# Weight management over the reproductive years for adult women living with obesity

Clinical Practice Guideline for the Management of Obesity in Adults in South Africa

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SOUTH AFRICAN METABOLIC MEDICINE AND SURGERY SOCIETY

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## KEY MESSAGE FOR HEALTHCARE PROVIDERS

This chapter addresses the management of weight related to three phases of the reproductive years – pre-conception, during pregnancy, and postpartum – for adult women with obesity. Although these reproductive periods are addressed separately, it is important to consider that these phases represent the continuum of weight management over the reproductive years in women with obesity. During these periods, women frequently access the healthcare system, thus providing clinicians with health promotion opportunities that may have positive impacts on the short- and long-term health of both the woman and her children. Discussion of the obstetric and anaesthetic management of women with obesity during pregnancy is beyond the scope of this clinical practice guideline.

## KEY MESSAGES FOR WOMEN WITH OBESITY DURING THE REPRODUCTIVE YEARS

The reproductive years, including before, during and after pregnancy, bring many additional challenges for women with obesity in terms of maintaining a healthy weight, beyond eating well and being physically active. It is important for women with obesity to seek advice and support from their healthcare providers on strategies to optimise their own health outcomes, as well as those of their children, over both the short and the long term.

The strategies described in this chapter include:

- Entering pregnancy at a lower body mass index
- Targeting weight gain during the entire pregnancy of 5 - 9 kg
- Returning to the pre-pregnancy body mass index or lower during the year after delivery.

## RECOMMENDATIONS

These recommendations pertain to the management of weight over the reproductive years for adult women living with obesity (i.e. body mass index ≥30 kg/m$^2$) with a singleton pregnancy, who are ≥18 years of age and do not have pre-existing diabetes or gestational diabetes.

**General advice.** We recommend that healthcare providers (HCPs) should discuss weight management targets specific to the reproductive years with adult women living with obesity: pre-conception weight loss (Level 3, Grade C);[1-4] gestational weight gain of 5 - 9 kg over the entire pregnancy (Level 4, Grade D);[5] and postpartum weight loss of – at minimum – gestational weight gain (Level 3, Grade C),[6,7] to reduce the risk of adverse outcomes in the current or a future pregnancy.

**Combined behaviour change interventions.** HCPs should offer behaviour change interventions, including both nutrition and physical activity, to adult women living with obesity who are considering a pregnancy (Level 3, Grade C),[7,8] who are pregnant (Level 2a, Grade B)[9-15] and who are postpartum (Level 1a, Grade A),[16] in order to achieve weight targets.

**Nutrition counselling alone.** We recommend that HCPs encourage and support pregnant women with obesity to consume foods consistent with a healthy dietary pattern in order to meet their target gestational weight gain (Level 3, Grade C).[17]

**Physical activity counselling alone.** We recommend that HCPs encourage and support pregnant women with obesity who do not have contraindications to exercise during pregnancy to engage in at least 150 minutes per week of moderate-intensity physical activity to assist in the management of gestational weight gain (Level 3, Grade C).[18-21]

**Pharmacotherapy.** HCPs should not prescribe metformin for managing gestational weight gain in women with obesity (Level 1b, Grade A).[22-24] We suggest no weight management medications during pregnancy or breastfeeding (Level 4, Grade D).[25]

**Breastfeeding.** We recommend that women with obesity be offered additional breastfeeding support owing to decreased rates of initiation and continuation (Level 3, Grade C).[26]

