



Article scientifique

Article

2016

Accepted version

Open Access

This is an author manuscript post-peer-reviewing (accepted version) of the original publication. The layout of the published version may differ .

Determinants of Health Behaviors After Gestational Diabetes Mellitus: A Prospective Cohort Study in Geneva

Kaiser, Barbara; Jeannot, Emilien; Razurel, Chantal

How to cite

KAISER, Barbara, JEANNOT, Emilien, RAZUREL, Chantal. Determinants of Health Behaviors After Gestational Diabetes Mellitus: A Prospective Cohort Study in Geneva. In: Journal of midwifery & women's health, 2016, vol. 61, n° 5, p. 571–577. doi: 10.1111/jmwh.12486

This publication URL: <https://archive-ouverte.unige.ch/unige:89725>

Publication DOI: [10.1111/jmwh.12486](https://doi.org/10.1111/jmwh.12486)

Determinants of Health Behaviors After Gestational Diabetes Mellitus: A Prospective Cohort Study in Geneva

Barbara Kaiser, PhD, Emilien Jeannot, MPH, Chantal Razurel, PhD

Introduction: Gestational diabetes mellitus (GDM) is one of the most common complications in pregnancy. The objective of this study was to specify the determinants of postpartum physical activity and dietary habits after a pregnancy complicated by GDM in a population of Swiss women. This information will be used to improve health promotion and diabetes prevention interventions for women with a history of GDM.

Methods: A prospective cohort study of 173 pregnant women with a diagnosis of GDM was carried out. Quantitative data were collected at the end of pregnancy (T1) and at 6 months postpartum (T3). Bivariate and multivariate logistic regression analysis was conducted to assess associations between the level of healthy lifestyle at 6 months postpartum, clinical and sociodemographic characteristics, motivation to adopt a healthy lifestyle after birth at the end of pregnancy, and postulated psychosocial correlates of health behaviors.

Results: Multivariate regression analysis showed that only 2 variables were determinants in a low adherence to healthy lifestyle in the postpartum period after GDM: a lower level of social support (odds ratio [OR], 1.5; $P < .001$) and more perceived barriers to a healthy lifestyle (OR, 1.2; $P = .002$).

Discussion: This study shows that, for women who had GDM, the problem of low adherence to a healthy lifestyle to prevent the onset of type 2 diabetes may be secondary to the lack of resources available for the promotion and development of healthy eating habits and regular physical activity. The findings of this study suggest that some women with a history of GDM do not have the means and resources in the postpartum period to apply the advice given during antenatal monitoring.

J Midwifery Womens Health 2016;00:1–7 © 2016 by the American College of Nurse-Midwives.

Keywords: dietary habits, gestational diabetes mellitus, health behaviors, physical activity, postpartum period, social support

INTRODUCTION

Gestational diabetes mellitus (GDM), defined as glucose intolerance occurring or diagnosed for the first time during pregnancy, is one of the most common complications in pregnancy.¹ Epidemiologic studies show that this disorder currently affects 2% to 18% of women during pregnancy^{2,3} depending on population and diagnostic criteria. In European populations, the average prevalence of GDM is in the order of 2% to 6%;⁴ however, currently in Switzerland it is approximately 10%.⁵

The risk of developing type 2 diabetes is up to 7 times higher in women with a history of GDM,⁶ and up to two-thirds of these women present with recurring GDM in subsequent pregnancies.⁷ These high-risk women should therefore be educated about the importance of following a basic healthy lifestyle so as to prevent the onset of diabetes after childbirth. This includes highlighting the need for regular physical activity (ie, moderate activity for at least 30 minutes/day, 5 days a week or strenuous exercise for at least 20 minutes/day, 3 days a week) and consumption of a balanced diet, including the recommendation to eat at least 5 servings of fruits and/or vegetables per day. A diet that is low in sugar, salt, and fat should also be recommended.⁸ This is also important given the impact that a healthy lifestyle will

have on the woman's family since children of women with diabetes are at greater risk of obesity and diabetes.^{9,10}

A recent systematic review of studies that have evaluated the determinants of postpartum health behavior in women who have had GDM indicates a lack of adherence to lifestyle recommendations to prevent the onset of type 2 diabetes.¹¹ This review also found that a lack of knowledge about prevention strategies, lack of motivation, and a low perception of risk to oneself to develop diabetes in the future had an adverse impact on adoption of a healthy lifestyle in the postpartum period after GDM. Other factors that could be involved include beliefs about health behaviors (eg, advantages, barriers, social influences), social support (ie, the actual and/or available instrumental and emotional support received by women specific to health-related behaviors),¹² and self-efficacy (ie, the extent or strength of belief in one's own ability to complete health-related behaviors).^{13,14}

There are, therefore, a number of factors influencing the adoption of preventive behaviors by women who have had GDM. However, studies conducted to date on this subject were systematically cross-sectional and often retrospective in nature, thus presenting considerable limitations in terms of scope of the data. To date, no study has combined these factors within the same protocol; therefore, this is the aim of the present study. Our main objective was to identify the associated factors and determinants of postpartum physical activity and dietary habits after a pregnancy complicated by GDM, in a population of women living in Switzerland, in order to improve health promotion interventions for women with a history of GDM.

