

Exercise Prescription for Overweight and Obese Women: Pregnancy and Postpartum

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KEYWORDS

- Maternal exercise • Overweight • Obese • Postpartum
- Weight management

Women of childbearing age are at an increased risk for obesity¹ and diabetes² because of excessive weight gain during pregnancy and weight retention after delivery.³ Population estimates of maternal obesity and being overweight range from 34%⁴ to 39%⁵ worldwide, with an increasing prevalence of 69% over 10 years (1993 to 2003) in nine states in the United States.⁶ A study of 18,633 patients collected from 1987 to 1997 showed a prevalence of 23% for overweight and obese pregnant women,⁷ which may be an underestimation of the current situation.

Overweight women who have experienced previous weight retention start their next pregnancy with a higher early rate of weight gain.⁸ This excessive weight gain during pregnancy has been strongly associated with maternal weight retention at 6 and 12 months postpartum, and each subsequent pregnancy is likely to result in more weight gain, with additional weight retention in the postpartum period.⁹ This escalating problem may contribute to the obesity epidemic and other disease risks, as overweight women who gain 10% or more of their before-pregnancy mass are at higher risk for complications, such as gestational diabetes mellitus (GDM)¹⁰ and pregnancy-induced hypertension.⁹ Additionally, higher recurrence of GDM has been

This work is supported by the Canadian Institute of Health Research, The Lawson Foundation, and the Molly Towell Perinatal Research Foundation.

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Obstet Gynecol Clin N Am 36 (2009) 301–316

doi:10.1016/j.ogc.2009.03.005

0889-8545/09/\$ – see front matter © 2009 Elsevier Inc. All rights reserved.

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associated with greater before-pregnancy weight, body mass index (BMI), and pregnancy weight gain.¹¹

Women who are overweight or obese have an increased risk of menstrual cycle irregularities, infertility,¹² and a diminished response to fertility treatments¹³ that reduce the probability of conception. It has been shown that body fat distribution may influence fertility, as a 0.1 unit increase in the waist-to-hip ratio of women decreased the probability of conception by 30% per menstrual cycle.¹⁴

Overweight and obese women who do conceive have a higher risk of maternal and fetal complications, contributing to longer hospitalization¹⁵ and increased instrumentation and delivery costs.¹⁵ Infants of obese women are more likely to experience neonatal intensive care unit admission¹⁶ and cesarean delivery.¹⁵ The infants of Class III obese women (BMI ≥ 40 kg/m²) are twice as likely to demonstrate fetal distress and low APGAR scores.¹⁷ The high incidence of complications in overweight and obese women increases the cost of prenatal hospital care by fivefold.¹⁵

THE MATERNAL-FETAL-CHILD LINK TO OBESITY

Obesity begets obesity.^{18,19} With childhood obesity on the rise worldwide, the recent release of the agenda for obesity research suggests that priority should be given to investigating critical periods throughout life. Three of these time points include early life: the fetal and neonatal periods, and pregnancy.²⁰

Mothers of obese preschoolers have a higher prepregnancy BMI,²¹ children of obese mothers are twice as likely to be large for gestational age (greater than the 95%ile) at birth, and large-for-gestational-age babies are more likely to be obese preschoolers.²¹ Excess pregnancy weight gain and weight retention are precursors to obesity in midlife² and prepregnancy overweight and obesity may lead to a vicious cycle of excessive weight gain and adiposity passed on from the mother to her offspring.²²

Although genetics are important, the robust link between the fetal environment and its profound influence on lifelong health and the future risk of chronic disease cannot be ignored.^{18,22,23} The maternal metabolic state has a powerful influence on whether the offspring later develops obesity.²⁴ This altered metabolic state can be represented by an increasing hyperglycemia during pregnancy (GDM and impaired glucose tolerance), which is associated with increased risk of obesity in children 5 to 7 years of age.²⁵ This increased risk is modifiable if GDM is treated or prevented,²⁵ which strongly suggests that the influence of the intrauterine milieu can be passed on to the next generation nongenetically, and that by maintaining a healthy fetal environment, undesirable influences affecting the offspring can be reversed and prevented.^{24,26–28}