# Pre-conception period

## Background

A woman's pre-conception health status, particularly the control of pre-pregnancy medical comorbidities, has been demonstrated to markedly impact on maternal, obstetric and fetal health outcomes during pregnancy.[27,28] While many pregnancies are unplanned, a pre-conception consultation offers women considering pregnancy the opportunity to engage in discussions with their healthcare providers (HCPs) about their individualised health risks during pregnancy, and to make informed decisions. In addition, the pre-conception period is a time when interventions can be implemented to reduce the risks of common adverse pregnancy outcomes.[28] As outlined in Table 1, for women with obesity, a body mass index (BMI) ≥30 kg/m$^2$ has consistently been associated with infertility,[29,30] congenital malformations,[31] and numerous clinically important adverse pregnancy outcomes (in a dose-response relationship with BMI), including hypertensive disorders of pregnancy, gestational diabetes, caesarean delivery, preterm birth, etc.[2,4,28,31-38] While there remains a paucity of data to specifically guide clinicians on how best to counsel women with obesity about these pregnancy-associated health risks, emerging data demonstrate that weight management prior to pregnancy may reduce many of them.[1] Discussion of specific nutritional supplementation (e.g. folic acid) and obstetric care is beyond the scope of this clinical practice guideline.

## Clinical strategies and resources to achieve pre-conception weight management for women with obesity

### Combined behavioural interventions

There have been few trials specifically conducted in women with obesity who are planning a pregnancy. Agha *et al.*'s[8] systematic review of randomised controlled trials (RCTs) in pre-conception women with overweight or obesity found that combined behavioural health interventions (i.e. nutrition and physical activity) were associated with significant reductions in gestational weight gain once pregnant. This is similar to the findings of Krukowski *et al.*,[7] who examined the effectiveness of a combined behavioural health intervention (combined nutrition and physical activity) beginning during the pre-conception period or up to 10 weeks' gestational age. The study found that women with obesity in the intervention arm had reduced gestational weight gain at 36 weeks' gestation. In addition, as outlined in the postpartum period section below, the use of combined behaviour change interventions during the postpartum period was associated with greater postpartum weight loss, which may affect the health outcomes of future pregnancies.

### Pharmacotherapy

At present, the fetal effects of several pharmacological agents used for the purpose of weight management are not known. In general, it is therefore not recommended that these agents be used during pregnancy. Consideration should be given to stopping these medications prior to pregnancy to limit exposure to the developing fetus.[25]

# Pregnancy/antenatal period

## Background

Women with obesity have an increased risk of numerous adverse maternal, obstetric and fetal outcomes during pregnancy, as outlined in Table 1. One promising strategy to reduce or prevent these adverse outcomes is through achievement of the recommended guidelines for gestational weight gain during pregnancy (see below), although this remains an area of active study. The current recommended guidelines for weight gain during pregnancy for uncomplicated singleton pregnancies were published by the Institute of Medicine (IOM) in 2009[54] (Table 2). These recommendations were developed based on the findings of numerous observational studies. The studies consistently demonstrated that gestational weight gain above or below these recommended ranges is associated with several important adverse clinical outcomes for women and their offspring, including birthweight large for gestational age or small for gestational age, caesarean delivery, preterm delivery, postpartum maternal weight retention and childhood obesity.[51] However, the data on the association between gestational weight gain and small-for-gestational-age infants remain contradictory.[40,43,50,51]

Several factors influence gestational weight gain for women with obesity, including depression,[55] health behaviours,[56] patient expectations and knowledge,[57] educational attainment/socioeconomic status,[58] and maternal age, parity and ethnicity.[59] Importantly, obesity prior to pregnancy is also an independent risk factor for excess gestational weight gain.[60-63] Although there are no data specifically for women with obesity, there is evidence that advice from a prenatal HCP is both desired by women[64] and can positively influence gestational weight gain.[65]

## Considerations for weight management during pregnancy for women with obesity

Women with a singleton pregnancy can expect to gain approximately 8.5 kg during the course of a full-term pregnancy, regardless of the increase in their own adipose tissue mass, as a result of the following physiological increases in weight: term baby (approximately 3 kg), the placenta, amniotic fluid, uterine muscle, increase in intravascular blood volume, and increase in total body water volume. For women with obesity, this weight gain amount is just below the upper limit of the IOM recommendations for optimal gestational weight gain (5 - 9 kg throughout the entire pregnancy). Future updates may offer stratified targets based on obesity class. As a result, weight management can be challenging for women with obesity, and should therefore be addressed at the first prenatal appointment and throughout pregnancy.

