2019 Canadian guideline for physical activity throughout pregnancy

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ABSTRACT

The objective is to provide guidance for pregnant women and obstetric care and exercise professionals on prenatal physical activity. The outcomes evaluated were maternal, fetal or neonatal morbidity, or fetal mortality during and following pregnancy. Literature was retrieved through searches of MEDLINE, EMBASE, PsycINFO, Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials, Scopus and Web of Science Core Collection, CINAHL Plus with Full Text, Child Development & Adolescent Studies, Education Resources Information Center, SPORTDiscus, ClinicalTrials.gov and the Trip Database from inception up to 6 January 2017. Primary studies of any design were eligible, except case studies. Results were limited to English-language, Spanish-language or French-language materials. Articles related to maternal physical activity during pregnancy reporting on maternal, fetal or neonatal morbidity, or fetal mortality were eligible for inclusion. The quality of evidence was rated using the Grading of Recommendations Assessment, Development and Evaluation methodology. The Guidelines Consensus Panel solicited feedback from end users (obstetric care providers, exercise professionals, researchers, policy organisations, and pregnant and postpartum women). The development of these guidelines followed the Appraisal of Guidelines for Research and Evaluation II instrument. The benefits of prenatal physical activity are moderate and no harms were identified; therefore, the difference between desirable and undesirable consequences (net benefit) is expected to be moderate. The majority of stakeholders and end users indicated that following these recommendations would be feasible, acceptable and equitable. Following these recommendations is likely to require minimal resources from both individual and health systems perspectives.

PREAMBLE

These Guidelines provide evidence-based recommendations regarding physical activity throughout pregnancy in the promotion of maternal, fetal and neonatal health. In the absence of contraindications (see below for a detailed list), following these Guidelines is associated with (1) fewer newborn complications (ie, large for gestational age) and (2) maternal health benefits (ie, decreased risk of pre-eclampsia, gestational hypertension, gestational diabetes, caesarean section, instrumental delivery, urinary incontinence, excessive gestational weight gain and depression; improved blood glucose; decreased total gestational weight gain; and decreased severity of depressive symptoms and lumbopelvic pain). Physical activity is not associated with miscarriage, stillbirth, neonatal death, preterm birth, preterm/prelabour rupture of membranes, neonatal hypoglycaemia, low birth weight, birth defects, induction of labour or birth complications. In general, more physical activity (frequency, duration and/or volume) is associated with greater benefits. However, evidence was not identified regarding the safety or additional benefit of exercising at levels significantly above the recommendations. Prenatal physical activity should be considered a front-line therapy for reducing the risk of pregnancy complications and enhancing maternal physical and mental health. For pregnant women not currently meeting these Guidelines, a progressive adjustment towards them is recommended. Previously active women may continue physical activity throughout pregnancy. Women may need to modify physical activity as pregnancy progresses. There may be periods when following the guidelines is not possible due to fatigue and/or discomforts of pregnancy; women are encouraged to do what they can and to return to following the recommendations when they are able. These Guidelines were informed by an extensive systematic review of the literature,

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expert opinion, and end user consultation and considerations of feasibility, acceptability, costs and equity.

RECOMMENDATIONS

The specific recommendations in the 2019 *Canadian Guideline for Physical Activity throughout Pregnancy* are provided below with corresponding statements indicating the quality of the evidence informing the recommendations and the strength of the recommendations (explanations follow).

1. All women without contraindication should be physically active throughout pregnancy. *Strong recommendation, moderate-quality evidence.*

Specific subgroups were examined:

- Women who were previously inactive. *Strong recommendation, moderate-quality evidence.*
- Women diagnosed with gestational diabetes mellitus. *Weak recommendation*[i]*, low-quality evidence.*
- Women categorised as overweight or obese (prepregnancy body mass index ≥25 kg/m^2). *Strong recommendation*[ii]*, low-quality evidence.*

2. Pregnant women should accumulate at least 150 min of moderate-intensity[iii] physical activity each week to achieve clinically meaningful health benefits and reductions in pregnancy complications. *Strong recommendation, moderate-quality evidence.*

3. Physical activity should be accumulated over a minimum of 3 days per week; however, being active every day is encouraged. *Strong recommendation, moderate-quality evidence.*

4. Pregnant women should incorporate a variety of aerobic and resistance training activities to achieve greater benefits. Adding yoga and/or gentle stretching may also be beneficial. *Strong recommendation, high-quality evidence.*

