Are Canadian Women Achieving a Fit Pregnancy? A Pilot Study

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ABSTRACT

Objectives: Canadian recommendations exist for energy intake (EI), physical activity (PA) and gestational weight gain (GWG) to help pregnant women avoid excessive GWG and attain “fit pregnancies”. Our objectives were: 1) to measure daily EI, PA and GWG to observe whether pregnant women were meeting recommendations, 2) to explore the impact of health care provider advice on PA and GWG, and 3) to determine behaviours associated with recommended weekly GWG.

Methods: Women (n=81) were recruited from prenatal classes. Current weight and self-reported pre-pregnancy weight were documented. Current PA levels and provider advice for PA and GWG were surveyed using questionnaires. Dietary recalls and pedometer steps were recorded for three and seven days respectively.

Results: The majority of our women were classified as having average pre-pregnancy body mass indices (BMI) of $23.3 \pm 4 \text{ kg/m}^2$, average EI of 2237 kcal/d and energy expenditure (EE) of 2328 kcal/d, but with weekly rates of GWG in excess of current recommendations despite having received advice about GWG (74%) and PA (73%). Most were classified as sedentary (<5000 steps/day (d)) and 36% as low active (<7500 steps/d). Women were most likely to achieve appropriate GWG if their total PA was >8.5 MET-hr/wk.

Conclusion: Health care providers need to provide appropriate PA and GWG guidelines to pregnant women. Development of pregnancy step and MET-hr/wk recommendations are warranted in order to promote greater PA during pregnancy.

Key words: Physical activity; pregnancy; gestational weight gain; information resources; steps

La traduction du résumé se trouve à la fin de l'article.

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The obesity epidemic affects all health professionals, including the obstetrical community, as women who exceed their gestational weight gains (GWG) increase their risk of pregnancy complications.¹ The concept of a “fit pregnancy” is emerging as women are trying to achieve optimal health outcomes for their unborn child and for themselves.² Women can attain a “fit pregnancy” with an appropriate GWG by balancing energy intake (EI) with energy expenditure (EE). Currently there exist dietary,^{1,3,4} exercise^{5,6} and GWG^{1,7} guidelines for pregnant women.

Nutritional requirements during pregnancy are based on Dietary Reference Intakes (DRI) recommended by the Institute of Medicine (IOM).¹ Recently the IOM adopted the World Health Organization (WHO) GWG recommendations, which state that women aim for total weight or weekly weight gains based on their pre-pregnancy BMI (PP-BMI).⁷ Joint SOGC/ CSEP Clinical Practice Guidelines encourage women to exercise if they have no contraindications.⁵ Currently there exist Canadian step recommendations for youth, adults and older adults, but none for pregnant women.^{8,9}

Despite recommendations, research shows that obstetricians seldom recommend PA,^{2,10} but rather participation is influenced by family members.¹⁰⁻¹² When health care providers do promote appropriate GWG by discussing weight goals, PA, and reviewing nutritional requirements during pregnancy, women who receive advice are more likely to target appropriate weight gains.¹³ However, intervention trials have not been uniformly successful.¹⁴⁻¹⁸

Research for pregnant women has focused on the strict exercise routines, not daily PA as it relates to EE.¹⁹ Daily PA can be addressed by quantifying total steps taken per day and by using validated questionnaires.¹⁹ To date, one Canadian study has assessed PA patterns during pregnancy, citing walking as the most frequently per-

formed type of PA during pregnancy,²⁰ but no study has examined the impact of PA on gestational weight gain.

The objectives of this study were to: 1) measure daily EI, PA and weekly GWG to observe whether pregnant women were meeting public health recommendations, 2) explore the impact of health care provider advice on PA and GWG, and 3) determine behaviours associated with recommended weekly GWG.