The recent opinion statement from the American College of Obstetricians and Gynecologists (ACOG) on obesity during pregnancy strongly suggests aggressive preventative management in all overweight and obese pregnant women both before conception and after delivery.²⁹ This strong opinion and the overwhelming evidence linking maternal health to the fetal environment reinforce the idea that the best solution for obesity prevention may begin with promotion of a healthy maternal lifestyle. Furthermore, excessive weight gain and failure to lose pregnancy weight by 6 months after delivery is an important predictor of long-term obesity in the mother.³⁰

Achievement and maintenance of a healthy weight needs to be encouraged and support provided to assist women in reaching and maintaining this goal during and after pregnancy.³¹ Progressive weight loss between pregnancies with a multidisciplinary weight-management approach may help decrease the risk for GDM and

hypertension in subsequent pregnancies.⁹ One of the risk factors for developing GDM is a sedentary lifestyle and thus, a common link between obesity and GDM is physical inactivity, with both obesity and GDM as risk factors for type-2 diabetes.³² Thus, prevention of excessive weight gain during pregnancy is highly recommended as an intervention to reduce the occurrence of GDM and prevent the development of true diabetes¹¹ and hypertension after pregnancy.

AEROBIC EXERCISE INTERVENTIONS FOR OVERWEIGHT OR OBESE PREGNANT WOMEN

Although the healthy lifestyle approach is intuitive,³³ to date only eight studies have examined the effectiveness of a combined nutrition and exercise intervention designed to prevent excessive weight gain during pregnancy, and not all exclusively examined overweight or obese women. As shown in **Table 1**, 63%^{34–38} were not successful in preventing excessive pregnancy weight gain in overweight and obese women. Studies using education alone as an intervention^{34–37} were not effective in preventing excess weight gain during pregnancy. Interventions for this population group need to be behavior-based because education programs increase knowledge but do not change behavior.³⁹ In addition, **Table 1** shows that behavior-based interventions without an individualized intervention of nutrition and exercise are not successful.³⁴

The interventions that used dietary control in combination with exercise as part of a lifestyle change for overweight and obese pregnant individuals included a variety of activities. Although successful in preventing excessive weight gain, aqua-aerobic classes, designed for obese pregnant women and offered one or two times per week would not improve aerobic fitness.⁴⁰ Artal and colleagues⁴¹ used a supervised moderate intensity (60% symptom-limited VO_{2max}) exercise session consisting of treadmill walking or cycling on a semirecumbent bike for obese GDM participants, once per week, followed by unsupervised exercise for the remaining 6 days at home. The exercise group had a mean exercise time of 153 plus or minus 91.4 minutes per week and 50% of them exercised more than 150 minutes per week.⁴¹ Weekly weight gain was lower than in the diet-only group.

Although only partially successful (50%) in preventing excessive gestational weight gain, a pilot study using a mild walking program (30% of estimated heart-rate reserve) starting at 25 minutes per session three to four times per week, building slowly by adding 2 minutes per week until 40 minutes was reached, was successful in improving glucose regulation and reducing insulin requirements in overweight women with GDM.³⁸ Pedometers used to count steps accumulated during the walking sessions read approximately 2,600 steps at 25 minutes and increased to 4,200 steps at 40 minutes by the end of pregnancy. When these exercise step counts were added to the mean daily activity steps (6,500 steps), the women in the walking program were taking approximately 10,000 steps three to four times per week.³⁸ The low intensity of the walking program allows even previously sedentary overweight and obese women to follow this exercise prescription. Finally, excessive gestational weight gain was prevented with a nutrition and exercise intervention, which included a similar walking program (using a pedometer to count steps) for overweight and obese women.⁴² By the end of the program, these women took over 10,000 steps three to four times per week, bringing them into the “active” category.⁴³ Because walking is the most popular activity for pregnant women,⁴⁴ the use of pedometers may aid in compliance for overweight and obese women.