5. Pelvic floor muscle training (PFMT) (eg, Kegel exercises) may be performed on a daily basis to reduce the risk of urinary incontinence. Instruction on the proper technique is recommended to obtain optimal benefits. *Weak recommendation*[iv]*, low-quality evidence.*

6. Pregnant women who experience light-headedness, nausea or feel unwell when they exercise flat on their back should modify their exercise position to avoid the supine position. *Weak recommendation*[v]*, very-low quality evidence.*

CONTRAINDICATIONS

All pregnant women can participate in physical activity throughout pregnancy with the exception of those who have contraindications (listed below). Women with absolute contraindications may continue their usual activities of daily living but should not participate in more strenuous activities. Women with relative contraindications should discuss the advantages and disadvantages of moderate-to-vigorous intensity physical activity with their obstetric care provider prior to participation.

The following are absolute contraindications to exercise:

- Ruptured membranes.
- Premature labour.
- Unexplained persistent vaginal bleeding.
- Placenta praevia after 28 weeks' gestation.
- Pre-eclampsia.
- Incompetent cervix.
- Intrauterine growth restriction.
- High-order multiple pregnancy (eg, triplets).
- Uncontrolled type I diabetes.
- Uncontrolled hypertension.
- Uncontrolled thyroid disease.
- Other serious cardiovascular, respiratory or systemic disorder.

The following are relative contraindications to exercise:

- Recurrent pregnancy loss.
- Gestational hypertension.
- A history of spontaneous preterm birth.
- Mild/moderate cardiovascular or respiratory disease.
- Symptomatic anaemia.
- Malnutrition.
- Eating disorder.
- Twin pregnancy after the 28th week.
- Other significant medical conditions.

STRENGTH OF THE RECOMMENDATIONS

The Grading of Recommendations Assessment, Development and Evaluation (GRADE) system was used to grade the strength of the recommendations. Recommendations are rated as strong or weak based on the (1) balance between benefits and harms, (2) overall quality of the evidence, (3) importance of outcomes (ie, values and preferences of pregnant women), (4) use of resources (ie, cost), (5) impact on health equity, (6) feasibility and (7) acceptability.

Strong recommendation

Most or all pregnant women will be best served by the recommended course of action.

Weak recommendation

Not all pregnant women will be best served by the recommended course of action; there is a need to consider other factors such as the individual's circumstances, preferences, values, resources available or setting. Consultation with an obstetric care provider may assist in decision-making.

QUALITY OF THE EVIDENCE

The quality of the evidence refers to the level of confidence in the evidence and ranges from very low to high.

High quality

The Guidelines Consensus Panel is very confident that the estimated effect of physical activity on the health outcome is close to the true effect.

[i] This was a weak recommendation because the quality of evidence was low, and the net benefit between women who were physically active and those who were not was small.

[ii] This was a strong recommendation because, despite low-quality evidence supporting physical activity during pregnancy for women categorised as overweight or obese, there was evidence from randomised controlled trials demonstrating an improvement in gestational weight gain and blood glucose.

[iii] Moderate-intensity physical activity is intense enough to noticeably increase heart rate; a person can talk but not sing during activities of this intensity. Examples of moderate-intensity physical activity include brisk walking, water aerobics, stationary cycling (moderate effort), resistance training, carrying moderate loads and household chores (eg, gardening, washing windows).

[iv] This was a weak recommendation because urinary incontinence was not rated as a 'critical' outcome and the evidence was of low quality.

[v] This was a weak recommendation because (1) the quality of evidence was very low, and (2) although harms were investigated there was limited available information to inform the balance of benefits and harms. This recommendation was primarily based on expert opinion.

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Moderate quality

The Guidelines Consensus Panel is moderately confident in the estimated effect of physical activity on the health outcome; the estimate of the effect is likely to be close to the true effect, but there is a possibility that it is substantially different.

Low quality

The Guidelines Consensus Panel's confidence in the estimated effect of physical activity on the health outcome is limited; the estimate of the effect may be substantially different from the true effect.

Very low quality

The Guidelines Consensus Panel has very little confidence in the estimated effect of physical activity on the health outcome; the estimate of the effect is likely to be substantially different from the true effect.