METHODS

Subject recruitment

Ethics approvals were obtained from McGill University, Ottawa Public Health Ethics Board, Centre de Santé et de Services Sociaux (CSSS) West Island and Cavendish. Inclusion criteria were for women >12 wks gestation and free of medical risks for PA, as described in the Physical Activity Readiness Medical Examination for Pregnancy (PARmed-X for PREGNANCY).²¹ Benefits of participating in the study included receiving a pedometer as well as study feedback. From August 2008 to December 2008, bilingual information sessions in Ottawa (ON) and Montreal (QC) public prenatal classes informed women about the study. Women interested in participating provided contact information and were scheduled for a home visit.

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During the home visit, women signed the consent form. Subjects were asked to self-report age, height, pre-pregnancy weight and date of last menses. Women were weighed using a Tanita HS-301 Digital Bathroom Scale (Tanita Corporation of America, Inc., Arlington Heights, Illinois). Weekly GWG was calculated using current pregnancy weight minus pre-pregnancy weight (kg) divided by gestational weeks minus twelve.^{1,22} Socio-demographic characteristics were obtained. Women orally answered questions regarding sources of GWG.

Physical activity assessment

Daily PA was assessed using the validated Pregnancy Physical Activity Questionnaire (PPAQ)¹⁹ during the home visit. It contains 32 questions that assess usual time spent performing different types of activities over the course of one day. This questionnaire permits assessment of activity by intensity and type and allows for calculation of daily EE (kcal) and metabolic equivalents (METs). METs are a method of expressing the energy needed to perform an activity compared to that when at rest.²³ Translation of the Joint SOGC/CSEP Clinical Practice Guidelines suggests women would expend 8.5 metabolic equivalent hours per week (MET-hr/wk) if they were meeting these recommendations. This falls within the recommendations of achieving 7.5-12.5 MET-hr/wk for non-pregnant adult populations.²³

Average EE, recorded in MET-hr/wk and kcals, was calculated by multiplying time spent for each activity by its intensity. Total average MET-hr/wk was calculated using the sum of sedentary, light-intensity, moderate-intensity, vigorous-intensity, household/care giving, occupation and sports/exercise as previously described.¹⁹

Currently, there are no step recommendations for the pregnant population. Health Canada defines "active lifestyles" as those that achieve >10,000 steps/d.^{8,9} As walking is the most reported activity during pregnancy,²⁰ women were asked to wear a pedometer [New Lifestyles Digi-Walker SW-200 pedometer (Less Summit, MO, USA)] for one week and to record their steps in a log book. The Digi-Walker has been used in pregnant populations and has been tested for accuracy.^{24,25} Sources of information and provider advice concerning PA during pregnancy were assessed using open-ended questionnaires.

Dietary assessment

Women participated in three non-consecutive 24-hour telephone food recalls to calculate average daily EI during the week they wore the pedometer. Dietary interview kits were provided to assist with estimating food portion sizes during recalls. The Canadian Nutrient File 2007²⁶ and ESHA Research Food Processor (version 9.1) (Salem, OR) were used to analyze food recalls for total energy (kcals), protein (g), fat (g) and carbohydrate (g). Estimated energy requirements (EER) were calculated using the formula from the DRI which estimates the EER based on age, PA level, height and the additional requirement associated with pregnancy.^{1,3}

Statistical analyses

Data analyses used SAS [Version 9.2, 2002-2003] (SAS Institute Inc., Cary, NC). Data were tested for normality and log transformed for GWG and EI. Differences between women who received provider advice and met or exceeded GWG recommendations, as well as those who accumulated >8.5 MET-hr/wk versus those who did not, were computed using independent t-tests. Differences between WHO PP-BMI classifications for weekly GWG (kg/wk), EE (kcals and