Thus, it would appear that initiating a walking program during pregnancy,^{38,42} or unstructured exercise at home,⁴¹ may be better than structured aqua-aerobic classes,

Table 1

Summary of studies using an exercise intervention to prevent excessive gestational weight gain in overweight or obese women

Study	Population	Intervention	Results	Successful?
Gray-Donald et al ³⁵	Cree women of James Bay, 112 in intervention versus 107 historic controls; all BMI categories.	Goal to optimize gestational weight gain by use of exercise groups and dietary education via media campaign.	No difference between groups in weight gain or rate of weight gain.	Not successful. No exercise prescription given.
Polley et al ³⁴	Low income; 120 normal weight or overweight/obese in Pittsburgh.	Randomized into stepped behavior intervention or usual prenatal care; intervention received educational materials.	Among overweight/obese women, 59% had excessive weight gain in intervention group versus 32% in usual care group.	Not successful. Exercise intervention focused on increased walking and a more active lifestyle.
Olsen et al ³⁶	Low and middle/upper income in Upstate NY; 179 normal or overweight enrolled in intervention compared with 381 historic controls.	Goal to use 2 tiers: (a) health care provider information (b) materials mailed, including newsletter, postcards, and other reminders.	Among historic controls, 45% gained excessive versus 41% in intervention group, $P > .05$; found overweight low income women benefited most.	Not successful- except in low income women. No exercise prescription given.
Kinnunen et al ³⁷	Six maternity clinics from Finland; three clinics were intervention ($n = 49$); three were control ($n = 56$) and received standard care; all women were primiparous and from all BMI categories.	Individual counseling on diet and physical activity plus information on weight gain recommendations.	46% of women in intervention group versus 30% in control group exceeded weight gain, $P > .05$.	Not successful. Did not increase activity or prevent excessive weight gain. Supervised group-exercise sessions once per week, 45–60 min. Encouraged 800 MET minutes per week.

Claesson et al ⁴⁰	Prospective case-controlled intervention; used 155 for intervention versus 193 in control group, received standard care in Sweden; all women were obese.	To decrease total weight gain to < 7 kg using behavioral intervention by weekly motivational talk using trained midwife.	Intervention group had lower weight gain and lost more weight at postnatal check-up than control, but no difference in number of women who gained < 7 kg.	Successful in controlling weight gain for obese women, especially nulliparous. Offered aqua aerobic classes 1 to 2 times/week.
Artal et al ⁴¹	Obese women with GDM; self-selected intervention.	Diet+exercise (<i>n</i> = 39) versus diet alone (<i>n</i> = 57); used standard GDM diet for both groups.	Weight gain/week lower in diet+exercise intervention group.	Successful in limiting weight gain. Encouraged 60% VO _{2peak} at least 5 days/week; 50% of exercise group = > 150 min/week.
Davenport et al ³⁸	GDM women; BMI ≥ 25kg/m ² ; pilot study. Groups matched by age, BMI, and insulin usage.	Conventional management (CM) (<i>n</i> = 20) versus CM+walking (<i>n</i> = 10)	CM+walking group had improved glucose regulation and used fewer insulin units/kg/day in late pregnancy. 50% of women in both groups did not gain excessive weight.	Partially Successful in preventing excessive weight gain (50%); however GDM improved in CM+walking group. Walking = 25 min, added 2 min/week until 40 min, three to four times per week.
Mottola et al ⁴²	Single-arm intervention matched to historical controls for overweight and obese women starting at 16 weeks gestation.	Nutrition and exercise lifestyle intervention (NELIP) consisting of GDM dietary program with walking (<i>n</i> = 65), using pedometer to count steps.	Weight gained on NELIP was 6.8 kg ± 4.1 kg; 0.38 kg ± 0.2 kg/week; 80% did not gain excessively.	Successful in preventing excessive weight gain. Exercise prescription (30% heart rate reserve) started at 25 min, three to four times/week; adding 2 min per week; until 40 min reached.

as structured classes may be more difficult for time management and not all participants have access to a pool.