Advice from prenatal HCPs positively influences women's achievement of gestational weight gain targets.[66-69] Further, pregnant women report that they want to discuss gestational weight gain with their HCPs.[70-72] Although Canadian data show that most HCPs reported routinely weighing pregnant women, only a minority routinely discussed the actual weight results.[73,74] Weight-related discussions are often perceived by HCPs as sensitive in nature and are therefore often avoided.[75-78] This hesitation in raising the topic could be mitigated to some extent by having a good patient-provider relationship.[79] Primary care providers have a longitudinal relationship with their patients and are therefore in an advantageous position to support women with obesity in achieving the recommended targets for gestational weight gain. A theoretical framework that is highly relevant to primary care clinicians is the Patient-Centred Clinical Method,[80] consisting of four interactive domains:

**Table 1. Associations between obesity, gestational weight gain and adverse clinical outcomes over the reproductive (pre-conception, antenatal and postpartum) periods**

| Reproductive period | Weight management issue | Adverse clinical outcome |
|---|---|---|
| Pre-conception | Pre-pregnancy obesity | ↑ Infertility[29] |
| | | ↑ Gestational diabetes[34] |
| | | ↑ Hypertensive disorders of pregnancy (i.e. gestational hypertension and pre-eclampsia)[2,4,32,35,36] |
| | | ↑ Maternal venous thromboembolism[32,37] |
| | | ↑ Postpartum depression[3] |
| | | ↑ Miscarriage[28] |
| | | ↑ Caesarean delivery[32] |
| | | ↑ Congenital malformations[31,38] |
| | | ↑ Newborn asphyxia[33] |
| | | ↑ Macrosomia/large for gestational age[33] |
| Pregnancy | Excess gestational weight gain | ↑ Gestational diabetes[38,39] |
| | | ↑ Hypertensive disorders of pregnancy (i.e. gestational hypertension and pre-eclampsia)[36,40-42] |
| | | ↑ Caesarean delivery[1,40,42,43] |
| | | ↑ Preterm birth (medically indicated)[43] |
| | | ↑ Macrosomia[40,42,44,45] |
| | | ↑ Neonatal hyperinsulinaemia[45] |
| | | ↑ Neonatal hypoglycaemia, hypomagnesaemia and hypocalcaemia[44] |
| | | ↑ Postpartum weight retention[46-49] |
| | Low gestational weight gain or weight loss | ↓ Hypertensive disorders of pregnancy (i.e. gestational hypertension[38] and pre-eclampsia)[35] |
| | | ↓ Caesarean delivery[1,40,43,50] |
| | | ↓ Large-for-gestational-age infant[42,43,51,52] |
| | | ↑ Macrosomia[2,50] |
| | Weight loss | ↑ Low-birthweight infant[40] |
| Postpartum | Pre-pregnancy obesity | ↑ Postpartum weight retention[32] |
| | Obesity during pregnancy | ↑ Obesity by 9 months postpartum[53] |
| | Excess postpartum weight retention | ↑ Gestational diabetes in a future pregnancy[1] |
| | | ↑ Hypertensive disorders in a future pregnancy[1] |
| | Reduction in BMI by 2 kg/m$^2$ | ↓ Gestational diabetes in a future pregnancy[6] |

BMI = body mass index.

**Table 2. Gestational weight gain recommendations[54]**

| Pre-pregnancy BMI | Total weight gain (range in kg) | Weight gain in 2nd and 3rd trimester (mean [range] in kg/week) |
|---|---|---|
| Underweight (<18.5 kg/m$^2$) | 12.5 - 18 | 0.51 (0.44 - 0.58) |
| Normal weight (18.5 - 24.9 kg/m$^2$) | 11.5 - 16 | 0.42 (0.35 - 0.50) |
| Overweight (25.0 - 29.9 kg/m$^2$) | 7 - 11.5 | 0.28 (0.23 - 0.33) |
| Obesity (≥30.0 kg/m$^2$) | 5 - 9 | 0.22 (0.17 - 0.27) |

BMI = body mass index.