Table 1. Population Characteristics

Characteristics*	(n) $\bar{X} \pm SD$ [range]
Rate of Gestational Weight Gain (kg/week), n=81	
Underweight (BMI <18.5)	(2) 0.48 $\pm$ 0.20 [0.34- 0.62]
Normal (BMI 18.5-24.9)	(55) 0.71 $\pm$ 0.44 [-0.34- 2.5]
Overweight (BMI $\geq$ 25.0)	(19) 0.44 $\pm$ 0.33 [0.04- 0.80]
Obese (BMI $\geq$ 30)	(5) 0.77 $\pm$ 0.33 [0.21- 1.55]
Energy Intakes (kcal), n=74	
Mean Energy Intake (kcal)	2237 $\pm$ 504 [1080, 3763]
Underweight (BMI <18.5)	(2) 2953 $\pm$ 396 [2673, 3234]
Normal (BMI 18.5-24.9)	(50) 2220 $\pm$ 500 [1079, 3762]
Overweight (BMI $\geq$ 25.0)	(19) 2234 $\pm$ 515 [1508, 2958]
Obese (BMI $\geq$ 30)	(3) 2052 $\pm$ 370 [1637, 2349]
Energy Expenditure by WHO BMI Classification (kcal), n=81	
Mean Energy Expenditure (kcal)	2328 $\pm$ 894 [728, 5494]
Underweight (BMI <18.5)	(2) 1258 $\pm$ 283 [1058, 1458]
Normal (BMI 18.5-24.9)	(55) 2161 $\pm$ 758 [900, 4530]
Overweight (BMI $\geq$ 25.0)	(19) 2820 $\pm$ 1098 [728, 5493]
Obese (BMI $\geq$ 30)	(5) 2733 $\pm$ 691 [2040, 3802]
Pedometer steps (steps/day), n=61	6118 $\pm$ 2187 [845, 11 090]
"Sedentary" (<5000 steps/d)	(21) 3820 $\pm$ 1142
"Low active" (5000-7499 steps/d)	(22) 6161 $\pm$ 745
"Active" (>7500 steps/d)	(18) 8745 $\pm$ 911
Total MET-hr/wk (MET-hr/wk) [†] , n=81	6.3 $\pm$ 2.5 [1, 14]

* BMI: Body Mass Index (weight [kg]/ height [m]²)

[†] MET-hr/wk, metabolic equivalent hours per week, is a method of expressing the energy needed to perform activity compared to that at rest.¹⁹ The Total MET-hr/wk is calculated by taking the sum of all the Pregnancy Physical Activity Questionnaire (PPAQ) Scores.

MET-hr/wk) and steps (steps/d) were analyzed using ANOVA with no adjustments. Univariate logistic regressions were used to compute odds ratios (OR) for achieving recommended GWG based on five variables: PA, EI, PP-BMI, provider advice and socio-demographic variables. Statistical significance was set at $p < 0.05$.

RESULTS

Population characteristics

Through 18 prenatal class visits, study researchers informed 142 women about the study. Of the 142, 81 women provided contact information (response rate=52%) and were visited at home. All 81 (second trimester: n=40, third trimester: n=41) consented to participate and completed the PPAQ. Seventy-four (91%) participated in telephone dietary recalls and 61 (75%) completed pedometer logbooks. A total of 60 women (74%) completed all components of the study. Mean age was 32 $\pm$ 5 years. Of the 81 women, 65% were married, 28% were cohabiting/engaged and 7% reported being single/divorced/separated. The majority (74%) had pre-university college degrees and 25% had completed university. Most were nulliparous (78%), Caucasian (85%) with household incomes >\$50,000/yr (75%).

The mean PP-BMI was normal at 23 $\pm$ 4 kg/m². Table 1 summarizes our sample characteristics. Regardless of BMI classification, average GWG was higher than recommended. Average steps/day were 6118 $\pm$ 2187, thus classifying most women as "sedentary" (34%) or "low active" (36%). Total mean MET-hr/wk averaged 6.3 $\pm$ 2.5. Additional analyses revealed that weekly GWG was negatively correlated with mean steps ($r = -0.31$, $p < 0.01$). Less than 30% met weekly GWG, steps/day, and MET-hr/wk recommendations while 57% exceeded EER.

