Academy of PHYSICAL MEDICINE

Research Paper Review

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Exercise & Pregnancy in Recreational & Elite Athletes
IOC Summary – Part 2

This is Part 2 of 5 in the series of evidence statements from the IOC expert committee on exercise and pregnancy in recreational and elite athletes. Part 1 focused on the effects of training during pregnancy and on the management of common pregnancy-related symptoms experienced by athletes. In Part 2, we focus on maternal and fetal perinatal outcomes.

Studies Reviewed:

1. Bø K, Artal R, Barakat R, et al. Exercise and pregnancy in recreational and elite athletes: 2016 evidence summary from the IOC expert group meeting, Lausanne. Part 1 – exercise in women planning pregnancy and those who are pregnant. *British Journal of Sports Medicine 2016; 50: 571–589.*

2. Bø K, Artal R, Barakat R, et al. Exercise and pregnancy in recreational and elite athletes: 2016 evidence summary from the IOC expert group meeting, Lausanne. Part 2 – the effect of exercise on the fetus, labour, and birth. *British Journal of Sports Medicine 2016; 50: 1297-1305.*

3. Bø K, Artal R, Barakat R, et al. Exercise and pregnancy in recreational and elite athletes: 2016/17 evidence summary from the IOC Expert Group Meeting, Lausanne. Part 3 - exercise in the postpartum period. *British Journal of Sports Medicine 2017; 51: 1516-1525.*

4. Bø K, Artal R, Barakat R, et al. Exercise and pregnancy in recreational and elite athletes: 2016/2017 evidence summary from the IOC expert group meeting, Lausanne. Part 5. Recommendations for health professional and active women. *British Journal of Sports Medicine 2018; 52: 1080-1085.*

ANALYSIS

Reviewed by Dr. Ceara Higgins

Background Information

Existing guidelines pertaining to physical activity during pregnancy encourage the continuation or adoption of an active lifestyle during and following pregnancy. However, a high proportion of women do not follow these guidelines during pregnancy, increasing their risk of obesity, gestational diabetes mellitus (GDM), and other diseases and complaints. Conversely, there exists a population of enthusiastic exercisers and elite athletes who are apt to meet or even exceed these guidelines. Currently, no guidelines have been developed for these women, leaving questions about safety with high levels of exercise during pregnancy unanswered. The International Olympic Committee (IOC) has undertaken a series of meetings to develop consensus statements with three aims:

1. To summarize common conditions, illnesses, and complaints during pregnancy and after childbirth that may interfere with strenuous exercise and competition;

2. To provide recommendations for exercise training for high-level exercisers and elite athletes during pregnancy and following childbirth; and

3. To identify major gaps in the literature which may limit the ability of experts to confidently make recommendations.

This work was published in a series of five papers, four of which are summarized in this 2-part Review (Part 4 of the series dealt specifically with research recommendations, so we chose to focus on the clinical aspects in this series).

Summary:

The Effect of Exercise on the Fetus, Labour, and Birth

The Effect of Exercise on the Fetus:

Normal fetal heart rate (FHR) is between 110 and 160 bpm, with rates < 110 bpm identified as fetal bradycardia and > 160 bpm identified as fetal tachycardia. Normal variability is considered to be 6-25 bpm from baseline. When pregnant women exercise, the increased secretion of catecholamines causes a redistribution of blood flow to the exercising muscles – changing the flow to the splanchnic organs, including the uterus, from about 26% at rest to 2% during strenuous exercise. As well, exercise at any intensity has been shown to trigger

an average increase in fetal heart rate of 10-15 bmp. There have also been several reports of abnormal FHR recording during strenuous exercise. Taken together, this may indicate that high intensity exercise could negatively affect the well-being of the fetus. However, in all studies, FHR changes were transitory and returned to normal when exercise stopped, and no neonatal abnormalities have been reported in these cases.

More than 10% of women will experience a miscarriage, with 80% occurring in the first trimester. The risk is closely tied to maternal age and is higher in individuals using fertility treatments. In addition, research has shown an increased risk of miscarriage in women who exercised for >7 hours per week and women participating in high-impact exercise such as jogging, ball games, and racquet sports early in pregnancy. However, this evidence was only of low to moderate quality. There was no association between exercise and risk of miscarriage after 18-weeks' gestation. In a large cohort study, the risk of miscarriage before 13 weeks increased with increased frequency of daily lifting at work and total burden lifted and miscarriage from 13-21 weeks was associated with total daily burden. There was no association between occupational lifting and stillbirth > 22 weeks. On the other hand, women who performed light or medium physical activity at work had lower risk of miscarriage than those who worked sedentary jobs and women performing light to moderate intensity leisure-time physical activity showed no increased risk of miscarriage.