1. Exploring women's experience of changes in weight during pregnancy
2. Understanding women's proximal and distal contexts
3. Finding common ground on the best approach to support appropriate weight gain during pregnancy
4. Enhancing the patient-clinician relationship.

From a patient-centred perspective, it is key to address the first two domains. Otherwise, the provider's recommendations are often neither meaningful nor able to be translated into patient behaviour change. (See the chapter 'Effective psychological and behavioural interventions in obesity management'.)

## Clinical strategies and resources to achieve recommended gestational weight gain targets for women with obesity

Based upon the above, a number of interventions and models of care could be helpful to women with obesity during pregnancy, when approached from a patient-centred perspective.

### Nutrition counselling

When implemented early in pregnancy, nutrition counselling can assist women with obesity in managing their pregnancy weight gain. Wolff *et al.*[17] randomised pregnant women with obesity to either an intervention arm (*n*=23), consisting of 10 1-hour sessions with a trained dietitian, or usual care (*n*=27). The sessions focused

on providing advice on eating a healthy diet according to Danish national dietary recommendations, with the use of food records to identify unhealthy eating patterns and to give individualised feedback for improvement. At 36 weeks' gestation, the mean gestational weight gain for the intervention group was 6.6 kg, compared with a mean gain of 13.3 kg for the control group ($p$=0.002).

**Physical activity**

Physical activity (a term used synonymously with exercise in this chapter) during pregnancy has been shown to be beneficial to women with obesity in managing their pregnancy weight gain (2019 Canadian guideline for physical activity throughout pregnancy).[81] Daly *et al.*[20] compared total gestational weight gain at 36 weeks' gestation between 88 pregnant women assigned to either an intervention consisting of intensive, medically supervised exercise or usual care. Fewer women in the exercise intervention group gained weight in excess of the guidelines compared with women in the control group (23.5% v. 45.2%; $p$<0.05). Barakat *et al.*[19] compared total gestational weight gain between pregnant women randomised to an exercise intervention or to standard care as an analysis of a secondary outcome in an RCT. The intervention consisted of 50 - 55-minute training sessions (3 days per week) from 9 - 11 weeks' gestation until 38 - 39 weeks' gestation (85 sessions in total). Among women with obesity ($n$=54), 44.0% of women in the intervention group experienced excess gestational weight gain compared with 51.7% of women in the control group. In a case-control study by Claesson *et al.*,[21] the intervention consisted of motivational talks to assist with behaviour change and regular exercise (aqua aerobics). The intervention group experienced significantly lower weight gain than the control group (8.7 kg v. 11.3 kg; $p$<0.001).

**Combined behavioural interventions**

A comprehensive approach targeting both nutrition and exercise has been shown to be effective in managing gestational weight gain. Vinter *et al.*[13] randomised 360 women with obesity at 10 - 14 weeks' gestation to a comprehensive behavioural intervention or standard care (Lifestyle in Pregnancy study). Women in the intervention group received four 30 - 60-minute nutrition counselling sessions delivered by trained dietitians and were encouraged to be moderately physically active for 30 - 60 minutes daily. At 35 weeks' gestation, women in the intervention group had gained significantly less weight than women in the control group (7.4 kg v. 8.6 kg; $p$=0.014).

Petrella *et al.*[14] randomised 38 women with obesity to a therapeutic behaviour changes programme consisting of 1 800 kcal/day and 30 minutes of physical activity of moderate intensity on at least 3 days per week, or to usual care. At delivery, women in the intervention group had experienced significantly lower gestational weight gain than women in the control group (6.7 kg v. 10.1 kg; $p$=0.047). In addition, 77.8% of women receiving the intervention experienced guideline-concordant gestational weight gain, compared with 30.0% of women in the control group ($p$=0.003).