INTRODUCTION

Regular physical activity across the lifespan is associated with substantial health benefits, including improvements in physical fitness and mental health, as well as decreased risk of chronic disease and mortality.[1] Pregnancy is a unique period of a woman's life, where lifestyle behaviours, including physical activity, can significantly affect her health, as well as that of her fetus.[2–13] Although guidelines around the world recommend women without contraindication engage in prenatal physical activity,[14] fewer than 15% of women will actually achieve the minimum recommendation of 150 min per week of moderate-intensity physical activity during their pregnancy.[15] Unfortunately, uncertainty among some pregnant women and obstetric care providers as to whether prenatal physical activity may increase the risk of miscarriage, growth restriction, preterm birth, fatigue or harm to the fetus have served as barriers to being active.[16] Concerns over harms have not been substantiated by research and the risks of *not* engaging in prenatal physical activity have not been adequately emphasised. Over the last three decades, the rates of pregnancy complications such as gestational diabetes mellitus, pre-eclampsia, gestational hypertension and newborn macrosomia have risen dramatically, most likely as a consequence of rising rates of maternal obesity.[17 18] Physical activity has been proposed as a preventative or therapeutic measure to reduce pregnancy complications and optimise maternal–fetal health.[19 20]

These evidence-based guidelines apply to pregnant women, and target users including obstetric care providers, policymakers and fitness professionals who provide guidance on the impact of prenatal physical activity on maternal, fetal and neonatal health outcomes.

Table 1 'Critical' and 'important' outcomes selected by the Guidelines Consensus Panel

'Critical' outcomes	'Important' outcomes
► Miscarriage.	► Antepartum haemorrhage.
► Stillbirth.	► Inadequate gestational weight gain.
► Neonatal death.	► Total gestational weight gain.
► Preterm birth.	► Delivery complications (instrumental delivery, length of labour, vaginal tears).
► Gestational diabetes mellitus.	► Birth defects.
► Pre-eclampsia.	► Lower back pain.
► Gestational hypertension.	► Pelvic girdle pain.
► Caesarean section.	► Urinary incontinence (during and following pregnancy).
► Maternal mental health (depression and anxiety during and following pregnancy).	► Induction of labour.
► Excessive gestational weight gain.	► Long-term maternal outcomes (cardiovascular disease, osteoporosis, diabetes, hypertension, obesity).
► Postpartum weight retention.	► Adverse outcomes (musculoskeletal injury, trauma, dehydration, hyperthermia, cardiovascular or respiratory events, maternal hypoglycaemia, fatigue).
► Glucose tolerance.	► Gestational age at birth.
► Preterm/prelabour rupture of membranes.	► Birth weight.
► Diastasis recti.	► Body composition (newborn adiposity, body mass index).
► Fetal responses to physical activity (fetal heart rate, uterine/umbilical blood flow).	► Birth complications (including shoulder dystocia, brachial plexus injury, APGAR, neonatal intensive care unit admittance, metabolic acidosis).
► Low birth weight (small for gestational age <2500 g, <10th/15th percentile for gestational age).	► Hyperbilirubinaemia.
► Intrauterine growth restriction.	► Offspring developmental milestones (cognitive, psychosocial, motor skills).
► High birth weight (large for gestational age, macrosomia, >4000 g, >90th percentile for gestational age).	
► Neonatal hypoglycaemia.	
► Long-term offspring outcomes (obesity, cardiovascular and metabolic diseases).	

METHODS

The 2019 *Canadian Guideline for Physical Activity throughout Pregnancy* were developed according to the methodological strategy outlined in the Appraisal of Guidelines for Research and Evaluation (AGREE) II instrument.[21] The goal of these guidelines was to provide evidence-based recommendations regarding physical activity during pregnancy in the promotion of maternal, fetal and neonatal health. The Guidelines Consensus Panel consisted of researchers in the field of prenatal exercise; methodological experts (AGREE II and GRADE; statistician and librarian); exercise professionals and representatives from the Canadian Society for Exercise Physiology (CSEP), the Society of Obstetricians and Gynaecologists of Canada (SOGC), the College of Family Physicians of Canada, the Canadian Association of Midwives, the Canadian Academy of Sport and Exercise Medicine, Exercise is Medicine Canada, and a public health representative (the Middlesex-London Health Unit). Prior to convening the Guidelines Consensus Panel, 10 pregnant women were recruited by convenience sampling and invited to provide input on the perceived benefits and harms of physical activity, as well as to identify pregnancy outcomes that were most important to them. During consensus meeting 1, the Guidelines Consensus Panel selected 37 outcomes related to maternal, fetal and neonatal health, 20 of which were rated as 'critical' and 17 as 'important', taking into consideration the feedback from pregnant women and the perspective of obstetric care providers based on their expert opinion (see table 1 for outcomes). The Guidelines Consensus Panel also identified four a priori subgroups of women believed to be at higher risk of pregnancy