EI and EE characteristics

Women met recommended energy distributions (53% carbohydrate, 17% protein and 30% fat), but only 43% consumed appropriate EER. Second trimester EI (2231 $\pm$ 533 kcal) did not differ

Table 2. Impact of Advice on Weekly Gestational Weight Gain (GWG) by Pre-pregnancy BMI Classification*

BMI Classification (kg/m ²)	WHO Target GWG (kg/wk)	With Advice† (n)	With Advice† $\bar{X} \pm SD$	No Advice (n)	No Advice $\bar{X} \pm SD$	p-value
Normal (BMI 18.5-24.9)	0.4	(42)	0.71 $\pm$ 0.39	(13)	0.68 $\pm$ 0.59	0.0553
Overweight/Obese (BMI $\geq$ 25.0)	0.3/0.2	(21)	0.71 $\pm$ 0.34	(3)	0.61 $\pm$ 0.53	0.2330

* GWG: {Current weight (kg) - Pre-pregnancy weight (kg)}/ (Weeks gestation- 12).^{1,22} For Underweight (BMI <18.5), target GWG is 0.5 kg/wk. Only two individuals fit this category; With Advice (n=1), 0.34 kg/wk; No Advice (n=1), 0.62 kg/wk.

† With Advice: Includes all health care professionals (physician, dietitian, nurse and midwife) and books/internet

Table 3. Comparison of Pregnancy Physical Activity Questionnaire (PPAQ) Scores of Women who Accumulate <8.5 MET-hr/wk versus >8.5 MET-hr/wk, n=81

PPAQ Scores	Accumulated <8.5 Met-h/wk $\bar{X} \pm SD$	Accumulated >8.5 Met-h/wk $\bar{X} \pm SD$	p-value
Intensity Score			
Sedentary (<1.5 METs)*	88 $\pm$ 28	82 $\pm$ 30	0.4328
Light (1.5-3.0 METs)†	66 $\pm$ 34	124 $\pm$ 35	<0.0001
Moderate (3.0-6.0 METs)‡	36 $\pm$ 28	120 $\pm$ 67	<0.0001
Vigorous (>6.0 METs)§	0.8 $\pm$ 2.6	3 $\pm$ 65	0.1587
Type Score			
Household/Caregiving	48 $\pm$ 30	106 $\pm$ 62	<0.0001
Occupational¶	73 $\pm$ 45	152 $\pm$ 64	<0.0001
Leisure-time Sports**	5 $\pm$ 6	10 $\pm$ 9	0.0426

* Sedentary: e.g., sitting and using a computer; sitting and reading or talking on the phone; driving or riding in a car; sitting at work or in class; watching TV or a video.

† Light intensity: e.g., preparing meals; dressing, bathing or feeding a child while sitting; playing with children; light cleaning; shopping; heavy cleaning; mowing lawn while on a riding mower; walking slowly to go places; standing or slowly walking at work not carrying anything.

‡ Moderate intensity: e.g., dressing, bathing or feeding a child while standing; playing with children while walking or running; carrying children; taking care of an older adult; playing with pets; mowing lawn using a walking mower; raking; gardening; walking quickly to go places; walking slowly for fun or exercise; walking more quickly for fun or exercise; prenatal exercise classes; swimming; dancing; standing or slowly walking at work while carrying things (heavier than 1 gallon milk jug); walking quickly at work while carrying things.

§ Vigorous intensity: e.g., walking quickly up hills for fun or exercise; jogging.

|| Household/Caregiving activities: e.g., preparing meals; dressing, bathing or feeding a child while sitting and standing; playing with children while sitting; standing, walking or running; carrying children; taking care of an older adult; light cleaning; shopping; heavy cleaning; mowing lawn while on riding mower or using a walking mower; raking and gardening.

¶ Occupational type activities: e.g., sitting at work or class; standing or slowly walking at work while carrying things or not (heavier than 1 gallon milk jug); walking quickly at work while carrying things or not (heavier than 1 gallon milk jug).