Address correspondence to Barbara Kaiser, PhD, School of Health Sciences-Geneva, University of Applied Sciences and Arts of Western Switzerland, Avenue de Champel 47, 1206 Geneva. E-mail: barbara.kaiser@hesge.ch



Quick Points

- ◆ Six months after giving birth, 63% of women with a history of GDM exhibit eating habits and a level of physical activity that is not in keeping with optimal prevention of diabetes.
- ◆ Two factors come into play for establishing healthy attitudes for the postpartum period 6 months after GDM: social support and the number of perceived barriers in attaining the desired health measures.
- ◆ For women who have had GDM, we envision the provision of postpartum care through a network of health services revolving around personalized dietary support, as well as engagement in physical activities adapted to individual women's constraints.

METHODS

A prospective cohort study was conducted between November 2011 and June 2013 during prenatal consultations held by midwives and obstetricians at Geneva University Hospital. This hospital is located in the French part of Switzerland and has an average of 4000 births each year. A convenience sample of 173 pregnant women was recruited between 30 and 36 weeks' gestation. Women were eligible for inclusion in the study on the basis of their medical records if they had a diagnosis of GDM in the current pregnancy but had not previously been diagnosed with either type 1 or type 2 diabetes; if they were aged 18 years or older; and if they could read, write, and speak French. Women who had a history of GDM in another pregnancy in addition to having GDM in the index pregnancy were included in the study. The population was composed of women of several different ethnicities, in line with the melting pot of the Geneva resident population. This study was approved by the Geneva University Hospital Central Commission of Ethics and Research in 2011 (project 11-083). For the complete protocol, please see Kaiser, Razurel, and Jeannot.¹⁵

Recruitment Strategies

Women were recruited at their diabetes consultation by 2 midwives, one of which was the first author. In Geneva, all women diagnosed with GDM attend a weekly obstetric, dietary, and diabetes checkup from the time of GDM diagnosis, which occurs at approximately 24 to 28 weeks' gestation, until they give birth. Although some of these women are followed by independent practitioners, all women who will give birth in the Geneva University Hospital maternity unit are required to have this consultation near the end of their pregnancy, at around 36 weeks' gestation or more. Recruitment was therefore carried out between 30 and 36 weeks' gestation.

Study Procedures

Quantitative data were collected from study participants at the time of recruitment (T1) and at 6 months postpartum (T3). Data from T2 (6 weeks postpartum) are not reported in this article. The participants signed an informed consent form at T1 and filled out the initial questionnaires. Baseline information about socioeconomic, personal medical, and obstetric history was obtained through an interviewer-administered questionnaire. At T3, questionnaires were sent by post with a prestamped envelope for return. A reminder by telephone

and/or by e-mail was carried out in the event of no response. All of the questionnaires were beta tested with 10 women to evaluate acceptability and understanding. No particular difficulty was identified, and the test period was estimated to take approximately 10 minutes to complete at T1 and 20 minutes at T3.

Measures at T1

Motivation to Adopt a Healthy Lifestyle After Birth

Participants' motivation, that is, their predisposition to lead a healthy lifestyle in the postpartum period, was evaluated at T1 using one item from the Rapid Eating and Activity Assessment for Participants, short version (REAP-S) questionnaire.¹⁶ The wording of this question was adapted to suit a population of women at the end of their pregnancy as follows: "After your delivery, to what extent are you willing to adopt a lifestyle (diet, physical activity) that will allow you to stay in good health?" The possible answers ranged from 1 (not willing) to 5 (highly willing).

Clinical and Sociodemographic Variables

An interviewer-administered questionnaire was used to capture baseline information on age, body mass index (BMI, calculated as the weight in kilograms divided by height in meters squared) before pregnancy, race/ethnicity, highest educational level completed, employment status, number of children, history of GDM, and family history of diabetes.