Poston *et al.*[10] randomly assigned 1 555 pregnant women with obesity who were between 15 and 18 weeks' gestation to either a theory-based intensive behavioural intervention or standard antenatal care (UK Pregnancies Better Eating and Activity Trial: UPBEAT). The intervention consisted of eight 60-minute weekly sessions addressing nutrition and physical activity by setting and achieving SMART goals. At delivery (mean gestational age 39.5 weeks for both groups), women in the intervention group had gained less weight than women in the control group (7.19 kg v. 7.76 kg; $p$=0.041).

Haby *et al.*[11] conducted an RCT evaluating a prenatal behavioural intervention compared with usual care for women with obesity, with gestational weight gain as one of the outcomes. The intervention group ($n$=459) received two 30-minute midwife-delivered personalised counselling sessions on food and physical activity during early pregnancy. Individualised dietary advice from a dietitian, food discussion groups with a dietitian, aqua aerobics led by a physiotherapist, prescriptions for physical activity, walking poles, pedometers and information about community resources were also available to the intervention group if desired. The control group ($n$=895) received usual care. Per-protocol analysis showed significantly lower gestational weight gain in the intervention group compared with the control group (8.9 kg v. 11.2 kg; $p$=0.031).

Renault *et al.*[82] undertook an RCT with 425 women with obesity being assigned to one of three groups: physical activity plus diet, physical activity alone, or control. Both interventions resulted in less gestational weight gain than the control ($p$=0.008). Median gestational weight gain, compared with the control group (10.9 kg), was lower in both intervention groups: physical activity plus diet 8.6 kg ($p$=0.01), and physical activity alone 9.4 kg ($p$=0.042).

**Metformin**

To date, RCT evidence for the use of metformin in the management of gestational weight gain for women with obesity who do not have diabetes is conflicting, and metformin is therefore not recommended. Although a Cochrane review by Dodd *et al.*[83] of three studies of metformin (up to 3 000 mg/day) in pregnant women with overweight or obesity found that women who received metformin may have a slightly lower gestational weight gain compared with placebo, the heterogeneity of the studies prevented meaningful evaluations.

**Healthcare provider behaviour**

There are limited data specifically focused on pregnant women with obesity. Observational studies in the general population show that HCP patient-centredness influences patients' adherence to weight gain recommendations[84-86] and patients' perception of 'finding common ground',[80] increases patient satisfaction, and decreases the burden of symptoms.[87]

In a qualitative Canadian study, Morris *et al.*[73] concluded that HCPs should initiate discussions about gestational weight gain in a patient-centred manner, specifically by 'asking women how they feel about discussing weight'.

Lindberg *et al.*[88] examined the weight outcomes before and after implementation of a 'best practice alert' in the electronic medical record, which provided tailored gestational weight gain goals and patient education materials based on patients' pre-pregnancy BMI and the 2009 IOM guidelines for weight gain during pregnancy. Overall, the intervention was associated with a significant increase in the proportion of women with obesity who had guideline-concordant gestational weight gain.

Surveys of HCPs identified the following gaps requiring additional clinical support: increasing HCP knowledge, improving skills and self-efficacy in discussing gestational weight gain, and supporting women to make positive health behaviour changes during pregnancy.[73] System-related changes identified included flexibility in the time available for perinatal health appointments and changes in billing requirements.

**Routine weighing**

To date, RCTs of routine weighing of pregnant women during antenatal visits have not found routine weighing to be associated with significant impacts on gestational weight gain. First, a trial by Brownfoot *et al.*[89] of the effect of an intervention (regular weighing in antenatal clinics) compared with control (routine care) on gestational

weight gain found no difference in the proportion of participants with obesity whose gestational weight gain was above, within or below the IOM recommended ranges. Second, McCarthy *et al.*[90] randomised 382 women with overweight or obesity and a singleton pregnancy, at less than 20 weeks' gestation and without diabetes, to serial self-weighing and simple dietary advice (intervention, *n*=190) or standard prenatal care (control, *n*=192). There was no difference in gestational weight gain for participants with obesity between the intervention and control groups (7.40 kg v. 8.77 kg).

