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Review

# Lifestyle interventions for type 2 diabetes prevention in women with prior gestational diabetes: A systematic review and meta-analysis of behavioural, anthropometric and metabolic outcomes☆

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ABSTRACT

*Purpose.* To systematically review lifestyle interventions for women with prior Gestational Diabetes Mellitus (GDM) to report study characteristics, intervention design and study quality and explore changes in 1) diet, physical activity and sedentary behaviour; 2) anthropometric outcomes and; 3) glycaemic control and diabetes risk.

*Methods.* Databases (Web of Science, CCRCT, EMBASE and Science DIRECT) were searched (1980 to April 2014) using keywords for controlled or pre–post design trials of lifestyle intervention targeting women with previous GDM reporting at least one behavioural, anthropometric or diabetes outcome. Selected studies were narratively synthesized with anthropometric and glycaemic outcomes synthesized using meta-analysis.

*Results.* Three of 13 included studies were rated as low bias risk. Recruitment rates were poor but study retention good. Six of 11 studies reporting on physical activity reported favourable intervention effects. All six studies reporting on diet reported favourable intervention effects. In meta-analysis, significant weight-loss was attributable to one Chinese population study (WMD = −1.06 kg (95% CI = −1.68, −0.44)). Lifestyle interventions did not change fasting blood glucose (WMD = −0.05 mmol/L, 95% CI = −0.21, 0.11) or type 2 diabetes risk.

*Conclusions.* Lack of methodologically robust trials gives limited evidence for the success of lifestyle interventions in women with prior GDM. Recruitment into trials is challenging.



**Contents**



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## Introduction

Gestational Diabetes Mellitus (GDM) is a form of diabetes that is diagnosed during pregnancy and affects up to 16% of pregnant women (Coustan et al., 2010). Recent changes in guidelines (Coustan et al., 2010) for clinical diagnosis of GDM, in addition to upward trends in obesity and unhealthy lifestyles, has increased the number of women being diagnosed (Dabelea et al., 2005). Progression to type 2 diabetes for women with GDM is reported to be between 15 and 50% at 5 years (Kim et al., 2002). Furthermore weight and BMI are significant predictors of development of type 2 diabetes at 15-year follow-up (Linne et al., 2002).

Guidelines on type 2 diabetes prevention (National Institute of Health and Care Excellence, 2008) clearly state that high-risk populations, such as women with GDM, should be offered lifestyle interventions. In women with GDM, physical activity and dietary change successfully improves glycaemic control, body composition, reduces requirements for insulin and may prevent onset GDM in subsequent pregnancies and future development of type 2 diabetes (Ruchat and Mottola, 2013; Bao et al., 2014). The Diabetes Prevention Program (DPP) showed that lifestyle interventions and Metformin reduced type 2 diabetes incidence by 58% and 31% respectively in people with impaired glucose tolerance (IGT), including those with a history of GDM (Ratner et al., 2008). These reductions in incidence rate were maintained up to 10 years (Knowler et al., 2009).

Several studies examining the effectiveness of lifestyle interventions in women with prior GDM have recently been published (Cheung et al., 2011; Ferrara et al., 2011; McIntyre et al., 2012) and more trials are in progress (Ferrara et al., 2014; Infanti et al., 2013a; Shih et al., 2013), however, evidence from intervention trials within the general population of pregnant and postpartum women suggests that behaviour change is challenging in these groups (Currie et al., 2013; Gilinsky et al., 2014/07). Similarly, research with GDM populations have reported difficulties recruiting or retaining participants (Cheung et al., 2011), and compared with women with IGT and no prior history of GDM, poorer engagement in lifestyle changes (Ratner et al., 2008). These findings suggest that lifestyle interventions and research methods may require adaptation for women with GDM. Lifestyle interventions for preventing type 2 diabetes in women with prior GDM have not been systematically reviewed to date, yet this is important to inform future research and practice.

The objectives of this research were to systematically review published studies investigating lifestyle interventions for women with previous diagnosis of GDM to explore changes in 1) behavioural outcomes (diet, physical activity and sedentary behaviour); 2) anthropometric outcomes and; 3) glycaemic control and diabetes risk. Study characteristics and quality in addition to intervention content and design are also reported.

## Methods

The review was registered with PROSPERO International prospective register of systematic reviews (www.crd.york.ac.uk/PROSPERO). Methods of the review followed COCHRANE (http://www.cochrane.org) and PRISMA guidance (http://www.prisma-statement.org), which specify recommended quality criteria for conducting and reporting systematic reviews and meta-analyses.

### *Study selection*

We included lifestyle intervention studies targeting women with previous diagnosis of GDM. Although recruitment and interventions could commence during pregnancy, as the focus was on prevention of type 2 diabetes in women with prior GDM, studies were only included if they reported interventions and outcomes during the postpartum period. Included interventions were those promoting weight loss or physical activity, change in diet, or decreasing sedentary behaviour and delivered via structured exercise programmes, lifestyle counselling, health education, and self-management programmes. Studies had to include at least one behavioural (diet, physical activity or sedentary behaviour) anthropometric (weight, BMI, percent body fat, waist or hip circumference) or diabetes outcome (measure of glycaemic control or diabetes risk). We included randomised controlled trials (RCTs), controlled trials or pre–post studies in the systematic review, however only RCTs were included in meta-analysis. We included all control/comparison groups (e.g. usual care, a waiting list, no treatment and/or a minimal intervention (e.g. leaflet)).

Studies not in the English language; dissertations, expert opinion, non-published studies and conference abstracts were excluded, however we contacted authors of relevant conference abstracts/protocol/baseline/methods papers to identify published data. Studies conducted with pregnant women with no diagnosis of GDM, pre-existing or current type 1 or