Measures at T3

Health Behaviors

To evaluate participants' lifestyles (dietary habits and physical activity) at 6 months postpartum, we used the REAP-S.¹⁶ This is a short questionnaire consisting of 15 items—13 for diet, and 2 for physical activity—which was originally intended to evaluate dietary habits and physical activity in persons with prediabetes. The questionnaire was built to be understandable regardless of participants' level of education. For each item corresponding to a lifestyle habit, the participant answers the question, "In a normal week, how many times do you ...?" Possible answers are on a scale from 0 (usually, often), 1 (sometimes), to 2 (rarely, never). Possible scores ranged from 0 to 30. A score of less than 15 corresponds to a low

adherence to guidelines for a healthy lifestyle, as recommended by the American Diabetes Association.⁸

Diabetic Risk Perception for Oneself

Participants' risk perception for developing diabetes in the future was measured by an item extracted from the Risk Perception Survey for Developing Diabetes (RPS-DD)^{17,18}: "In your opinion, what is your level of risk of developing diabetes in the next 10 years?" The scores ranged from 1 (almost no risk) to 4 (maximum risk).

Knowledge About Diabetes Risk Factors and Preventive Strategies

A corresponding 10-item subscale of the RPS-DD was used to assess participants' knowledge of diabetes risk factors and preventive strategies. For each item, participants check one of 4 possible responses: "increases risk," "has no effect on risk," "reduces risk," or "don't know." Each incorrect answer or "don't know" response corresponds to a score of 0, and each correct answer corresponds to a score of 1. Total scores ranged from 0 to 10.

Social Support

To evaluate perceived level of social support, we revised a scale developed by Sallis et al,¹² which specifically relates to physical activity and healthy eating, by adding items related to participants' perception of the assistance they receive in terms of child care and housework because these factors have been identified as having a major influence, particularly on physical activity in women.¹⁹ For each of the 8 items on the scale (4 relating to physical activity and 4 relating to diet), participants were asked, "In general, how often do one or more people in your life (eg, your partner, family, friends, or others) ...?" Responses ranged from 0 (rarely, never) to 2 (usually, often) and possible total scores ranged from 0 to 16.

Self-Efficacy

Participants' feelings of self-efficacy in terms of their own health behaviors were measured using a modified version of the scale developed by Marcus et al,¹⁴ which has good retest reliability.²⁰ Participants were asked to what degree they feel capable on a scale of 1 (not at all capable) to 5 (very capable) of partaking in physical activity and adopting a healthy diet in 5 different situations: 1) when they feel tired, 2) when they are in a bad mood, 3) when they have little time, 4) when they are on holiday, and 5) when they find it requires too much effort. This scale contains 10 items (5 for physical activity, 5 for diet). The possible range of scores was 10 to 50.

Health Beliefs

In agreement with Ajzen's theory of planned behavior,²¹ participants' beliefs about their own health behaviors (physical activity and healthy diet) were evaluated using 12 questions (6 for each target health behavior) constructed according to Ajzen's guidelines.²² This questionnaire evaluates the perceived advantages of behaviors, normative influence (ie, the people who have the most influence on whether a person

adopts or does not adopt these behaviors), the perceived barriers that prevent these behaviors from being adopted, and the facilitators for the behaviors. The questions are open by nature, for example, "According to you, what are the main advantages to partaking in regular physical activity?" All of the health beliefs thus identified were used to establish a qualitative list of the most commonly held beliefs about physical activity and diet in the study population. Quantitative analysis concerned perceived advantages and barriers. The number of beliefs for each dimension was taken into account (eg, number of perceived barriers for physical exercise + number of perceived barriers for healthy diet = number of healthy lifestyle barriers).

Statistical Methods

Descriptive statistics, one sample *t*-test and chi-square goodness-of-fit analyses, were used to compare the distribution of characteristics between 2 groups of participants, categorized according to their level of adherence to a healthy lifestyle: participants with a REAP-S score 15 or higher versus participants with a REAP-S score lower than 15.^{8,16}

Bivariate logistic regression analysis was conducted to assess associations between REAP-S scores at 6 months postpartum and motivation to adopt healthy lifestyle after birth measured at the end of pregnancy, clinical and sociodemographic characteristics, and postulated psychosocial correlates of health behaviors. Multivariate logistic regression included all significant ($P < .05$) results from the bivariate analysis.

The Tabachnick & Fidell²³ formula was used to calculate the power of the sample size. For an alpha probability of .05 and a power of .80, the recommended sample size (*N*) to correctly evaluate the predictor variables (*m*) in a multivariate logistic regression is: $N = 50 + 8m$. In our study, 6 postulated psychosocial predictors of health behaviors after GDM could be considered: motivation to adopt a healthy lifestyle after birth, diabetic risk perception for oneself, knowledge about diabetes risk factors and preventive strategies, social support, self-efficacy, and health beliefs. It was therefore necessary to have at least 98 participants, and 173 participants were recruited. Moreover, the power of the test is acceptable when the ratio "number of participants/number of predictor variables" is greater than or equal to 15, which is the case with our sample size ($173/6 = 28.8$).