## Postpartum period

### Background

The postpartum period is recognised to begin immediately following the birth of a baby, although its duration is not well defined. While many of the physiological changes of pregnancy resolve by 6 weeks after delivery,[91-93] several physiological and psychological changes continue to exist for over a year, particularly if women continue to breastfeed.[52] A period of 1 year after giving birth is therefore generally considered as the working definition of the postpartum period.[52]

A wide range of diverse and complex factors influence maternal weight after pregnancy. Higher gestational weight gain is recognised as a major risk factor for postpartum weight retention.[12,47-49] The evidence is mixed with regard to the association between pre-pregnancy weight and postpartum weight retention, as several[48,94-97] but not all[98-100] studies have demonstrated that having a higher pre-pregnancy BMI is associated with higher postpartum weight retention. Other factors, such as sleep patterns,[101] psychological factors (e.g. depression, anxiety and stress symptoms)[102-105] and maternal characteristics, including age,[48,106] ethnicity,[48,99,107] parity,[98,108] socioeconomic status[48,106,109] and educational attainment,[48,109] are associated with postpartum weight retention.

The findings that weight gain during pregnancy and the potential lack of, or limited, weight loss after pregnancy increase the risk of longer-term obesity or the risk of moving into a higher BMI category are consistent across studies and worldwide. Wallace *et al.*,[32] for example, examined inter-pregnancy weight change using data from the Aberdeen Maternity and Neonatal Databank and identified that 86% of women who were initially categorised in the obesity BMI categories gained a further 9 kg by their third pregnancy. In Ireland, Mullaney *et al.*[53] investigated the trajectory of postpartum weight change and found that 90% of women with obesity in early pregnancy retained obesity at 4 and 9 months postpartum. In a prospective cohort study of Canadian women,[91] BMI increased by approximately 1.5 kg/m$^2$ from pre-pregnancy to 10 - 12 weeks postpartum across all pre-pregnancy BMI categories. A population-based study of 58 534 Canadians who experienced successive pregnancies[110] demonstrated that approximately 25% of women were ≥5 kg heavier at the beginning of a subsequent pregnancy, approximately 9% were heavier by ≥10 kg, and approximately 2% developed obesity after starting the previous pregnancy with a lower BMI. Retaining or gaining weight following pregnancy may also be associated with adverse pregnancy outcomes in future pregnancies. These adverse outcomes are described in the pre-conception and antenatal sections and in Table 1.

Many of the pregnancy-related contributors to gestational weight gain, such as fluid gained during pregnancy and increased organ size (e.g. of the uterus), are lost during the first 6 weeks after delivery. After this period, postpartum weight retention is mainly due to increased fat mass.[91] Despite the adverse long-term health impact of postpartum weight retention, no detailed guidelines have been established to define cut-points for excess postpartum weight retention.[111] The dietary reference intakes established by the IOM (2005)[112] recommend weight loss of approximately 0.8 kg/month during the first 6 months postpartum, but this amount of weight loss is not specifically for women with obesity. These guidelines are based on a review by Butte and Hopkinson[113] of nine longitudinal studies conducted with affluent postpartum women, which showed that well-nourished women experienced an average weight loss of 0.8 kg/month during the first 6 months postpartum. Weight stability is assumed after this period,[114] and there is no consensus about the amounts of or timelines for continued weight loss after the first 6 months postpartum.

For women who entered pregnancy with obesity, a postpartum weight loss of at least the amount gained during gestation should be achieved to not increase the risk of adverse pregnancy outcomes in a future pregnancy.[6,115] Sorbye *et al.*[6] demonstrated that postpartum weight loss by more than two BMI units protects against the development of gestational diabetes in future pregnancies among women with obesity. Postpartum weight gain increases the risk of gestational diabetes in the next pregnancy. McBain *et al.*[115] also found that women in the overweight/obesity BMI categories were more likely to remain in the same BMI category in the next pregnancy.