AEROBIC EXERCISE PRESCRIPTION FOR OVERWEIGHT AND OBESE PREGNANT WOMEN

A recent study in which 20 medically prescreened obese and 20 normal-weight pregnant women participated in a graded-treadmill exercise test to volitional fatigue, examined the impact of obesity on the ventilatory response to weight-bearing exercise during pregnancy.⁴⁵ The investigators concluded that exercise ventilatory response is increased during pregnancy but is not affected further by obesity during graded-treadmill exercise. This is important in that there is no apparent ventilatory limitation to submaximal weight-bearing exercise representing daily living activities, such as walking, in pregnant obese women, which lends support to the feasibility of exercise prescription in this population group.⁴⁵

Evidence-based guidelines for exercise during pregnancy indicate that regular prenatal exercise is an important component of a healthy pregnancy.⁴⁶ In addition to maintaining physical fitness, exercise may be beneficial to prevent or treat maternal-fetal diseases.^{32,47} Walking has been shown to be the most popular activity during pregnancy⁴⁴ and as three of the intervention studies have shown, walking in combination with nutritional control can be effective in preventing excessive weight gain in overweight and obese women.^{38,41,42}

ACOG suggests that all pregnant women with low-risk pregnancies should exercise on most if not all days of the week.⁴⁸ The Physical Activity Guidelines for Americans (PAGA)⁴⁹ for healthy pregnant women recommends at least 150 minutes (2 hours and 30 minutes) of moderate-intensity aerobic activity per week, with this activity spread throughout the week. These guidelines also suggest that pregnant women who begin physical activity should increase the amount gradually over time.⁴⁹ Exercise prescription requires knowledge of the physical ability of the participant to engage in various activities.⁵⁰ With overweight or obese pregnant women, this information, included with a thorough clinical evaluation to ensure low obstetric risk, is extremely important before prescribing exercise. The PARmed-X for Pregnancy⁴⁶ is a tool that can be used by health care providers for medical prescreening in a simple checklist format. This document also provides more specific guidelines using the FITT principle for Frequency, Intensity, Time (duration) and Type of exercise after medical prescreening.⁴⁶

Frequency of Exercise

ACOG⁴⁸ suggests exercise on most if not all days of the week for pregnant women, while the latest guidelines for Americans suggest that this activity be spread throughout the week.⁴⁹ A recent study would also suggest caution, as frequency of structured exercise, especially during late pregnancy, was a determinant of birth weight.⁵¹ In a case-controlled study of 526 women, the odds of giving birth to a small-for-gestational-age baby was 4.61 times more likely for women who engaged in structured exercise more than five times per week and also 2.64 times more likely for those women who engaged in structured exercise two or less times per week.⁵¹ Because small-for-gestational-age babies are at risk for obesity and cardiovascular disease later in life,²³ structured exercise performed three to four times per week would seem ideal. Starting an exercise program at three times per week with a day of rest between each exercise day may also help eliminate fatigue.⁴⁶

Intensity of Exercise

Although it has been suggested that target heart-rate zones should not be used to monitor exercise intensity during pregnancy, recent evidence would suggest otherwise, especially for overweight and obese women. Using 106 medically prescreened overweight and obese women between 16 and 20 weeks of gestation, the relationship between aerobic capacity (VO_2) and heart rate (HR) was established over a full spectrum of exercise intensities.⁵² Using regression analyses, it was found that $\%VO_{2\text{reserve}}$ ($VO_{2\text{reserve}} = VO_{2\text{max}} - VO_{2\text{rest}}$) is not equivalent to $\%HR_{\text{reserve}}$ ($HR_{\text{reserve}} = HR_{\text{max}} - HR_{\text{rest}}$) at intensities below 70% $VO_{2\text{reserve}}$. This indicates that if an exercise prescription is followed for moderate-intensity exercise, pregnant overweight and obese women may be exercising at a higher intensity ($\%VO_2$) than intended for a given heart rate, and that prescription describing $\%VO_{2\text{reserve}}$ as a proxy for $\%HR_{\text{reserve}}$ is appropriate for 70% and above, but not below.⁵² Even though they are not equivalent below 70%, $\%HR_{\text{reserve}}$ is best described by $\%VO_{2\text{reserve}}$ and not $VO_{2\text{peak}}$ in pregnant overweight and obese women.⁵²