RESULTS

Out of 200 women who were eligible for this study, 173 agreed to participate, so the response rate was 86.5%. Fifty-one women were lost at follow-up, but 122 completed the study by sending back the questionnaires 6 months after giving birth, which represents a dropout rate of 29.4%. There were no statistically significant differences between women who left the study and those who completed the questionnaires at T3 ($P > .05$ for clinical, sociodemographic variables, and for Motivation to Adopt a Healthy Lifestyle After Delivery).

Participants' characteristics, according to their level of adherence to a healthy lifestyle 6 months after birth, are shown in Table 1. There were several statistically significant differences between participants with a REAP-S score 15 or

Table 1. Comparison of Characteristics Between Participants Categorized Into 2 Groups According to Their Level of Adherence to Healthy Lifestyle at 6 Months Postpartum (REAP-S ≥ 15 Versus REAP-S < 15; N = 122)				
Demographic Characteristics	Total sample	REAP-S < 15	REAP-S ≥ 15	P Value
Participants, n (%)	122 (100)	77 (63.2)	45 (36.8)	
REAP-S, mean (SD)	8.16 (9.86)	1.12 (3.62)	20.2 (3.02)	$< .001$
Age, mean (SD), y	33.6 (5.36)	32.8 (5.89)	34.6 (4.16)	.07
BMI before pregnancy, mean (SD), kg/m²	26.3 (5.66)	28.5 (6.08)	24.2 (3.59)	$< .001$
Race/Ethnicity				.06
African, n (%)	35 (28.6)	25 (32.4)	10 (22.2)	
Asian, n (%)	9 (7.3)	8 (10.3)	1 (2.2)	
Hispanic, n (%)	28 (22.9)	20 (25.9)	8 (17.7)	
White, n (%)	50 (40.9)	24 (31.2)	26 (57.7)	
Highest educational level completed				$< .001$
Senior high school or lower, n (%)	67 (55)	55 (71.2)	12 (26)	
University degree or equivalent, n (%)	55 (45)	22 (28.8)	33 (74)	
History of GDM besides the index pregnancy, n (%)	14 (11.4)	9 (11.7)	5 (11.1)	.86
Family history of diabetes, n (%)	67 (55)	40 (52)	27 (60)	.57
Employment status				$< .001$
Employed, n (%)	79 (64.7)	39 (50.7)	40 (88.8)	
Unemployed, n (%)	43 (35.2)	38 (49.3)	5 (12.2)	
Number of children				.07
1 child, n (%)	51 (41.8)	25 (32)	26 (57.7)	
2 children, n (%)	48 (39.3)	34 (44)	14 (31.1)	
3 or more, n (%)	23 (18.8)	18 (24)	5 (12.2)	
Motivation to adopt healthy lifestyle after birth, mean (SD)^a	4.06 (0.93)	4.03 (1.01)	4.09 (0.81)	.73
Diabetic risk perception for oneself, mean (SD)^b	2.08 (0.95)	1.34 (0.7)	2.82 (0.8)	$< .001$
General knowledge of diabetes prevention strategies and risk factors, mean (SD)^c	6.2 (1.75)	6.09 (1.39)	6.36 (1.54)	.85
Social support, mean (SD)^d	8.3 (4.61)	0.59 (2.43)	7.78 (3.82)	$< .001$
Self-efficacy, mean (SD)^e	12.5 (1.12)	14 (1.09)	11 (0.86)	.15
Health beliefs				
Number of reported healthy lifestyle advantages, mean (SD)	2.46 (0.88)	2.31 (0.7)	2.61 (1.10)	.07
Number of reported healthy lifestyle barriers, mean (SD)	0.37 (0.65)	0.67 (0.81)	0.07 (0.38)	$< .001$

Abbreviations: BMI, body mass index; GDM, gestational diabetes mellitus; REAP-S, Rapid Eating and Activity Assessment for Participants short version; SD, standard deviation.

^aOne item with scores ranging from 1 (not willing) to 5 (highly willing).

^bOne item with scores ranging from 1 (almost no risk) to 4 (maximum risk).

^c10-item scale with 0 = incorrect answer or "don't know" and 1 = correct answer. Total scores range from 0 to 10.

^d8-item scale with answers ranging from 0 (rarely, never) to 2 (usually, often) and total scores ranging from 0 to 16.