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Table 2 Absolute and relative contraindications to physical activity during pregnancy

Absolute contraindications	Relative contraindications
► Ruptured membranes, premature labour.	► Recurrent pregnancy loss.
► Unexplained persistent vaginal bleeding.	► History of spontaneous preterm birth.
► Placenta praevia after 28 weeks' gestation.	► Gestational hypertension.
► Pre-eclampsia.	► Symptomatic anaemia.
► Incompetent cervix.	► Malnutrition.
► Intrauterine growth restriction.	► Eating disorder.
► High-order multiple pregnancy (eg, triplets)	► Twin pregnancy after the 28th week.
► Uncontrolled type I diabetes, uncontrolled hypertension or uncontrolled thyroid disease.	► Mild/moderate cardiovascular or respiratory disease.
► Other serious cardiovascular, respiratory or systemic disorder.	► Other significant medical conditions.

complications. These include women who were previously inactive, women diagnosed with gestational diabetes mellitus, women categorised as overweight or obese prior to pregnancy, and women >35 years of age. Twelve systematic reviews were prepared to describe the effect of physical activity on 'critical' and 'important' outcomes, and to present the balance between benefits and potential harms of physical activity.[2–13] A comprehensive search was created and run by a research librarian on MEDLINE, EMBASE, PsycINFO, Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials, Scopus and Web of Science Core Collection, CINAHL Plus with Full Text, Child Development & Adolescent Studies, Education Resources Information Center, SPORTDiscus, ClinicalTrials.gov and the Trip Database up to 6 January 2017 for randomised and observational studies examining the relationships between prenatal physical activity and the identified health outcomes in women without contraindication. Overall, 27 624 titles and abstracts were screened, and 675 unique studies were included. The recommendations were primarily based on a subset of exercise-only randomised controlled trials (RCT; n=104) and cohort studies (n=4). Detailed methodology and the results are available in two issues of the *British Journal of Sports Medicine* and the *Journal of Obstetrics and Gynaecology Canada*.[2–13 22] Consensus meeting 2 was held in October 2017 to review evidence and draft the recommendations. In April 2018, feedback from stakeholder groups and pregnant women was solicited through the networks of the Guidelines Consensus Panel via surveys in both English and French. The recommendations were revised based on this feedback, and a second round of surveys were distributed. A draft of the Guidelines was shared with the boards of CSEP, SOGC, as well as the Guidelines Consensus Panel members in May 2018. The Guidelines were further revised, and the final version of the recommendations was sent to the SOGC and CSEP Executive for review and endorsement.

WHO SHOULD BE PHYSICALLY ACTIVE DURING PREGNANCY?

These Guidelines are intended for women who do not have contraindications (see table 2) that would prevent them from engaging in physical activity. Women with absolute contraindications may continue the usual activities of daily living but should not participate in more strenuous exercise. Women with relative contraindications should discuss the advantages and disadvantages of moderate-to-vigorous intensity physical activity with their obstetric care provider.

Recommendation 1

All women without contraindication should be physically active throughout pregnancy. *Strong recommendation, moderate-quality evidence.*

Specific subgroups were examined:

- Women who were previously inactive. *Strong recommendation, moderate-quality evidence.*
- Women diagnosed with gestational diabetes mellitus. *Weak recommendation, low-quality evidence.*
- Women categorised as overweight or obese (prepregnancy body mass index ≥25 kg/m^2). *Strong recommendation, low-quality evidence.*