The American College of Sports Medicine⁵³ suggested that previously sedentary overweight and obese pregnant women should initiate an aerobic exercise program at an intensity equivalent to 20% to 39% $VO_{2\text{reserve}}$, which indicates the lowest level of physical activity that could provide health benefits.⁵³ However, values below 70% $VO_{2\text{reserve}}$ are not equal to $\%HR_{\text{reserve}}$ in pregnant overweight and obese women, and thus, the range of 20% to 39% $VO_{2\text{reserve}}$ was equivalent to 13% to 33% HR_{reserve} .⁵² Target heart-rate zones based on age were developed and validated on the above population, equivalent to 13% to 33% HR_{reserve} . These target heart-rate zones are 110 to 131 beats per minute (bpm) for women 20 to 29 years of age and 108 to 127 bpm for women 30 to 39 years of age.⁵² Low-risk pregnant overweight and obese women, who use these lower intensities, may be more compliant, especially when walking is used as the exercise modality. Even at these lower intensities, this population group will gain aerobic fitness. Alternate target heart-rate zones (validated on 156 pregnant women) have been suggested that also include the fitness level of the individual. Low-risk women who are not fit (in the bottom 25% of peak aerobic fitness), between the ages of 20 and 29 years (average BMI = 29.8 kg/m² ± 1.2 kg/m²; $VO_{2\text{peak}} \leq 21\text{mL/kg/min}$) and between 30 to 39 years (average BMI = 31.6 kg/m² ± 1.0 kg/m²; $VO_{2\text{peak}} \leq 19.6\text{mL/kg/min}$), can exercise safely between 128 and 144 bpm.⁵⁴ These target heart-rate zones were developed and validated, based on 60% to 80% of peak aerobic capacity and may not be appropriate for obese women, but may be offered as an alternative for overweight women who are not fit and wish to start an aerobic exercise program.

Rating of perceived exertion (RPE) is another indicator of appropriate intensity.^{46,50} On the 6- to 20-point scale, an exertion rating of 12 to 14 (somewhat hard) indicates moderate activity.^{46,50} Using the “talk test” will also confirm that the pregnant woman is not over exerting. The “talk test” indicates an appropriate intensity, as long as the woman can carry on a conversation while exercising.⁴⁶

Time (Duration of Exercise Session)

Overweight and obese pregnant women should initially attempt 15 minutes, building slowly to a maximum of 30 minutes of aerobic activity at a specific target heart rate, even if it means reducing the intensity and using rest intervals.⁴⁶ All aerobic activity should be preceded by a brief 10- to 15-minute warm-up of low-intensity stretching or calisthenics and followed by a short 10- to 15-minute cool down.⁴⁶ A mild walking program starting at 25 minutes, adding 2 minutes per week until 40 minutes, and maintained until birth is also feasible for overweight and obese pregnant women.^{42,52}

Structured exercise of a moderate intensity totaling 150 minutes per week, using a frequency of three sessions per week, would approximate 50 minutes of activity (30 minutes of which is at the appropriate target heart rate, with a 10-minute warm-up, followed by a 10-minute cool down), or 30 minutes per session, four times per week, with a 5-minute warm-up and a 5-minute cool down. These recommendations may provide a choice based on the initial fitness level and initial prepregnancy BMI of the participant. Individual prescription based on clinical evaluation is important in this population group.

Type of Exercise

Walking three to four times per week at the appropriate intensity is highly recommended to help prevent excessive gestational weight gain and other chronic disease risks for both the overweight and obese mother and the developing fetus.⁴² Aerobic exercise in which large muscle groups are used, including walking, stationary cycling, aquatic exercise, or low-impact aerobics are appropriate for overweight and obese pregnant women. Active living should also be promoted in this group, in which women are encouraged to take the stairs, rather than the elevator, or park farther away from the door to increase daily step counts. Exercises that are contraindicated are those that increase the risk of falling, abdominal trauma, and collision, and contact sports, such as gymnastics, horseback riding, downhill skiing, soccer, and basketball.⁴⁹ Scuba diving should also be avoided and pregnant women are cautioned when they exercise at altitude.⁵⁰

RATE OF PROGRESSION

The best time to progress is during the second trimester, when the risks and discomforts of pregnancy are lowest. Aerobic exercise should be increased gradually from a minimum of 15 minutes per session, three times per week at the appropriate target heart rate or RPE to a maximum of 30 minutes per session, four times per week (at the appropriate target heart rate or RPE), preceded by the warm-up and followed by the cool down.⁴⁶