^eParticipants are asked to what degree they feel capable (on a scale of 1 [not at all capable] to 5 [very capable]) of partaking in physical activity and adopting a healthy diet; total scores range from 10 to 50.

higher and participants with a REAP-S score lower than 15. Specifically, those with a REAP-S score lower than 15 had a higher BMI before pregnancy, a lower level of education, a lower risk perception for themselves for developing diabetes in the future, a lower level of social support, were more frequently unemployed, and reported more barriers to the adoption of a healthy lifestyle. It is notable that at T1, the women in both groups exhibited the same level of motivation to adopt a healthy lifestyle after giving birth (4.03 vs 4.09, $P = .73$ out of a range of 1 to 5, with 5 indicating "highly willing") while at 6 months postpartum only 45 (36.8%) of them exhibited behaviors that were compatible with prevention of type 2 diabetes (REAP-S score ≥ 15).

In terms of health attitudes for the entire sample, the main perceived advantages of healthy behaviors were weight loss (77%) and promotion of good health (68%); the main normative influences were husband/partner (81%) and other family members (56%). For the women in the group with a low adherence to a healthy lifestyle, the main barriers were no time (83%), taking care of children (69%), no idea of what to do/eat (64%), and fatigue (31%). Regarding facilitators, they expressed a need for personalized advice (65%), and to be able to exercise in sports facilities where their children can be looked after (69%), and/or that involve other women who have recently given birth (53%). For the women in the group with suitable adherence to a healthy lifestyle, the main

Table 2. Determinants of Low Adherence to Healthy Lifestyle After GDM, as Analyzed by Bivariate and Multivariate Logistic Regression

Variable	Bivariate Logistic Regression		Multivariate Logistic Regression ^a	
	Odds ratio (95% CI)	P Value	Odds Ratio (95% CI)	P Value
Body mass index before pregnancy	0.9 (0.7–1.1)	.58		
University degree or equivalent	1		1	
Senior high school or lower	5.9 (2.6–13.2)	< .001	0.4 (0.07–2.01)	0.25
Employed	1		1	
Unemployed	0.13 (0.03–0.4)	< .001	0.10 (0.01–1)	.05
Lower diabetic risk perception for oneself	6.6 (3.6–11.9)	.01	1.9 (0.6–5.9)	.32
Lower level of social support	1.87 (1.5–2.2)	< .001	1.5 (1.4–1.7)	< .001
More perceived barriers to a healthy lifestyle	1.9 (1.6–2.4)	< .001	1.2 (1.08–1.5)	.002

^aControlled variables for multivariate analysis: BMI.

barriers were professional activity (34%) and time spent taking care of the infant/the family (31%). The main facilitator was work less (63%).

Bivariate regression analysis found that lower level of education, to be unemployed, lower diabetic risk perception for oneself, lower level of social support, and more perceived barriers to a healthy lifestyle were significantly associated with a low adherence to healthy lifestyle after GDM (Table 2). In contrast, after controlling for individual factors that were significant, the multivariate regressions found that only 2 variables were determinants in the low adherence to healthy lifestyle in the postpartum period after GDM: lower level of social support (odds ratio [OR], 1.5; 95% confidence interval [CI], 1.4–1.7; $P < .001$), and more perceived barriers to a healthy lifestyle (OR, 1.2; 95% CI, 1.08–1.6; $P = .002$). However, this model explains only 41% of the variance in adoption of health behaviors among the women in this study.

DISCUSSION

The main objective of this research was to identify the factors determining whether women who have recently had GDM have adopted a healthy lifestyle during the postpartum period.

The results showed that 6 months after giving birth, 63% of the women in this sample reported eating habits and a level of physical activity that was not consistent with optimal prevention of diabetes. This level of adherence to a healthy lifestyle was very similar to that seen in women within the general Swiss population, since 38% claim to have healthy eating habits,²⁵ and 34% to 41% regularly engage in a physical activity.²⁶ Given the demonstrated higher risk of developing type 2 diabetes in the population of women who have had GDM, this level of postnatal health-enhancing lifestyle is somewhat alarming. Furthermore, it is possible that the level of physical activity for this sample was an overestimation. The REAP-S used 2 items to assess physical activity in terms of duration and frequency, and by means of sedentary time that was objectified by reporting the time spent watching television. In an Australian study assessing the level of postpartum physical activity following GDM, the notion of the intensity of the physical activity was also taken into account,²⁷ thereby revealing a lower level of physical activity among women who had GDM compared to women in the general population.