One hundred and four exercise-only RCTs were identified regarding the effects of physical activity on one or more prioritised outcomes. These data represent 'moderate' quality evidence of a beneficial effect of prenatal physical activity on maternal, fetal and newborn health outcomes. Prenatal physical activity was associated with a reduction in the odds of gestational diabetes mellitus (38%; 39 fewer per thousand (from 25 fewer to 50 fewer)), pre-eclampsia (41%; 12 fewer per thousand (from 2 fewer to 19 fewer)), gestational hypertension (39%; 15 fewer per thousand (from 6 fewer to 22 fewer)), prenatal depression (67%; 134 fewer per thousand (from 90 fewer to 163 fewer)) and macrosomia (39%; 30 fewer per thousand (from 6 fewer to 47 fewer)) without increasing the odds of adverse outcomes including preterm birth, low birth weight, miscarriage and perinatal mortality.[2–5 7] Feedback from stakeholder (n=429) and pregnant women (n=170) indicated that a large proportion of women agreed that the benefits of physical activity during pregnancy outweighed the costs (51% strongly agree, 22% agree), and that physical activity was feasible (27% strongly agree, 41% agree), acceptable (36% strongly agree, 45% agree) and equitable (62% strongly agree, 21% agree) for pregnant women. The survey results supported strong recommendations in favour of prenatal physical activity.

Physical activity during the first trimester did not increase the odds of miscarriage or congenital anomalies.[3 8] Importantly, there was also evidence suggesting that not engaging in physical activity from the first trimester increased the odds of pregnancy complications (ie, gestational diabetes mellitus, pre-eclampsia, gestational hypertension, excessive gestational weight gain and severity of depressive symptoms).[2 5 11 23–25] As such, it is the opinion of the Guidelines Consensus Panel that physical activity should be encouraged throughout pregnancy.

Regarding a priori subgroup analyses, the evidence supported recommendations in favour of physical activity during pregnancy across subgroups, and the survey results indicated a large proportion of women and stakeholders agreed that the benefits of physical activity outweighed the costs, and that physical activity was feasible, acceptable and equitable. The Guidelines Consensus Panel made a strong recommendation for previously inactive women based on moderate-quality data and the results of the surveys. This was a strong recommendation because, despite low-quality evidence supporting physical activity during pregnancy for women categorised as overweight or obese, there was evidence from RCTs demonstrating an improvement in gestational weight gain and blood glucose. The recommendation for women with gestational diabetes mellitus was a weak

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recommendation because the quality of evidence was low, and the net benefit between women who were physically active and those who did not was small. No studies exclusively examining women 35 years of age or older were identified; therefore, no recommendation for this subgroup was provided.

WHAT PHYSICAL ACTIVITY IS RECOMMENDED DURING PREGNANCY?

Recommendation 2

Pregnant women should accumulate at least 150 min of moderate-intensity physical activity each week to achieve clinically meaningful reductions in pregnancy complications. *Strong recommendation, moderate-quality evidence.*

Recommendation 3

Physical activity should be accumulated over a minimum of 3 days per week; however, being active every day is encouraged. *Strong recommendation, moderate-quality evidence.*

Recommendation 4

Pregnant women should incorporate a variety of aerobic exercise and resistance training activities to achieve greater benefits. Adding yoga and/or gentle stretching may also be beneficial. *Strong recommendation, high-quality evidence*.

Recommendation 5

PFMT (eg, Kegel exercises) may be performed on a daily basis to reduce the odds of urinary incontinence. Instruction on the proper technique is recommended to obtain optimal benefits. *Weak recommendation, low-quality evidence*.

Recommendation 6

Pregnant women who experience light-headedness, nausea or feel unwell when they exercise flat on their back should modify their exercise position to avoid the supine position. *Weak recommendation, very low-quality evidence*.

The results of the systematic reviews identified that, compared with no physical activity, accumulating at least 150 min of moderate-intensity physical activity over three or more days per week was associated with clinically meaningful reductions in the odds of developing gestational diabetes mellitus, pre-eclampsia and gestational hypertension.[5] Accumulating more physical activity (frequency, duration or volume) over the week was associated with greater benefits; however, physical activity below the recommendations also incurred some benefits. The findings of the systematic reviews also demonstrated that combining aerobic exercise and resistance training during pregnancy was more effective at improving health outcomes than interventions focused on aerobic exercise alone.[7 13] We further identified a dose–response relationship between increasing intensities of physical activity and decreasing odds of pre-eclampsia, gestational diabetes, gestational hypertension, and a reduction in depressive symptoms and circulating maternal blood glucose.[2 5 6] It is important to note that for many outcomes, lower intensity physical activity also imparts benefits. Therefore, pregnant women should be encouraged to be physically active, even if they are unable to meet these recommendations. However, evidence was not identified regarding the safety or additional benefit of exercising at levels significantly above the recommendations. Indeed, the highest intensity of physical activity prescribed in the RCTs was 7.0 metabolic equivalents (METs; equivalent to jogging). As such the safety and efficacy of chronic high-intensity physical activity for the mother, the fetus and the neonate are not known. Accordingly, the Guidelines Consensus Panel recommends high-intensity physical activity only in a monitored environment. Moderate-intensity physical activity is recommended throughout pregnancy.