MUSCLE CONDITIONING AND STRENGTH TRAINING

Muscular strength and conditioning involves specific muscle groups that are stretched or moved through a specific range of motion, with or without added resistance to that muscle group.⁴⁶ The effects of muscle strength and conditioning exercise performed during pregnancy have rarely been examined, especially in the overweight or obese population. Muscle conditioning exercises in combination with aerobic activities provide a well-rounded fitness program for pregnant women who have no contraindications to exercise. Possible advantages to incorporating muscular strength and conditioning activities into an exercise program may be improvement in overall strength, posture, and core muscle strength that may help in labor and birth. By strengthening muscles of the body core, perhaps lower-back pain and pelvic-joint pain may be avoided as pregnancy progresses and the center of gravity shifts forward.⁵⁵ Strengthening the pelvic floor muscles during pregnancy have been shown to prevent urinary incontinence during gestation and 3 months after delivery.⁵⁶ Low back pain and pelvic pain are common complaints during pregnancy, which may interfere with activities of daily living.⁵⁷ The main factors associated with these complaints may be mechanical, because of an alteration in posture required to support the increase in body mass, the shift in the center of gravity, and hormonal changes

(relaxin).⁵⁷ It was found that the higher the number of previous leisure-time physical activities, the lower the risk of low back and pelvic pain during pregnancy.⁵⁷

Very little evidence-based literature reports guidelines on muscle conditioning for pregnant women, as most of the studies investigate the physiologic effects of aerobic exercise. Common sense and traditional medical advice have suggested that pregnant women avoid heavy lifting or straining, especially those activities that have a static or isometric exercise component.⁵⁸ Theoretical risks of resistance exercise during pregnancy have included changes in maternal blood pressure, especially if the Valsalva Maneuver (holding one's breath while working against a resistance) is initiated,⁵⁹ initiation of premature labor,⁶⁰ and transient fetal hypoxia (drop in oxygen levels).⁶¹ High-resistance exercise may reduce blood flow and oxygen supply to the uterus, which may cause a mild transient decrease in fetal oxygen concentrations,⁵⁸ reflected by a drop in fetal heart rate (bradycardia).⁶² A stable fetal heart-rate pattern during isotonic and isometric exercise has been reported in the literature,^{55,58,62-64} while others revealed transient changes in fetal heart rate, especially during maternal exercise performed while lying on the back (supine position).^{61,65} Thus, maternal strength conditioning exercises do not compromise maternal or fetal well-being in healthy pregnancies; however, exercises performed in the supine position should be avoided and this is reflected in several guidelines.^{46,48,49}

One study examined the effects of circuit-type resistance training using rubber tubing on women with gestational diabetes. The exercise program consisted of eight exercises performed in a continuous circuit with short rests (< 1 minute) between stations, starting at two sets of 15 repetitions of each exercise and progressing to three sets of 20 repetitions. Intensity was monitored by instructing the participants to exercise at the level of "somewhat hard" on the RPE scale. Only those women who were overweight in the exercise intervention program had a reduced amount of insulin required to control their blood-glucose concentrations compared with a dietary intervention without exercise.⁶⁶ Because this was the only study investigating muscle strength and conditioning exercises during pregnancy, evidence-based research is lacking and this includes studies on yoga and Pilates.⁶⁷ Thus, muscle strength and conditioning activities should be conducted with caution and common sense.

POSTPARTUM

Maternal obesity has a negative association with the initiation of, and continuation of, breastfeeding, which may be attributed to excessive gestational weight gain, complications of pregnancy and delivery, or condition of the infant at birth.⁶⁸ Excessive fat may hinder mammary gland development and lactogenesis in obese women.⁶⁹ The greater the BMI of the mother before pregnancy, the less likely breastfeeding will be initiated⁷⁰ and the more likely she will terminate breastfeeding early.⁷¹ Others have linked childhood obesity with parental control of feeding at 1 year of age⁷² and rapid velocity of growth during infancy,⁷³ attributing this to formula-feeding.³⁹ In addition, it has been shown that the pattern of dietary intake of fats and energy among children resembles that of their parents, with the parental influence during early childhood as fundamental.⁷⁴