In many animal studies, it has been shown that strenuous exercise impairs fetal growth. This is theorized to be a result of redistribution of blood flow away from the uterus to the muscles during strenuous exercise. There is less clear data for humans. Moderate intensity exercise during pregnancy may reduce the risk of both large- and small-for-gestational-age babies and babies of women who perform regular strenuous exercise during the last trimester generally have babies with a lower birth weight (~200g). These babies tend to have a lower fat mass but greater lean mass. Sedentary women are 31% more likely to have a newborn over the 90th percentile for gestational age and larger babies are at a higher risk for shoulder dystonia, caesarean section, and childhood obesity.

There is no association between leisure-time physical activity and preterm birth (birth of a live infant prior to the completion of the 37th week of gestation). Strenuous exercise may even modestly reduce the risk of a preterm birth. There is also no evidence of exercise having an effect on Apgar scores.

The Effect of Exercise on Delivery:

The rates of induction of labour have increased in recent years due in large part to elective induction based on scheduling concerns and concerns for complications. Episiotomy and epidural anesthesia are both common elective procedures. Therefore, it is reasonable that evidence has shown no increase in rates of induction, episiotomy, or epidural based on exercise. There has been some suggestion that regular exercise may cause a tighter pelvic floor, leading to increased risk of operative delivery or severe perineal lacerations. However,

there is no evidence of this with regular pelvic floor muscle strengthening or general exercise.

For women giving birth for the first time, a prolonged second stage of labour is defined as > 3 hours with an epidural or > 2 hours without. In multiparous women, this is adapted to > 2 hours with an epidural or > 1 hour without. Risk factors for a prolonged second stage include a non-occiput anterior head position, fetal size, and epidural. Exercise during pregnancy seems to have no effect on the length of the second stage labour, but does seem to shorten the first stage of labour.

Caesarean sections are more common in first pregnancies, women with obesity, women of advanced maternal age, and women with certain medical complications. Inconsistent evidence shows that women who exercised during their pregnancies may have a lower risk of caesarean delivery.

A final concern for labour is pelvic floor injury. This most commonly includes injury to the levator ani muscle (LAM) or perineal tearing. Individuals with LAM injuries are more likely to experience decreased lower pelvic floor muscle strength and endurance, pelvic organ prolapse (POP), urinary incontinence (UI), and a feeling that the vagina is too loose in the first year postpartum. They are also significantly more likely to experience POP in middle-age. LAM injuries are more likely in deliveries complicated by forceps delivery, anal sphincter rupture, large fetal head circumference, increased fetal weight, and prolonged second stage. There is some data showing that athletes have larger LAMs than sedentary populations, however, this may not correlate with increased strength. Third- and fourth-degree perineal tears affect the anal sphincter and are more common in cases where a midline episiotomy is performed, first vaginal deliveries, women with shorter perineal length, perineal edema, instrumented deliveries, prolonged second stage of labour, birth weights > 4000g, and fetal occipitoposterior presentations. Tears affecting the anal sphincter increases the risk of anal incontinence (AI) postpartum up to 5-10 years after childbirth. Exercise has been shown to have no effect on the rate of anal sphincter tears, but the incidence has been shown to be reduced with the use of warm compresses and perineal massage during labour.

Exercise in the Postpartum Period

Factors Related to Returning to Exercise After Childbirth in Elite Athletes:

Initial research showed that 80% of women had partial denervation of the pelvic floor during their first pregnancy as measured by electromyography. Another study of first-time mothers showed that 30% had denervation of the levator ani muscle at 6 weeks postpartum, with only 35% of those women recovering after 6 months. The levator hiatus area widens during pregnancy, increases significantly after vaginal birth and generally reaches maximum recovery by 4-6 months postpartum. Bladder neck mobility increases after vaginal birth and, while this reduces postpartum, mobility remains higher after vaginal

delivery than when measured before 37 weeks' gestation. While we know that the pelvic floor is actively recovering during the early postpartum period, there is little data with regards to the effect of exercise on that recovery and future pelvic floor health. There is evidence from small studies showing that early return to heavy physical work after childbirth leads to increased risk of UI and POP. Therefore, it may be wise for athletes, especially those with a complicated delivery or LAM or anal sphincter injury, to minimize activities that cause large increases in intra-abdominal pressure and/or repetitive high impact for several months postpartum.