Table 3 Heart rate ranges for pregnant women

Maternal age	Intensity	Heart rate range (beats/min)
<29	Light	102–124
	Moderate	125–146
	Vigorous	147–169*
30+	Light	101–120
	Moderate	121–141
	Vigorous	142–162*

Moderate-intensity physical activity (40%–59% heart rate reserve (HRR)); vigorous-intensity physical activity (60%–80% HRR).
Target heart rate ranges were derived from peak exercise tests in medically screened, low-risk pregnant women.[26 27]
*As there is minimal information regarding the impact of physical activity at the upper end of the vigorous-intensity heart rate ranges, women wishing to be active at this intensity (or beyond) are encouraged to consult their obstetric care provider.

Maternal heart rate is a measure of physical activity intensity. Table 3 presents pregnancy-specific target heart rate zones for women who wish to monitor their heart rate during physical activity.[26 27] Other measures of physical activity intensity include the 'talk test'. As the term 'talk test' implies, the woman is at a comfortable intensity if she is able to maintain a conversation during physical activity and should reduce the intensity if this is not possible.

The Guidelines Consensus Panel developed recommendations on two specific types of physical activity: PFMT and supine exercise. PFMT is recommended to prevent urinary incontinence even though it was not rated as a 'critical' outcome and was based on low-quality evidence. Prenatal PFMT is associated with a 50% reduction in prenatal and 35% reduction in postnatal urinary incontinence, which the Guidelines Consensus Panel deemed warranted a weak recommendation.[9] The Guidelines Consensus Panel recommended instruction on proper technique to obtain optimal benefits. The recommendation for women to modify their physical activity position to avoid the supine position when feeling unwell was deemed weak as the quality of evidence was very low.[12] In addition, although harms were investigated, there was limited information from RCTs to inform the balance of benefits and harms. This recommendation was primarily based on expert opinion, resulting in a weak recommendation.

CONSIDERATIONS FOR IMPLEMENTATION

The following guidance is based on the expert opinion of the Guidelines Consensus Panel.

Safety precautions

General safety precautions for women who are pregnant and physically active are presented in box 1. Some sport activities carry significant risk in pregnancy and are considered contraindicated. Women should not scuba-dive in pregnancy, as the fetus is not protected from decompression sickness and gas embolism.[28] Women are recommended to avoid activities which involve physical contact or danger of falling, which may increase the risk of fetal trauma. These activities include, but are not limited to, horseback riding, downhill skiing, ice hockey, gymnastics or Olympic lifts. Pregnant women are recommended to avoid non-stationary cycling as this activity may carry a higher

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Box 1 Safety precautions for prenatal physical activity

- Avoid physical activity in excessive heat, especially with high humidity.
- Avoid activities which involve physical contact or danger of falling.
- Avoid scuba diving.
- Lowlander women (ie, living below 2500 m) should avoid physical activity at high altitude (>2500 m). Those considering physical activity above those altitudes should seek supervision from an obstetric care provider with knowledge of the impact of high altitude on maternal and fetal outcomes.
- Those considering athletic competition or exercising significantly above the recommended guidelines should seek supervision from an obstetric care provider with knowledge of the impact of high-intensity physical activity on maternal and fetal outcomes.
- Maintain adequate nutrition and hydration—drink water before, during and after physical activity.
- Know the reasons to stop physical activity and consult a qualified healthcare provider immediately if they occur (see Box 2).

risk of falling due to changes in body mechanics and the ability to respond to the environment (eg, traffic, unsteady surfaces) as pregnancy progresses. As an alternative, brisk walking, stationary cycling, swimming or aquafit are aerobic activities that are associated with less risk of falling or physical contact. With appropriate acclimatisation, moderate-intensity physical activity at altitudes up to 1800–2500 m (6000–8250 ft) does not appear to significantly alter maternal or fetal well-being.[29 30] However, women should be wary of hiking in a location where they might fall. It is also important that women stay hydrated and avoid vigorous physical activity in excessive heat, especially with high humidity, to avoid dehydration (eg, hot yoga).