POSTPARTUM EXERCISE INTERVENTIONS FOR OVERWEIGHT OR OBESE WOMEN

Two recent reviews suggest that dieting and exercise together is more effective than dieting alone in reducing weight retention after childbirth,⁷⁵ and that more interventions are necessary that focus primarily on weight management from a multi-level approach that includes the health care provider.⁷⁶ Problems exist in postpartum

care, as education on the increased risk for development of type-2 diabetes mellitus and cardiovascular disease, the benefits of breastfeeding, and the importance of healthy lifestyle changes, such as increased physical activity and nutritional control, are not emphasized, especially for overweight and obese women.^{30,77} Currently, only three studies exist in the literature in which an intervention program was specifically designed to reduce postpartum weight retention in overweight or obese women. Lovelady and colleagues⁷⁸ examined the effects of a 10-week calorie-reduced (by 500 kcal/day) and exercise program (4 days/week, 65%–80% of maximum HR) on infant growth in overweight, exclusively breastfeeding women. The exercise program, starting at 15 minutes per session, began at 4-weeks postpartum and was increased gradually until the women were walking, jogging, or aerobic dancing for 45 minutes per day. The women in the intervention group lost more weight and increased aerobic fitness compared with the control group. Infant growth patterns were not different between groups.⁷⁸ In a subsequent study, with the same protocol and the addition of supplementation of vitamin B₆, with a limitation of no less than 1,800 kcal/day for the dietary program, the results showed that a moderate weight loss of 0.5 kg per week did not affect B₆ status or infant growth in lactating overweight women.⁷⁹ More recently, overweight women in a structured diet (caloric deficit of 350 kcal/day) and exercise (increase energy expenditure by at least 150 kcal/day or > 1,050 kcal/week) program successfully lost weight and most maintained this weight loss by 1 year after delivery.⁸⁰ However, dropout rate was high and retention rate low (58%) in the follow-up period at 1 year after delivery.⁸⁰ This may be partially explained by the fact that women with children are 1.67 times more likely to quit an exercise program.⁴⁴ These findings may be important, in that in order for postpartum exercise programs to succeed, time management, social support, cultural sensitivity, and child care should be incorporated.⁸¹ In addition, exercise sessions that include the infant, such as stroller walking, or muscle conditioning programs that include mother-child interaction may be more successful.

With obesity on the rise in reproductive age women, it is important that exercise and active living be introduced into the postpartum period to help diminish weight retention and promote safe weight loss. The literature suggests that lactation, reduction of daily energy intake (as long as at least 1,800 kcal/day are maintained), exercise, and weight loss (approximately 0.5 kg per week) are compatible, even in overweight or obese women.^{78,79} More research is necessary to provide recommendations that are evidence-based.

EXERCISE GUIDELINES FOR OVERWEIGHT AND OBESE POSTPARTUM WOMEN

Exercise guidelines for postpartum women are virtually nonexistent⁸¹ and certainly do not exist for overweight and obese women. Common sense, as indicated with recommendations for exercise during pregnancy, would suggest that postpartum women seek approval from their health care providers before beginning a moderate, structured exercise program. PAGA recommends at least 150 minutes (2 hours and 30 minutes) of moderate-intensity aerobic activity per week, with this activity spread throughout the week for postpartum women.⁴⁹ Although these guidelines are general, it is important that mode of delivery (vaginal, instrument-assisted, or caesarian) be considered and that the 6 to 8 week after-delivery assessment by the health care provider includes opportunity to discuss the issue of level of discomfort and other complicating factors, such as anemia or wound infection.⁶⁷ Care should be given to the c-section incision site, and stretching exercises should be avoided until the

incision is healed.⁸¹ Initiation of pelvic floor exercises is recommended in the immediate postpartum period to reduce the risk of future urinary incontinence.⁶⁷

GENERAL GUIDELINES FOR BREASTFEEDING AND EXERCISE

Common-sense guidelines are available for postpartum women who wish to exercise. These include exercising after the baby has been fed or the breasts are empty to reduce discomfort. It is recommended that a good support bra be worn and that a sports bra be avoided because of breast compression.⁸¹ Adequate nutrition and hydration should be maintained to support the energy demands of breastfeeding and exercise.⁸¹ If there were no complications from delivery, a mild exercise program consisting of walking, pelvic floor exercises, relaxation, and light stretching of all muscle groups can begin in the immediate postpartum period.⁸¹ Other activities, including walking up and down stairs and performing muscle-conditioning exercises can begin without delay after uncomplicated vaginal delivery.⁸²

