

SMA STATEMENT

The benefits and risks of exercise during pregnancy

SMA strongly urges all women who are considering exercising during pregnancy, especially those who wish to participate in competitive sport, to discuss the benefits and risks with their treating medical practitioner. The following information is based on research in the area of exercise and pregnancy, which is current at the time of writing. It is designed to assist those who are involved in the management of active pregnant women, and the women themselves, to consider these benefits and risks, so that they can make informed decisions about participation.

How safe is aerobic exercise?

Current research suggests that healthy pregnant women can begin or maintain moderate intensity aerobic exercise programs with little fear of adverse effects on their unborn foetus.

Numerous studies investigating the effects of exercise on pregnancy, the foetus, and the mother have been performed in the last ten years. In a normal healthy pregnancy, no study has found any negative effect of moderate intensity aerobic training on the development of the foetus or the outcome of pregnancy. In fact, it appears that the benefits of exercise during pregnancy clearly outweigh the potential risks.

Many forms of moderate intensity aerobic exercise such as swimming, running, aerobics and cycling (stationary, later in pregnancy) appear to be safe throughout pregnancy. Limited research and some anecdotal data have also shown that it may be possible to perform higher intensity exercise during pregnancy, but this should only be considered with close monitoring from the treating doctor. The safe upper limit of exercise in pregnancy is unknown.

In a large prospective controlled trial of women performing aerobic exercise, Clapp (1991) found no association between exercise and risk of miscarriage, congenital malformations, ectopic pregnancies, pre-term rupture of membranes, placental insufficiency, retarded intrauterine growth, or unexplained foetal deaths. These findings have been confirmed in a number of subsequent studies. (Webb 1994, Sternfeld 1995, Bell 1995, Wolfe 1994)

The evidence from many studies also shows that aerobic exercise has no effect on the course or outcome of labour (Bell 1995, Horns 1996, Kardel 1998, Lokey 1991, Magann 1996, Sternfeld 1995). However, one study has shown that physically fit women who ran or performed aerobics continually throughout their pregnancy had fewer medical interventions during labour than a control group (Clapp '96)

How safe is resistance (weight) training?

Although general muscular conditioning, in the form of weight or resistance training, is probably safe during pregnancy, there have been few studies of this type of exercise during pregnancy.

From the few studies which have been conducted, no adverse findings have been reported when exercise involved light to moderate weight training with free weights, weight machines or a combination of free weights and stretching. These studies have shown that strength and flexibility are improved, that injury risk is not increased, and that there are no obvious positive or negative effects on weight gain, pregnancy complications, course of labour, or birth weight. (Avery, 1999; Clapp 2000).

As resistance training strengthens muscles, it may help pregnant women to tolerate their heavier body weight and altered centre of gravity more easily. In particular, there may be less low back discomfort due to stronger truncal musculature. (Shangold 1994) Concerns regarding possible injury from resistance training due to increased laxity of ligamentous structures during pregnancy have not been borne out.

It is generally recommended that resistance training during pregnancy involve only light to moderate weights, and that heavy lifts, in particular, maximal isometric muscle contractions, are avoided, due to the cardiovascular responses to this type of activity, and the added pressure on the musculo-skeletal system. It is also important to ensure that beginners are supervised to ensure safe technique, and that proper breathing techniques are used (avoiding breath holding and the valsalva manoeuvre). Because venous return of blood to the heart can be compromised by the developing foetus, exercises in the supine position should be avoided after the first trimester.

How much exercise is 'safe'?

The American College of Obstetricians and Gynecologists used the findings of a meta-analysis to develop their guidelines on exercise during pregnancy (Lokey et al 1991). The meta-analysis concluded that an exercise program comprising any of a variety of exercise modes that is performed for an *average* of 43 minutes, three times a week, at a heart rate of up to 144 bpm does not appear to be associated with adverse effects to the mother or foetus in a normal pregnancy (Lokey et al 1991). It should be noted however that at that time few studies were considered to be sufficiently methodologically sound to be included in this meta-analysis, and none of these included women exercising at the highest levels (equivalent to elite level training). In light of more recent findings that highly trained women athletes have continued to exercise throughout pregnancy without problems, current opinion is that these guidelines may be somewhat conservative for highly trained athletes.

In general, healthy women who have uncomplicated pregnancies can *continue* their preconceptual regular aerobic exercise during pregnancy, after consulting with their treating doctor. Whilst there are some more conservative opinions (Hartman 1999), many authors believe that more sedentary women can *begin* a light to moderate exercise programme during pregnancy, in consultation with their doctor (Stevenson 1997, Clapp 2000, Collings 1983, Sibley 1981, Webb 1994). This was confirmed by Clapp (1998), who commenced a large group of previously sedentary women on a moderate exercise programme at the beginning of their pregnancy, with no ill effects.

Consideration of the potential benefits

There is general agreement in most of the current research that maintenance of regular moderate intensity exercise during uncomplicated pregnancy will have significant health benefits for women.

Maternal weight control

In relation to maternal weight control, there is evidence to suggest that women who exercise before pregnancy and continue to do so during pregnancy tend to weigh less and gain less weight than controls (Mittlemark, Dorey and Kirschbaum 1991). However, a meta-analysis of all the available evidence up to 1990 found no effect of exercise on maternal weight gain (Lokey et al, 1991). This conclusion probably reflects the difficulties of conducting research in this area, as energy intake and expenditure, which are difficult to control in pregnancy studies, affect weight gain. Controlling weight gain during pregnancy is however an important public health priority,

because, for many women, pre-pregnancy weight is not recovered (Williamson, Madans, Pamuk et al 1994) and the weight which is gained during pregnancy could therefore signal the onset of 'creeping obesity' and its associated health problems. Since Australia is currently facing an epidemic of overweight and obesity (NHMRC 1997), attempts to encourage women to remain active during and following pregnancy should be supported.