** Leisure-time Sports activities: e.g., walking slowly or more quickly for fun and exercise; walking quickly up hills; jogging; prenatal exercise classes; swimming; dancing.

significantly from third trimester EI (2242 $\pm$ 480 kcal), nor were there differences across PP-BMI classifications (Table 1). In contrast, EE significantly differed between women classified as normal (BMI 18.5-24.9) and overweight/obese (BMI $\geq$ 25) (p <0.002). The mean energy differences (EI-EE) were also significantly different between similar PP-BMI classifications (p <0.004).

Provider advice for weight and PA

The majority (79%) received advice about GWG: 44% from books/internet, 32% from a physician, and 14% from another health professional (dietitian, nurse or midwife); 10% referenced multiple sources. Recommended total GWG were: <25 lbs (12%), 25-35 lbs (59%) and >35 lbs (7%). Table 2 compares weekly GWG by PP-BMI classification and whether the women received advice or not. On average, women exceeded GWG recommendations and provider advice did not lower rates of weight gain.

Advice for PA was less structured and uniform than for GWG and came from a variety of sources, including books (73%), internet

sites (69%), partners/family or friends (63%), physicians (41%), physiotherapist/chiropractor/kinesiologists (35%), magazines (25%), nurses (20%), personal trainers (12%), dietitians (10%), midwives (9%) and newspaper articles (4%). This advice both promoted PA (i.e., "...keep active...", "... walk, bike and swim...") and discouraged PA (i.e., "... don't feel guilty if inactive...", "...no biking, no sex, no running, don't exercise...") and was therefore inconsistent.

PA characteristics

Across trimesters there was no significance difference in steps/d. However, within a trimester, active women averaged 8745 $\pm$ 911 steps/d whereas inactive women took fewer than 4990 $\pm$ 944. No differences were found in the number of steps/d when classified by PP-BMI.

Using the PPAQ, 39% of the score was attributed to sedentary activities (<1.5 METs), 36% to light-activities (1.5-3.0 METs) and 25% to moderate-intensity (3.0-6.0 METs). Fifty-seven percent of the PPAQ score was attributed to occupationally-related activities followed by household/caregiving activities (38%) and leisure time/sport-related activities (4%). There were no differences in PPAQ scores among PP-BMI classifications or between trimesters.

Women who engaged in more hours of light-intensity and moderate-intensity activities in the form of household/caregiving, occupational and leisure-time PA accumulated >8.5 MET-hr/wk, the calculated value associated with meeting the current Joint SOGC/CSEP Clinical Practice Guidelines⁵ (Table 3).

Behaviours associated with GWG

Table 4 summarizes univariate logistic regression analyses used to predict behaviours associated with achieving appropriate GWG. Only women who accumulated 8.5 MET-hr/wk achieved their recommended GWG. No significant odds ratios were observed for women who accumulated >5000 steps/d or received advice concerning GWG.

DISCUSSION

Our results show that women who are active, as represented by PPAQ score, are more likely to achieve appropriate GWG compared to those who focus on EI. Thus, to assume that diet alone affects GWG is incorrect. Most women in the study were physically inactive and were not accumulating sufficient steps from walking. Only 30% of study participants met the adult steps recommendations.^{8,9} Although occupational and household/caregiving types of activities were continued by all women, only those who accumulated >8.5 MET-hr/wk influenced GWG. Moreover, the provider advice regarding PA was not focused or consistent, making achievement of any PA goal during pregnancy difficult.