This study provides evidence that the lack of adherence to health behaviors to prevent the occurrence of type 2 diabetes among women who have had GDM is linked primarily with a lack of social support and with a number of perceived barriers. The main problem stems from a lack of available resources to establish healthy eating habits and inability to participate in regular physical activity. These results corroborate those of 2 studies previously focusing on social support conditions associated with postpartum health behaviors after GDM among women living in the United States.^{30,31} Social support—especially from family and friends³⁰—was proved to be associated with family dietary habits, available time for meal preparation, and an adequate level of physical activity.^{30,31} Moreover, a more recent Australian study²⁷ conducted among women who had experienced GDM 6 months to 3 years earlier found that social support was a key factor for the adoption of an adequate level of physical activity after GDM (OR, 1.06; 95% CI, 1.03–1.09).

The women reported moderate motivation to adopt healthy eating habits and regular physical activity after giving birth at the end of pregnancy (mean score = 4.06 out of 5 for the full sample), no matter what their behavior was at 6 months postpartum. The message regarding diabetes prevention and health promotion, therefore, appears to be getting across during their treatment of GDM. Thus, the women's motivation does not seem to be a determining factor in affecting postpartum behaviors. The multivariate analysis, on the other hand, indicated that only 2 factors, social support and perceived barriers, affected establishing healthy behaviors during the 6-month postpartum period. The main barriers given by the women with a REAP-S score lower than 15 were no time, taking care of children, no idea of what to do/eat, and fatigue. One could assume that these variables are directly linked to the level of daily social support for these women. No time and taking care of children are indicative of a lack of instrumental social support, and no idea of what to do/eat is indicative of a lack of informational social support.²⁸ Moreover, concerning the no time barrier, it is important to know that in Geneva, the maternity leave lasts 14 weeks, so at 6 months postpartum women who work outside of home have returned to work.

One could assume that the no idea of what to do/eat barrier was associated with a lack of knowledge regarding preventive diabetes measures. However, this is not the case

because the participants in the 2 groups had a similar level of knowledge in this area (6.09 vs 6.36 out of 10, $P = .85$). However, the nature of the items in the questionnaire about their knowledge may explain the lack-of-knowledge barrier. The items on the Risk Perception Survey for Developing Diabetes questionnaire concern general knowledge regarding the need to adopt healthy eating habits and to regularly engage in physical activity, and also knowledge about which populations are at risk of developing diabetes (eg, people of certain ethnic origins, family history of diabetes, prior GDM). This knowledge does not relate to exact behavioral health modalities such as what types of food to eat, what size portions, what physical activities to engage in, and how often per week.

The majority of the participants appeared to know that having had GDM is a risk factor for diabetes. Despite this, the participants had a low risk perception for themselves for developing diabetes in the future (mean score = 2.08 out of 4 for the full sample), no matter what their level of adherence to a healthy lifestyle was. A phenomenon of comparative optimism is also noted (ie, the belief that adverse events are more likely to occur with others than oneself).²⁹ In the multivariate analysis, the perception of risk for oneself did not appear to be a factor that determines postpartum health attitudes after GDM, although it would nonetheless be interesting to explore this phenomenon in future studies.

Finally, counter to other studies on this subject,^{27,30–32} the results of our study did not provide evidence for an impact of self-efficacy on the adoption of postpartum health behaviors after GDM. In most of the studies that have evaluated self-efficacy, it was measured using specific scales for physical activity^{27,30,31} or specific for food intake.^{30,32} It is possible that our adapted questionnaire, designed to measure self-efficacy both for physical activity and food intake, might not be sensitive enough.

One strength of this study is that unlike many studies on the subject,¹¹ generalizing the present results to other populations—including US populations—becomes possible because of the high ethnic, educational, and economic mix among the participants. This constitutes an important issue to the extent that in the United States, there is an inverse relationship between economic status and prevalence of type 2 diabetes especially.²⁴

One limitation of our study is that the self-report measure of health behaviors could be influenced by social desirability. In addition, health behaviors of women who dropped out or declined to participate may have been more optimal for decreasing the risk of diabetes.

Finally, we chose not to include analysis of breastfeeding status for 2 reasons. The first is methodologic: The aim of the study was to assess the determinants of postpartum health behaviors recommended by the American College of Obstetricians and Gynecologists (ACOG) following a pregnancy complicated by GDM, and breastfeeding is not part of these specific recommendations. ACOG suggests that “individuals at increased risk should be counseled regarding diet, exercise, and weight reduction or maintenance to forestall or prevent the onset of type 2 diabetes.”⁸ The second reason is related to the specific situation of Switzerland regarding breastfeeding. Breastfeeding rates are very high in this country; it is 94% in hospital discharge, the rate being maintained on average up

to 31 weeks after childbirth.³³ We therefore considered that this variable would not discriminate women in the cohort despite the fact that breastfeeding appears to be a protective factor against type 2 diabetes.³³

CONCLUSIONS AND CLINICAL IMPLICATIONS

A pregnancy complicated by GDM must be viewed as a prime opportunity to promote health. In this context, midwives can play a crucial role in preventing diabetes in general, especially because a woman's healthy lifestyle has a positive influence on the health of her children and spouse. Women who have had GDM should be educated in the importance of following health and dietary measures in the same way that they are taught about the importance of monitoring their blood glucose level. To address the lack of resources described by this population, a partnership could be established between midwives, dietitians, physicians, and exercise professionals. For women who have had GDM, we envision the provision of postpartum care through a network of health services revolving around personalized dietary support, as well as engagement in physical activities adapted to women's constraints (eg, care of young children).