Notably, evidence shows that women want an opportunity to discuss postpartum weight loss with their HCPs, and suggests that it should be a part of standard care.[72] This discussion could take place either during the 6-week postnatal check-up or even during pregnancy in order for women to have the opportunity to start thinking about postpartum weight loss early on.[72] According to Ohlendorf,[116] 67% of postpartum women are attempting behavioural interventions or maintaining healthy behaviour at 4 weeks postpartum, and 84% at 8 weeks postpartum. Most (82%) postpartum women with obesity reported that they planned to seek information about losing pregnancy weight through their physicians and midwives, as well as from the media.[117]

### Clinical strategies and resources to achieve postpartum weight management for women with obesity

Considering the above evidence, the following clinical interventions should be considered to assist with weight management of postpartum women with obesity:

#### Physical activity and motivational interviewing

Physical activity and motivational interviewing during pregnancy have been shown to be beneficial to women with obesity in managing their postpartum weight loss. Claesson *et al.*[21] undertook a study involving pregnant women with obesity who participated in a programme to limit gestational weight gain by including regular physical activity (aqua aerobics class) and using motivational interviewing to identify and plan for individual behaviour change. Study participants had a significantly lower body weight at 10 - 12 weeks postpartum compared with controls (mean [standard deviation] (93.2 [13.32] kg v. 96.5 [14.48] kg; $p$=0.037). The intervention was delivered weekly during pregnancy and every 6 months during the first 2 years after delivery. The effects of the intervention were assessed 12 and 24 months later.[118] The mean weight change in the intervention group was –2.2 kg compared with +0.4 kg in the control group from early pregnancy to the follow-up 12 months after delivery ($p$=0.046). More women in the intervention group showed sustained weight loss 24 months after delivery than women in the control group over the same time period ($p$=0.034). Women with obesity in the intervention group who gained less than 7 kg during pregnancy had a significantly lower weight than the controls at the 24-month follow-up ($p$=0.018).

**Combined behavioural intervention**

A comprehensive approach targeting both nutrition and exercise has been shown to be beneficial for women with obesity in managing postpartum weight loss. Vesco *et al.*[12] randomly assigned 114 pregnant women with obesity to either a group-based intervention or a control group receiving usual care to test the effectiveness of the intervention on maternal weight change from randomisation to 2 weeks postpartum. The intervention programme included a combination of dietary and exercise recommendations, as well as the use of behavioural self-management techniques and attendance at weekly group meetings until delivery. Control participants received one-time dietary advice. The intervention group lost more weight at 2 weeks postpartum compared with the control group (–2.6 kg v. +1.2 kg, mean difference of –3.8 kg; 95% CI –5.9 - 1.7; $p<0.001$). However, the maternal weight-related benefits of this intervention did not persist at 1 year postpartum.[119]

Nascimento *et al.*[16] conducted a systematic review and meta-analysis to test the effect of physical exercise strategies on weight loss in postpartum women with overweight or obesity (i.e. BMI ≥25 kg/m$^2$). Although the results were not separated for women with BMI ≥25 kg/m$^2$, combined physical activity (with clear targets) and nutrition had the greatest impacts on weight loss, with a mean difference of –4.34 kg (95% CI –5.15 - –3.52; $I^2$=0%) across all included studies.