During pregnancy, some women will experience a visible separation of their abdominal muscles, called diastasis recti. Those women are counselled to seek physiotherapy advice and avoid abdominal strengthening exercises (eg, abdominal curls) as this may worsen the condition,[31] increasing the likelihood of requiring postnatal repair. However, continuing aerobic exercise such as walking is associated with decreased odds of developing diastasis recti.[4] While there has been less research on resistance exercises as compared with aerobic exercises in pregnancy, available evidence regarding resistance exercise in pregnancy has not identified adverse impacts on the mother, the fetus or the neonate. Therefore, resistance training that adheres to the safety considerations in box 1 is encouraged. Further, our systematic reviews identified that 'mixed' interventions combining aerobic and resistance training activities demonstrated greater improvements in pregnancy outcomes than aerobic activity alone. Women who experience light-headedness with excessive Valsalva manoeuvre (straining while holding one's breath) when exercising should avoid the breath-hold.

Women considering athletic competition or exercising significantly above the recommended guidelines should speak to their obstetric care provider to clarify risk and make modifications, if necessary. Elite athletes who continue to train during pregnancy are advised to seek supervision from an obstetric care provider with knowledge of the impact of vigorous-intensity physical activity on maternal, fetal and neonatal outcomes. Recently, the IOC released a series of recommendations to guide elite athletes during and following pregnancy.[32–35]

Box 2 Reasons to stop physical activity and consult a healthcare provider

- Persistent excessive shortness of breath that does not resolve on rest.
- Severe chest pain.
- Regular and painful uterine contractions.
- Vaginal bleeding.
- Persistent loss of fluid from the vagina indicating rupture of the membranes.
- Persistent dizziness or faintness that does not resolve on rest.

Finally, it is suggested that a warm-up and cool-down period be included in any physical activity regimen. Ligaments become relaxed during pregnancy due to increasing hormone levels and may impact on the range of movement, thereby increasing the risk of injury.[36]

All women should stop activity and seek medical attention if they experience any of the symptoms identified in box 2.

HOW TO START BEING ACTIVE DURING PREGNANCY?

Previously inactive women are encouraged to start physical activity in pregnancy but may need to begin gradually, at lower intensity and increase the duration and intensity as their pregnancy progresses. It is important to note that when dose–response relationships between physical activity and pregnancy outcomes were identified, more physical activity (frequency, intensity, duration and volume) was associated with greater health benefits. However, an upper limit was not established.

It may be difficult for some women to follow these Guidelines without additional support or advice. Obstetric care professionals and exercise professionals must carefully consider the potential costs and perceived barriers to prenatal physical activity to facilitate participation. These Guidelines may be appropriate for women with a disability or medical condition; however, an obstetric care professional should be consulted for additional guidance. Although the majority of the evidence base for these recommendations used supervised exercise, physical activity during pregnancy does not need to be done in a supervised setting or with any specific equipment. For those with financial or other barriers to participating in organised exercise, activities as simple as walking can have positive benefits.

Other healthy lifestyle habits during pregnancy

In addition to physical activity, other components of a healthy lifestyle including adequate nutrition and sleep, as well as abstinence from smoking, alcohol, marijuana and illicit drugs, are highly encouraged.[37–39]

RESOURCES FOR THE HEALTHCARE PROVIDER, EXERCISE PROFESSIONAL AND PREGNANT WOMEN

The Physical Activity Readiness Medical Examination for Pregnancy (PARmed-X for Pregnancy) was developed by the CSEP and endorsed by the SOGC and Health Canada (and available through CSEP's website at www.csep.ca/forms.asp) as an aid for medical professionals to identify contraindications for pregnant women prior to their participation in physical activity.[40]

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SUMMARY

The *2019 Canadian Guideline for Physical Activity throughout Pregnancy* represent a foundational shift in our view of prenatal physical activity from a recommended behaviour to improve quality of life, to a specific prescription for physical activity to reduce pregnancy complications and optimise health across the lifespan of two generations. It is critical that these Guidelines be implemented into clinical practice to achieve the significant and potentially lifelong health benefits for both the mother and the child.

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