Interventions based on various strategies derived from Social Cognitive Theory could also potentially be effective for increasing health behaviors among postpartum women after GDM. According to Social Cognitive Theory, there are multiple influences on behavior, including social factors.³⁴ Behavioral strategies based on Social Cognitive Theory include increasing social support (ie, eliciting support from family and friends), enjoyment of the behavior, and outcome expectancies, which refer to the degree to which the individual believes behaviors will lead to a particular outcome. It could be a telephone-based intervention, because non-face-to-face interventions may be ideal due to time constraints, child-care conflicts, and transportation constraints sometimes present for women during the postpartum period.³⁵ Those interventions could maximize the impact of the advice given and improve adherence to health recommendations.

However, the perception of risk remains an open question awaiting further research of educational health interventions centered on this concept. Research in this area should be carried out in the postpartum period after GDM. The clinical implications of this study therefore relate to the means and resources required during the postpartum period so that all women who have had GDM have ample access to suitable relevant advice during postnatal follow-up.

AUTHORS

Barbara Kaiser, PhD, is a professor in the Midwifery Department of the School of Health Sciences at the HES-SO University of Applied Sciences, Geneva, Switzerland.

Emilien Jeannot, MPH, is a scientific assistant at the HES-SO University of Applied Sciences, Geneva, Switzerland.

Chantal Razurel, PhD, is a professor in the Midwifery Department of the School of Health Sciences at the HES-SO University of Applied Sciences, Geneva, Switzerland.

CONFLICT OF INTEREST

The authors, have no conflicts of interest to disclose.

ACKNOWLEDGEMENTS

This study is financed by the Swiss National Science Foundation (project number: 13DPD6.136664), and by the internal development funds of the HES-SO University of Applied Sciences (project number: 41477).