**Breastfeeding**

Breastfeeding has been shown to improve a range of maternal and infant health outcomes, although the effects on postpartum weight retention remain under study.[31] However, studies have demonstrated that women with obesity have additional challenges with breastfeeding, requiring individualised support.[31] Specifically, a prospective cohort study[26] of 4 231 postpartum women who were enrolled at the time of birth of their babies and were followed up at 3, 12, 24 and 48 months postpartum evaluated breastfeeding. Information gathered on breastfeeding patterns showed that the median duration of exclusive and total breastfeeding was decreased in the obesity group compared with the group with lower weight. Also, women with obesity have an increased probability of weaning their babies from the breast by 3 months postpartum compared with women with lower weight. Therefore, women with obesity are less likely to initiate and maintain breastfeeding[26,120,121] compared with their counterparts with lower weight, and they may require additional support on establishing and continuing breastfeeding.[26] Of note, the safety of pharmacotherapeutic agents for weight maintenance has not yet been established during breastfeeding, so these agents are generally avoided.[25]

## Gaps in the literature/future research for women with obesity over the reproductive years

- **Health outcomes in women with obesity (BMI ≥30 kg/m$^2$).** There remains a paucity of data specific to women with obesity (BMI ≥30 kg/m$^2$), as many studies aggregate women with a pre-pregnancy BMI ≥25 kg/m$^2$ into a single group for analysis for studies over the three reproductive periods. This is an important distinction, as women with a pre-pregnancy BMI ≥30 kg/m$^2$ may have different trajectories of gestational weight gain from those whose BMI is 25 - 29.9 kg/m$^2$.[122,123]
- **Pre-conception weight management.** There are emerging intervention studies on weight management before conception for women with obesity to improve fertility and obstetric outcomes. However, more data are needed to examine how to implement these interventions into clinical practice to engage a broader range of women with obesity and their HCPs.
- **Pre-conception counselling on pregnancy risks.** Numerous observational studies have demonstrated that women with obesity have increased risks of several adverse pregnancy outcomes. Research is needed to identify effective counselling strategies to discuss pregnancy risks using a patient-centred approach.
- **Classes of obesity.** The current IOM/Health Canada recommendations for gestational weight gain for women with obesity were not stratified by obesity classes, which may be associated with different obstetric risks.[50] There remains a paucity of data regarding the impact of low weight gain or weight loss during pregnancy among women with different classes of obesity.[124]
- **Low weight gain or weight loss during pregnancy.** While HCPs commonly recommend gestational weight gain below guidelines for women with obesity, this advice is not consistent with the current recommendations. Research is needed to examine both the clinical outcomes and HCPs' reasons for providing this advice.[125]
- **Patient-HCP relationship.** The impacts of the relationship between HCPs and their patients on gestational weight gain have not been extensively examined. Compared with women with lower weight, data demonstrate that providers asked fewer lifestyle questions and gave less lifestyle information to women with overweight and obesity. Point-of-care tools developed based on principles of patient-centredness and pregnant women's self-efficacy to manage gestational weight gain may be simple clinical tools, although these require further study.[122]
- **Duration of pregnancy.** The current recommendations for total gestational weight gain pertain to term pregnancies, typically defined as 37 - 41 completed weeks' gestation. However, evidence suggests that this group does not have homogeneous fetal outcomes.[126,127] Future research needs to separate the independent effects of gestational weight gain from the independent effects of gestational age during this 5-week period.
- **Postpartum weight management.** In general, there remains a paucity of specific literature to guide women with obesity and their HCPs on the optimal timing, rate and amount of weight loss during the postpartum period and the impacts on clinically important health outcomes. In addition, more research is needed to examine factors that motivate and support women with obesity to engage in and maintain weight management strategies during the postpartum period.[117]

## Conclusion

Pre-conception health, particularly the management of pre-pregnancy medical comorbidities, has been demonstrated to markedly impact on maternal, obstetric and fetal health outcomes during pregnancy. While many pregnancies are unplanned, a pre-conception consultation offers women considering pregnancy the opportunity to engage in discussions with their HCPs about their individualised health risks during pregnancy, and to make informed decisions. Women with obesity have an increased risk of numerous adverse maternal, obstetric and fetal outcomes during pregnancy. Physiological and psychological changes associated with pregnancy may persist beyond a year. Optimising preconception BMI, minimising gestational weight gain, and achieving a return to pre-pregnancy BMI or lower are critical objectives. We hope that this chapter will serve to support women living with obesity in their reproductive years.

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