (48)
Ethnicity, n (%)					
White	1334 (82)	39 (70)	848 (80)	296 (86)	151 (86)
Nonwhite	293 (18)	17 (30)	207 (20)	45 (14)	25 (14)
Smoking in pregnancy, n (%)					
Yes	22 (1)	2 (4)	11 (1)	3 (1)	6 (3)
No	1608 (99)	54 (96)	1044 (99)	339 (99)	169 (97)
Parity, n (%)					
Nulliparous	909 (56)	31 (55)	614 (58)	171 (50)	93 (53)
Multiparous	721 (44)	25 (45)	442 (42)	172 (50)	82 (47)
GWG guidelines, n (%)					
Below guidelines	310 (19)	14 (25)	247 (23)	23 (7)	26 (15)
Met guidelines	529 (32)	26 (46)	392 (37)	78 (23)	33 (19)
Exceeded guidelines	791 (49)	16 (29)	417 (40)	242 (70)	116 (66)
CFG score	3.2 ± 1.6	3.1 ± 1.7	3.3 ± 1.6	3.1 ± 1.5	2.9 ± 1.6
LH score	3.4 ± 2.6	3.2 ± 2.6	3.3 ± 2.5	3.4 ± 2.7	3.7 ± 2.5

[1]Values are means ± SDs unless otherwise indicated. CFG, Canada's Food Guide; GWG, gestational weight gain; LH, less healthy.
[2]Currency is in Canadian dollars.

scores than did women in other BMI groups, with those who were obese having the lowest scores (3.3 compared with 3.1, 3.1, and 2.9 for normal weight compared with underweight, overweight, and obese, respectively). In addition, the range of LH scores was 0–19, indicating that no woman was in the top third for consumption for all 8 of the LH food groups. Mean ± SD LH score in the whole cohort was 3.4 ± 2.5, and mean LH scores by prepregnancy BMI were 3.2, 3.3, 3.4, and 3.7 for underweight, normal-weight, overweight, and obese women, respectively. The most commonly consumed LH food group was "cakes and cookies," which were reported to have been consumed by 45% of women, followed by the food groups "high-energy soft drinks" and "candy," with 25% of the cohort reporting the consumption of foods from each of these groups. **Figure 1** shows the reported consumption of the most commonly consumed food groups included in the LH score by prepregnancy BMI. More than one-third (34%) of women who were obese prepregnancy reported the consumption of high-energy soft drinks compared with 27%, 22%, and 21% of women who were overweight, normal weight, and underweight, respectively. In addition, the greatest proportion of women in each BMI group reported the consumption of foods from the "cakes and cookies" group: 55%, 46%, 40%, and 42% of women who were underweight, normal weight, overweight, and obese, respectively.

Patterns of the proportions of women who consumed numbers of servings of each food group included in CFG were largely similar across prepregnancy BMI groups (**Figure 2**). However, 13% and 9% of women in the underweight and obese groups,

respectively, reported not consuming any fruit or vegetables compared with 5% of both normal-weight and overweight women. The proportions of women who met each specific CFG recommendation, stratified by prepregnancy BMI, are shown in **Table 3**. Just over half of the women (56%) met the recommendation to choose reduced-fat milk, whereas <1% of women reported meeting the pregnancy-specific recommendation of consuming an extra 2–3 servings from any food group/d. Further analyses
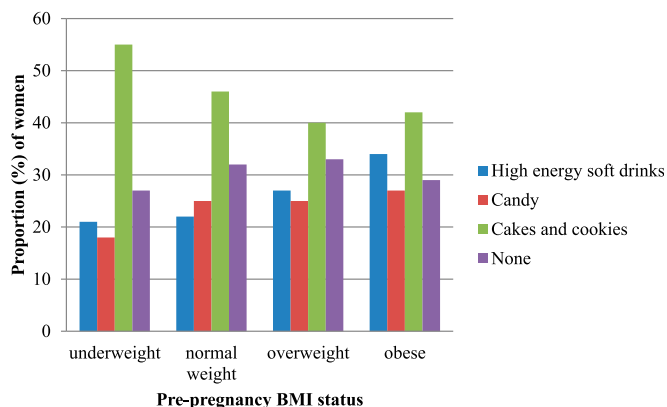