Operative deliveries, including forceps and vacuum procedures and caesarean section, create their own set of issues. Forceps deliveries come with a significantly higher prevalence of levator avulsion and a greater chance of POP and surgery for prolapse. Caesarean births are related to more postpartum abdominal pain, which commonly requires analgesia for 5-10 days and is worse at the corners of the incision. Most women have recovered enough to begin training 4-6 weeks after surgery. However, women who have undergone caesarean section are more likely to report extreme tiredness and back pain at 6 and 12 months postpartum. They are also less likely to report UI at 3, 6, and 12 months postpartum. Studies of caesarean scars show that the scar starts out five times thicker than the surrounding tissue and gradually decreases. Ultrasound at 6 weeks post-surgery shows that scar thickness is still increased, suggesting that remodelling is still occurring with abdominal fascia regaining 51-59% of original tensile strength by 6 weeks post-surgery and 73-93% of original tensile strength by 6-7 months post-surgery.

Cardiovascular measures gradually return toward baseline but are still significantly different from pre-pregnancy levels at 1 year postpartum and respiratory measures return to pre-pregnancy levels within 6-12 weeks postpartum.

The World Health Organization (WHO) recommends breast feeding for at least 6 months. There has been concern that intense exercise might impair milk production, but in actuality, high-volume aerobic exercise resulted in slightly greater quality and quantity of milk, while also impacting the athletes' postpartum weight loss and return to competition due to the increased caloric expenditure associated with breast feeding. If intestinal calcium is insufficient during pregnancy and breastfeeding, there may be some bone resorption, but there is no evidence that this causes osteoporosis or fractures. Guidelines state that women should be advised that moderate exercise during lactation will not affect the quality or composition of their breast milk or their infant's growth, as long as women have proper food and fluid intake. As well, it is suggested that nursing women make sure they are adequately hydrated before exercising and consider feeding their infant before exercise to avoid the discomfort of engorged breasts during exercise. It may also be helpful to wear a sports bra that offers support without compression. A breast pump can be used to allow for greater flexibility in the workout and feeding schedule.

Due to the lack of research on athletes, the authors used data from studies on physically fit soldiers as a guide. Postpartum soldiers were found to need 2 to 24 months, with an average

of 11 months, to return to pre-pregnancy fitness levels as indicated by Army Physical Fitness Test scores. At 6 months postpartum, only 19% of women were able to perform at levels equal to or better than pre-pregnancy.

Common Postpartum Complaints and Diseases: Risk Factors, Prevention and Treatment

One year after pregnancy, the average woman retains between 0.5 and 4kg of weight, with the amount of weight gained during pregnancy being constantly identified as the strongest predictor of postpartum weight retention. Excess weight retention has been associated with increased long-term risk of obesity, cardiovascular disease, and type 2 diabetes. There are few studies on the effect of exercise on postpartum weight retention. The few available suggest that individuals performing medium-volume exercise and those performing high-volume exercise show similar weight loss at 12 weeks postpartum.

Most women who have LBP or pelvic girdle pain (PGP) during pregnancy experience spontaneous recovery shortly after delivery, but 20% report pain persisting for years. Caesarean delivery has been shown to increase the risk of persistent, severe PGP at 6 months postpartum. There is moderate evidence suggesting that exercise focused on improving coordination of the local and overall muscle system, combined with physical therapy improve functional status, pain, and physical health.

Between 30 and 68% of women develop diastasis recti abdominis (DRA) by the postpartum period. Those with an inter-rectus distance of > 3.5 cm at 8 weeks postpartum showed reduced curl-up capacity, however, by 6 months postpartum there was no correlation between inter-rectus distance and reduced abdominal muscle strength. Women with DRA reported higher rates of abdominal and pelvic pain at 3 months postpartum but similar rates to primiparous women without DRA at 6 and 12 months postpartum. Limited research exists and provides no consensus on which abdominal exercises should be recommended to correct DRA, although in-drawing exercises (lifting the navel towards the spine) should be avoided as they appear to widen the gap on ultrasound. There is also little evidence supporting the use of surgery for DRA.

As we have seen, pelvic floor dysfunction including UI, AI, and POP is a common issue postpartum. Women with UI 3 months after delivery who received pelvic floor muscle training were about 40% less likely than women who did not receive training to report UI at 12 months postpartum, with the treatment effects being greater the more intensive the program. Pelvic floor muscle training is also effective in reducing POP, but there is no evidence of its effect on AI. Women who did not train those muscles before birth may need instruction and supervision to learn to perform a correct pelvic floor muscle contraction, starting with short duration contractions and progressing to 6-8 second contractions, 3 sets of 8-12 contractions daily.