REFERENCES

1. American Diabetes Association. Standards of medical care in diabetes. *Diabetes Care*. 2014;37(Suppl 1):S14-S80.
2. Chen P, Wang S, Ji J, et al. Risk factors and management of gestational diabetes. *Cell Biochem Biophys*. 2015;71(2):689-694.
3. Gabbe SG, Landon MB, Warren-Boulton E, Fradkin J. Promoting health after gestational diabetes: a National Diabetes Education Program call to action. *Obstet Gynecol*. 2012;119(1):171-176.
4. Hunt KJ, Schuller KL. The increasing prevalence of diabetes in pregnancy. *Obstet Gynecol Clin North Am*. 2007;34(2):173-199, vii.
5. Ramyeard L, Boulvain M. Dépistage du diabète gestationnel. *Info@gynäkologie*. 2012;11-13.
6. Bellamy L, Casas JP, Hingorani AD, Williams D. Type 2 diabetes mellitus after gestational diabetes: a systematic review and meta-analysis. *Lancet*. 2009;373(9677):1773-1779.
7. Getahun D, Fassett MJ, Jacobsen SJ. Gestational diabetes: risk of recurrence in subsequent pregnancies. *Am J Obstet Gynecol*. 2010;203(5):467.e1-e6.
8. American College of Obstetricians and Gynecologists. ACOG Practice Bulletin: clinical management guidelines for obstetrician-gynecologists. Number 30, September 2001. *Obstet Gynecol*. 2001;98(3):525-538.
9. Lawlor DA, Fraser A, Lindsay RS, et al. Association of existing diabetes, gestational diabetes and glycosuria in pregnancy with macrosomia and offspring body mass index, waist and fat mass in later childhood: findings from a prospective pregnancy cohort. *Diabetologia*. 2010;53(1):89-97.
10. Boney CM, Verma A, Tucker R, Vohr BR. Metabolic syndrome in childhood: association with birth weight, maternal obesity, and gestational diabetes mellitus. *Pediatrics*. 2005;115(3):e290-e296.
11. Kaiser B, Razurel C. Determinants of postpartum physical activity, dietary habits and weight loss after gestational diabetes mellitus. *J Nurs Manag*. 2013;21(1):58-69.
12. Sallis JF, Grossman RM, Pinski RB, Patterson TL, Nader PR. The development of scales to measure social support for diet and exercise behaviors. *Prev Med*. 1987;16:825-836.
13. Ormrod JE. *Educational Psychology: Developing Learners*. 5th ed. Upper Saddle River, NJ: Pearson/Merrill Prentice Hall; 2006.
14. Marcus BH, Selby VC, Niaura RS, Rossi JS. Self-efficacy and the stages of exercise behavior change. *Res Q Exerc Sport*. 1992;63:60-66.
15. Kaiser B, Razurel C, Jeannot E. Impact of health beliefs, social support and self-efficacy on physical activity and dietary habits during the post-partum period after gestational diabetes mellitus: study protocol. *BMC Pregnancy Childbirth*. 2013;13:133.
16. Segal-Isaacson CJ, Wylie-Rosett J, Gans KM. Validation of a short dietary assessment questionnaire: the Rapid Eating and Activity Assessment for Participants short version (REAP-S). *Diabetes Educ*. 2004;30(5):774, 776, 778.
17. Walker EA, Engel SS, Zybert PA. Dissemination of diabetes care guidelines: lessons learned from community health centers. *Diabetes Educ*. 2001;27(1):101-110.
18. Walker EA, Mertz CK, Kalten MR, Flynn J. Risk perception for developing diabetes: comparative risk judgments of physicians. *Diabetes Care*. 2003;26(9):2543-2548.
19. Wen LM, Thomas M, Jones H, et al. Promoting physical activity in women: evaluation of a 2-year community-based intervention in Sydney, Australia. *Health Promot Int*. 2002;17(2):127-137.
20. Kaptein AA, van Korlaar IM, Cameron LD, Vossen CY, van der Meer FJ, Rosendaal FR. Using the common-sense model to predict risk perception and disease-related worry in individuals at increased risk for venous thrombosis. *Health Psychol*. 2007;26(6):807-812.
21. Ajzen I. The theory of planned behavior. *Organ Behav Hum Decis Process*. 1991;5:179-211.
22. Ajzen I. Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior. *J Appl Soc Psychol*. 2002;32:665-683.
23. Tabachnick BG, Fidell LS: *Using Multivariate Statistics*. Boston, MA: Allyn & Bacon; 2001.
24. Evans JM, Newton RW, Ruta DA, MacDonald TM, Morris AD. Socio-economic status, obesity and prevalence of Type 1 and Type 2 diabetes mellitus. *Diabet Med*. 2000;17:478-480.
25. MOSEB. Alimentation et activité physique en Suisse. Office Fédéral de la Santé Publique, OFSP en collaboration avec Promotion Santé Suisse et OBSAN; 2012.
26. Lamprecht S. Activité physique, sport et santé. Faits et tendances se dégageant des enquêtes suisses sur la santé de 1992, 1997 et 2002. Office Fédéral de la Statistique; 2006.
27. Koh D, Miller YD, Marshall AL, Brown WJ, McIntyre D. Health-enhancing physical activity behaviour and related factors in postpartum women with recent gestational diabetes mellitus. *J Sci Med Sport*. 2010;13:42-45.
28. House JS. *Work Stress and Social Support*. Reading, MA: Addison-Wesley; 1981.
29. Armor DA, Taylor SE. Situated optimism: specific outcome expectancies and self-regulation. *Adv Exp Soc Psychol*. 1998;30:309-379.
30. Kim C, McEwen LN, Kieffer EC, Herman WH, Piette JD. Self-efficacy, social support, and associations with physical activity and body mass index among women with histories of gestational diabetes mellitus. *Diabetes Educ*. 2008;34:719-728.
31. Symons Downs D, Ulbrecht JS. Understanding exercise beliefs and behaviors in women with gestational diabetes mellitus. *Diabetes Care*. 2006;29:236-240.
32. Zehle K, Smith BJ, Chey T, McLean M, Bauman AE, Cheung NW. Psychosocial factors related to diet among women with recent gestational diabetes: opportunities for intervention. *Diabetes Educ*. 2008;34:807-814.
33. Pellaud N, Jeannot E. Swiss pediatrician's training needs in promoting and supporting breastfeeding. *Colloque Société Suisse de Pédiatrie*. 2008.
34. Morton S, Kirkwood S, Thangaratinam S. *Curr Opin Obstet Gynecol*. 2014 Dec;26(6):476-486.
35. Bandura A. Health promotion by social cognitive means. *Health Educ Behav*. 2004;31(2):143-164.
36. Lewis BA, Martinson BC, Sherwood NE, Avery MA. A pilot study evaluating a telephone-based exercise intervention for pregnant and postpartum women. *J Midwifery Womens Health*. 2011;56(2):127-131.