Our findings also show that our pregnant women exceeded weekly GWG most likely in part due to: 1) health care providers not con-

Table 4. Odds Ratio of Achieving Recommended GWG Categorized by Behaviour*

Behaviour	Odds Ratio	(95% CI)	p-value
Physical Activity			
Accumulated ≥ 7500 steps/d	1.6	(0.38, 6.26)	0.538
Accumulated ≥ 8.5 MET-hr/wk	3.8	(1.18, 12.38)	0.025
Energy Intake			
Exceed estimated energy requirements	1.0	(0.33, 3.34)	0.950
Weight Classification			
Pre-pregnancy-BMI was "Normal/Healthy" (18.5-24.9)	4.0	(0.82, 19.31)	0.087
Provider Advice			
Received advice regarding GWG	2.4	(0.71, 8.05)	0.160
Socio-demographic Characteristics			
University degree or equivalent	1.9	(0.64, 5.60)	0.251
Nulliparous	3.0	(0.94, 10.0)	0.060
Income $> \$50,000/\text{yr}$	1.4	(0.32, 6.14)	0.668

* n=81, except for physical activity (steps/d, n=61) and energy intake (n=74)

veying the correct information and 2) targeted GWG recommendations based on PP-BMI classification not being achieved, as others have shown.¹⁴⁻¹⁸ Most pregnant women cited 25-35 lbs as an appropriate weight gain. We suspect that they did not understand that GWG is based on PP-BMI.⁷ Limitations to our study include the use of self-reported data, small sample size and participant burden. Our findings also suggest that any public health message should target women prior to pregnancy and focus on their achieving healthy PP-BMIs.

CONCLUSION

Most study participants exceeded their GWG recommendations and maintained an inactive lifestyle during their pregnancy. This brings forward an important public health message. Governmental agencies are highlighting the importance of healthy lifestyles to reduce obesity; similar efforts are needed for the pregnant population. Public health initiatives targeted toward pregnant women are warranted to emphasize the importance of appropriate GWG, PP-BMI and sufficient PA during pregnancy.

Future research agendas should include the use of validated assessment tools and should study appropriate steps/day and MET goals for the pregnant population. Physical activity in combination with a well-balanced diet and appropriate gestational weight gain need to become part of the public health message for achieving a "fit pregnancy".

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RÉSUMÉ

Objectifs : Les recommandations canadiennes à l'égard de l'apport énergétique (AE), la pratique de l'activité physique (AP) et le gain de poids gestationnel (GPG) peuvent être utiles pour éviter un GPG excessif et atteindre une « grossesse en santé ». Les objectifs de cette étude étaient : 1) estimer l'AE et l'AP quotidiens et le GPG pour établir si les femmes enceintes observent les recommandations, 2) étudier l'impact des conseils reçus des professionnels de la santé sur le GPG et la pratique d'AP, et 3) déterminer les comportements associés au GPG recommandé.

Méthodes : Des femmes enceintes (n=81) ont été recrutées lors de classes prénatales. Le poids actuel mesuré et le poids auto-rapporté avant la grossesse ont été utilisés pour les analyses. La pratique actuelle d'AP et les conseils reçus concernant le GPG et l'AP ont été estimés à l'aide de questionnaires. La collecte de données incluait aussi trois rappels de 24-heures et de l'utilisation d'un pedomètre durant 7 jours.

Résultats : Les participantes à l'étude avaient un indice de masse corporelle (IMC) moyen de $23,3 \pm 4 \text{ kg/m}^2$ avant la grossesse, un AE moyen de 2237 kcal/jour et une dépense énergétique moyenne de 2328 kcal/jour. Par contre, celles-ci ont eu un GPG hebdomadaire supérieur aux recommandations malgré avoir reçu des conseils au sujet de GPG (74 %) et de l'AP (73 %). La plupart des femmes étaient sédentaires (<5000 pas/jour); 36 % étaient légèrement actives (<7500 pas/jour). Les femmes ayant un niveau d'activité physique supérieur à 8,5 MET-hr/sem avait plus de chance d'avoir un GPG approprié.

Conclusion : Les professionnels de la santé doivent modifier les conseils relatifs à l'AP et au GPG donnés aux femmes enceintes. L'élaboration de recommandations pour le nombre de pas quotidien durant la grossesse et le nombre de MET-hr/sem est justifié pour encourager la pratique de l'AP lors de la grossesse.

Mots clés : activité physique; grossesse; gain de poids gestationnel; source d'information; pas

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