Sexual desire generally drops postpartum and improves over the first year. Sexual dysfunction is reported by 41-83% of women at 2-3 months postpartum, with sexual pain reported most commonly. There is no evidence to indicate that either vaginal or caesarean births lead to better postpartum sexual function, and pelvic floor training has been shown to improve at least one sexual variable in women identified as having pelvic floor dysfunction. It is also important to address sexual dysfunction as a serious concern, advise patients of the importance of adequate rest and putting aside time for intimacy, and encourage the use of vaginal lubricants.

CLINICAL APPLICATION & CONCLUSIONS

These articles contain a number of important take-away points for working with elite athletes and high-level exercisers during pregnancy.

Exercise and Birth Outcomes

- Light to moderate-intensity leisure-time physical activity does not increase the risk of miscarriage and may even decrease it. However, there is insufficient data regarding miscarriage risk in high-intensity, speed, endurance, or weight training during the first trimester.

- There is evidence of an increased risk of preterm birth with excessive standing and heavy lifting at work, but a lack of evidence on the risk of preterm birth in elite athletes.

- No conclusions can be drawn regarding the effects of habitual strenuous physical activity on the rate of labour induction, episiotomy, epidural analgesia, levator ani muscle defects and anal sphincter tearing.

- There is some evidence suggesting that exercising pregnant women have a shortened first stage of labour.

- While there is insufficient evidence regarding the risk of caesarean birth in elite athletes, they are more likely to have normal BMIs, which has been associated with a decreased risk.

- Babies of more active women usually weigh slightly less (1 to 60g) than babies of less active women.
- Apgar scores are not affected by the level of maternal physical activity.

Exercise in the Postpartum Period

- Return to sport after childbirth should follow three steps: 1) Return to participation - participation in rehabilitation, training, or sport, but at a lower level than before pregnancy; 2) Return to sport – return to her defined sport, but not performing at her previous level; 3) Return to performance – the athlete has gradually returned to her defined sport and is performing at or above her pre-pregnancy level.

- Endurance training in the postpartum period should start gradually, with low-impact activities such as cross-country skiing, fast walking, low impact aerobics, and step training which put little pressure on the pelvic floor.

- Strength training should start gradually, first focusing on the pelvic floor. The secondary focus during his period should be on the abdominal and back muscles.

- WHO recommends exclusive breast feeding for at least 6 months. Exercise during this period is safe and helps women to resume normal weight. Athletes may find exercise more comfortable after breast feeding and may find a fitted bra with features of greater breast elevation more comfortable than a standard encapsulation sports bra.

Advice for Common Postpartum Complaints and Diseases

- Strength training of the pelvic floor muscles can start immediately after birth. Focused rehabilitation and treatment with a clinician specializing in the pelvic floor may be indicated, especially in cases where injuries to the peripheral nerves, fascia/ligaments, or the pelvic floor muscles have occurred.

- Many athletes undergo significant loading to the lumbopelvic region and may be at heightened risk of low back and pelvic girdle pain, especially following birth. Athletes presenting with low back and pelvic girdle pain should be referred to a sport/women's health clinician.

- There is currently no evidence to guide elite athletes on which abdominal exercises are the most useful for reducing diastasis recti and strengthening the abdominals.

- A limited, but growing body of evidence suggests that physical activity before, during, or after pregnancy may reduce the risk of postpartum depression.

- Athletes resuming training soon after delivery can expect to return their pre-pregnancy weight within 6 months of birth. Athletes who are breastfeeding while training should ensure adequate dietary intake to avoid excess weight loss.

- Sexual dysfunction is common after childbirth but will generally improve over the first year postpartum, particularly after stopping breastfeeding with a return to normal estrogen levels.

STUDY METHODS

A systematic review was undertaken with a search of all available databases and a scan of existing guideline's reference lists. Each member of the working group was assigned as lead author of one or more of the topics covered and 1-3 others were assigned to review each topic. A first full consensus draft was reviewed during the 3-day IOC meeting.

STUDY STRENGTHS/WEAKNESSES

Strengths

This multi-part consensus statement fills a gap in the current recommendations for a population (enthusiastic, pregnant exercisers and athletes) that we will likely see more and more of as the population becomes more educated about the importance of exercise for their health.

Weaknesses

As with all consensus statements, these articles are based partially on the existing literature and partly on expert opinion. As with anything based upon opinion, there is the potential for unsubstantiated recommendations to be included.