FIGURE 1 Proportion of women who consume the 3 most commonly consumed food groups and women who consume none of the food groups, included in the less-healthy score, by prepregnancy BMI status.
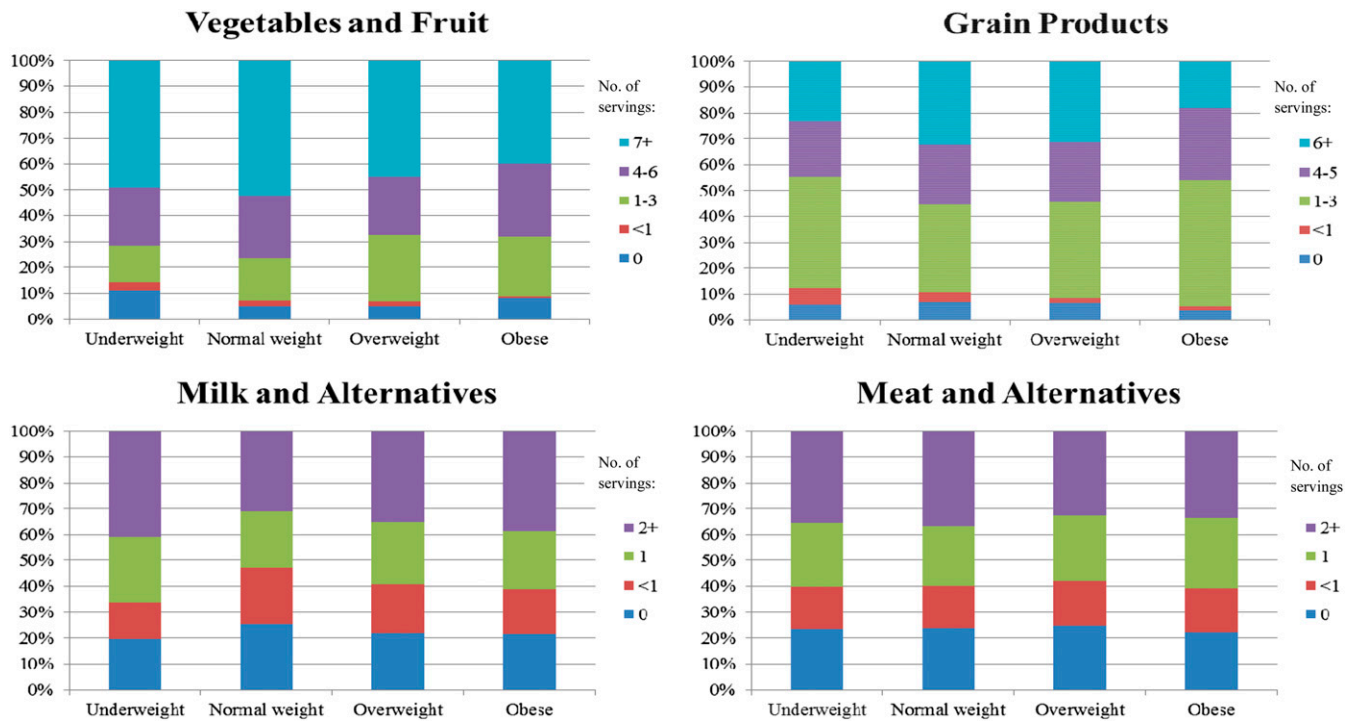
FIGURE 2 Proportion of women who consume the numbers of servings per day by each food group in Canada's Food Guide, stratified by prepregnancy BMI. Canada's Food Guide recommendations for daily servings of these food groups are as follows: fruit and vegetables, 7–8 servings; grains, 6–7 servings; dairy and alternatives, 2 servings; and meat and alternatives, 2 servings.