GUIDELINES FOR AEROBIC EXERCISE FOR OVERWEIGHT AND OBESE POSTPARTUM WOMEN

Every structured aerobic-exercise program should be based on the FITT principle. Once medical approval has been obtained, frequency of a moderate program should begin slowly at three times per week, and depending on the mother's fitness level, can be increased to four or five times per week.⁸¹ Intensity can be monitored by the "talk test" and the RPE scale, where intensity should be of a moderate level (somewhat hard). If this is difficult for the overweight or obese woman, using an appropriate target heart rate estimating 20% to 39% of $VO_{2\text{reserve}}$ may be more appropriate.⁵³ This can be gradually increased as the participant's fitness level improves. Starting an exercise program at 15 minutes, with a 5- to 10-minute warm-up of lower intensity followed by a 5- to 10-minute cool down, including rest intervals to avoid fatigue may be recommended.⁸¹ Exercise time at the target heart rate or RPE can progress from 15 minutes, adding 5 minutes per week, as long as the individual is not overly fatigued,⁸¹ to at least 150 minutes (2 hours and 30 minutes) of moderate-intensity aerobic activity per week, with this activity spread throughout the week.⁴⁹ The type of activity recommended can include walking while pushing a stroller (also improves muscular strength), jogging, aerobic dancing,⁷⁸ or other activities that promote movement of major muscle groups.

Muscle-conditioning exercises for postpartum women may be more successful if the activity includes the infant and may help to overcome barriers to exercise.⁴⁴ The infant can be used as a resistance tool (the infant's head must be supported at all times before 6 months of age) for improving upper body strength.⁸¹ Muscle-conditioning exercise can be resumed in the supine position and the infant can be placed on the abdominal muscles of the mother; while she is holding her thighs for support, the mother can perform abdominal exercise.⁸³ Muscle-conditioning activity that promotes maternal-infant interaction may also be successful in promoting active living.⁸¹ More research is necessary to replace common-sense guidelines with evidence-based recommendations.

SUMMARY

To break the spiraling cycle of generations of unhealthy body weights and obesity-related health problems in adulthood, it is imperative to prevent excessive weight gain and to promote a healthy lifestyle during prenatal life and the postpartum period, especially for those women who are overweight and obese. The link between maternal lifestyle and the fetal environment reinforces the idea that the best solution for obesity

prevention may begin with the promotion of a healthy lifestyle during pregnancy. Progressive weight loss between pregnancies with a multidisciplinary weight management approach may help decrease the risk for GDM and hypertension in subsequent pregnancies. Once a low-risk pregnancy has been established, walking, which is the most popular activity, combined with nutritional control may be the most effective in preventing excessive weight gain in overweight and obese women. Maternal exercise prescription should use the FITT principle, with a frequency of three to four times per week as ideal. Intensity based on a target heart-rate zone of 110 to 131 bpm for women 20 to 29 years of age and 108 to 127 bpm for women 30 to 39 years of age, coupled with use of the RPE scale and the “talk test” is suggested. A 5- to 10-minute warm-up preceding exercise starting at 15 minutes per session, building up to 30 minutes, should then be followed by a 5- to 10-minute cool down.

Dieting and exercise together are more effective than dieting alone in reducing weight retention after childbirth. Compliance may be improved by incorporating child care and children into the exercise routine. Exercise guidelines for postpartum women are virtually nonexistent and do not exist for overweight and obese women. Postpartum women should seek approval from their health care provider before beginning a moderate structured exercise program, which should begin slowly at three times per week, and increased to four or five times per week. Intensity, monitored by the “talk test” and the RPE scale, should be at a moderate level (somewhat hard), which can be adjusted as needed. Exercise can start from 15 minutes, adding 5 minutes per week, as long as the individual is not overly fatigued, to at least 150 minutes (2 hours and 30 minutes) of aerobic activity per week, with this activity spread throughout the week. The type of activity recommended includes walking while pushing a stroller, jogging, aerobic dancing, or other activities that promote movement of major muscle groups.

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