showed that <1% of women consumed 1 extra serving from any food group, whereas none reported the consumption of 4 extra servings, indicating that women were not close to meeting the pregnancy-specific recommendation (data not shown). Compared with women in the normal-weight prepregnancy group, fewer women who were overweight or obese met the recommendations for fruit and vegetable consumption (54% compared with 47% and 41% for overweight and obese women, respectively). In addition, fewer women who were obese met the recommendation for the consumption of 6–7 portions of grains/d than did those who were normal weight (18% compared with 33% for obese and normal-weight women, respectively).

Multivariate regression analyses showed significant associations between several participant characteristics with CFG score and LH score (**Table 4**). The 2 diet scores were inversely associated with each other, such that each additional 1-point increase in CFG score was associated with a −0.04-point decrease in LH diet score (95% CI: −0.07, −0.01 points). In addition, women with higher levels of education and higher incomes were more likely to have higher CFG scores. Notably, those who were obese were more likely to have lower CFG scores than those who were normal-weight prepregnancy. Conversely, women with higher incomes and those who were younger were more likely to have higher LH diet scores. Furthermore, women who were

TABLE 3 Proportion of women meeting each of the 9 daily dietary recommendations outlined in CFG, stratified by prepregnancy BMI[1]

CFG recommendation	All, n (%)	Underweight, n (%)	Normal weight, n (%)	Overweight, n (%)	Obese, n (%)
7–8 servings fruit and vegetables/d	827 (51)	28 (50)	566 (54)	161 (47)	72 (41)
≥1 vegetable is an orange vegetable	544 (33)	19 (34)	366 (35)	107 (31)	52 (30)
≥1 vegetable is a dark-green vegetable	625 (38)	16 (29)	421 (40)	125 (36)	63 (36)
6–7 servings grains/d	509 (31)	14 (25)	353 (33)	110 (32)	32 (18)
≥3–3.5 servings of grains are whole grains	483 (30)	18 (32)	317 (30)	96 (28)	52 (30)
2 servings milk and alternatives/d[2]	673 (41)	28 (50)	419 (40)	146 (43)	80 (46)
Choosing reduced-fat milk	917 (56)	31 (55)	598 (57)	193 (56)	95 (54)
2 servings meat and alternatives/d	698 (43)	24 (43)	467 (44)	136 (40)	71 (41)
Include 2–3 extra servings from any food group	8 (0.5)	0	6 (0.6)	0	2 (1)

[1] CFG, Canada's Food Guide.
[2] For women aged <19 y the recommendation is to consume 3–4 servings of milk and alternatives/d and was accounted for in this analysis.

studies in women in the United Kingdom showed that, in both prepregnancy and during pregnancy, those who consumed a diet rich in fruit, vegetables, and whole grains were also less likely to consume energy-dense, nutrient-poor foods such as chips, fries, and refined grains, and vice versa. We also observed that women with higher levels of education tended to report the consumption of diets more adherent to CFG recommendations. This is consistent with the findings from other studies, which showed that higher levels of education are associated with greater awareness (7) and adherence to dietary guidelines (22).

Although we observed a significant association indicating that women who were obese prepregnancy had higher LH scores and lower CFG scores than women with normal prepregnancy BMI, the effect sizes were minimal. However, this indication that diet quality during pregnancy is lower in those who are obese prepregnancy is consistent with findings from large cohort studies, including the Framingham and NHANES studies (26, 27). It was of interest that mean CFG scores were the same in women in the underweight and overweight categories. One possible explanation is that the underweight women were not consuming enough servings to meet the CFG recommendations because, in general, they ate less, whereas the overweight women were not consuming enough servings of the foods to meet CFG recommendations but were getting more of their calories from LH foods, indicated by a difference in mean LH score.

In our study, more women who were overweight or obese exceeded GWG guidelines. In a previous study in the same cohort we also observed that the trajectories of GWG were very similar across prepregnancy BMI groups (12). In a health care system in which GWG guidelines are based on prepregnancy BMI, it may be necessary to tailor dietary guidelines as well. This conclusion is shared by the Academy of Nutrition and Dietetics (formerly the American Dietetic Association), which reported that prepregnancy BMI and rates of GWG should be taken into account when providing dietary guidance to pregnant women (13). Although more research is required to explore this hypothesis, the idea that CFG may need to be revisited is consistent with previous suggestions that the lack of guidance concerning LH foods and the high energy intake that would be experienced if the CFG recommendations were followed would promote tacit overconsumption of calories in an "obesogenic environment" (28–30).

Strengths and limitations

This study was not without limitations. The use of a single 24-h recall for dietary assessment presents challenges. Because 24-h recalls tend to underestimate habitual intakes, it is possible that more of the CFG recommendations were being met over the longer term than was captured in our scoring method. However, studies that aimed to assess the relative validity of dietary assessment tools have suggested that those with higher levels of education may report diet more accurately (31); and in our population, 77% of women had a university-level education. In addition, underreporting is often associated with social-desirability bias, with the LH food groups being underreported (32). Therefore, it is possible that any underestimation in our study would be more likely to have occurred in the LH score rather than in the CFG score. However, our analyses were

carried out at a food-group level, which is likely to vary less than the reporting of individual foods. Studies of dietary patterns during pregnancy with the use of repeated dietary assessment methods have shown that women are unlikely to vary in their food choices throughout pregnancy (33–35). In addition, CFG recommendations are for daily intake; therefore, we expect that our dietary assessment was useful for ranking women according to their adherence to CFG recommendations. An additional challenge was presented by creating a scoring approach that not only accounted for adherence to CFG recommendations but also attempted to account for the consumption of LH foods. Although Health Canada has developed a tool for assessing diets reported in surveillance activities (36), a recent study concluded that it was not suitable for use in analyses that aimed to use adherence to CFG as an exposure related to a health outcome (37). Finally, reliance on self-reported prepregnancy weight may have caused some women to be misclassified in their prepregnancy BMI categories. However, in an earlier publication describing patterns of GWG in this same cohort, we showed that BMI calculated by using self-reported prepregnancy weight was a reasonable estimate (12).

A key strength of our study is that our score is simple to use and provides an assessment that reflects overall adherence, which could be used in analyses of predictors and outcomes associated with this diet pattern. Because CFG does not include quantifiable recommendations on the consumption of LH foods, a separate score was necessary to account for the consumption of these foods as well. Other strengths of our study are that, in a large, contemporary cohort, this is the first study to our knowledge that assesses adherence to CFG recommendations in pregnancy. Overall, this simple scoring system allows for easy interpretation and is likely to be transferable to other studies that assess adherence to national dietary guidelines.

Conclusions

We developed a simple score to reflect adherence to Canadian dietary guidelines and the consumption of LH foods during pregnancy. Our observations suggest that adherence to national dietary recommendations in pregnancy is low and is an important area for further research to tease out the extent to which low adherence is due to lack of awareness, or if other factors are in play. Thus, future research to better understand the barriers to and facilitators of good-quality diets during pregnancy needs to take a mixed-methods approach. Observational data need to be complemented by robust qualitative research to unravel the complexity of the influences on diet in pregnancy. In addition, future research must involve both practitioners and women in order to advance practices that better support women to have healthy diets and gain appropriate amounts of weight during pregnancy.

from PJR and RCB; RCB: is a principal investigator of the ENRICH study and a coinvestigator of the APrON cohort; RCB and PJR: supervised MJ; KN: provided a clinical perspective and assisted in the presentation of the results and writing of the manuscript; MJ, RCB, KN, and PJR: reviewed drafts of the manuscript; and all authors: read and approved the final manuscript.

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