Maternal fitness

Throughout pregnancy there are gradual increases in respiratory volume, cardiac output and blood volume, so that the increasing oxygen and substrate requirements of the foetus, uterus, placenta, myocardium, respiratory muscles and kidneys can be met (Bell & O'Neill 1994). As a result, by the third trimester of pregnancy, oxygen uptake is greatly enhanced. These improvements in oxygen carrying capacity can be maintained for several months post-partum (Sady, Haydon, Sady et al 1990) and it is likely that they underpin the improved performances which have been shown in the months immediately following birth (Potteiger, Welch & Byrne 1993).

Additional benefits

There has been surprisingly little focus in the scientific literature on the effects of exercise during pregnancy on the prevention of gestational diabetes mellitus (GDM). GDM is the most common complication of pregnancy, affecting about 5% of pregnant women (unpublished data from the Australian Longitudinal Study on Women's Health, ALSWH). In terms of the treatment of GDM however, several studies have shown that the training of large muscle groups during pregnancy leads to improved insulin sensitivity and glucose utilisation, and consequent normalising of blood sugar levels (Artal & Sherman 1999; Hartmann & Bung 1999).

Similarly, there has been little research into the mental health benefits of continuing participation in sport during pregnancy. Continued participation in sport and physical activity is however likely to have significant benefits in terms of mental health and emotional well-being (particularly self-esteem) both during pregnancy and following the birth (Clapp 1994; Sternfield 1997). Although definitive data are not yet available, there is some evidence to suggest that rates of post-partum depression may be decreased as a result of exercise during or after pregnancy.

Consideration of the potential risks

Hyperthermia

As exercise during pregnancy can pose a challenge to maternal thermoregulation, most current guidelines continue to advise against overheating, particularly in the first trimester.

During the initial weeks of pregnancy, animal studies have shown that there may be associations between hyperthermia and spinal cord or other developmental abnormalities. There are however differences in thermoregulation between animals and humans, such that, in pregnant women, there are compensatory mechanisms which help to dissipate heat during exercise (Wang & Apgar 1998).

It is also likely that, if demands of exercising muscle divert blood flow from the uterus, then compensatory changes in placental oxygen extraction will prevent impairment of the supply of essential nutrients and oxygen to the foetus (Sternfield 1997). Thus, while it is true that animal studies have shown some adverse foetal outcomes, including spinal cord defects, several studies in women, including the collaborative peri-natal project in the US, have found no association between increased maternal temperature and risk of foetal malformation (Clarren, Smith, Havey et al, 1979).

Nonetheless there remains a potential risk of overheating if women exercise vigorously in hot weather. However, since trained athletes are better at dissipating heat than untrained women, it is likely that they can exercise safely at higher intensities than untrained women (Artal & Sherman 1999). Notwithstanding this, all women should be counselled to avoid exercise in hot conditions, and to ensure adequate hydration. This is likely to be especially important in the early stages of pregnancy.

Risk of maternal injury due to falls

Despite the complete lack of research in this area, it would seem reasonable to advise pregnant women that, as weight increases and centre of gravity changes, there may be an increased risk of falling, particularly in those sports which require balance skills.

It should also be noted that the increased joint and ligament laxity that occurs during pregnancy can predispose a woman to joint pain, particularly in the **(L; I think this is pubis)** pubic symphysis and sacro-iliac joints. While this laxity does not necessarily increase the risk of ligament injuries and tears, there are no studies to support this view. Interestingly, appropriate strength and conditioning can assist and prevent joint and ligament pain and injury.

Risk of abdominal injury

Although trauma to a mother and foetus is a potential risk during sport, there is no published information about abdominal injury due to sport during pregnancy, so the risk is presumed to be low. There is however emerging literature about the risk of adverse outcomes following severe and catastrophic trauma to pregnant women. The vast majority of these trauma cases in pregnant women are the result of blunt trauma (Rogers et al., 1999) and most foetal morbidity is the result of catastrophic trauma to the mother (Dahmus & Sibai, 1993).

Motor vehicle accidents are the primary cause of trauma in pregnant women, accounting for up to 78% of all cases of blunt trauma in this group (Dahmus & Sibai, 1993; Towery, et al., 1993; Poole, et al., 1996; Connolly, et al., 1997; Pak, et al., 1998). Assault, particularly domestic violence, and falls account for most of the remaining cases. Participation in sport has not been mentioned as a cause of blunt trauma during pregnancy in any published studies, suggesting that sport is not a major cause of significant trauma to pregnant women.

Because the underlying injury mechanisms are different, injuries sustained during physical contact, such as those which occur during sport, tend to be less severe than those sustained during motor vehicle accidents (Pearlman, et al., 1990). It is therefore not appropriate to translate conclusions relating to adverse outcomes of road trauma to injuries sustained in other contexts, such as on the sports field. The published studies simply do not inform about sports injury/trauma and adverse pregnancy outcomes.

Abdominal trauma during sports participation can occur during falls or as a result of a direct blow to the abdomen from another body part, a ball or racquet. However, studies which have reported injuries in non-pregnant athletes, have generally found abdominal/chest injuries to account for fewer than 2% of all injuries, even in contact sports. Most of these published studies do not differentiate between the chest and abdomen and provide no specific details on the exact nature or mechanisms of the injuries. Given the limitations of the published studies, an examination of data from two Australian general injury databases (one describing hospital admissions, the other hospital emergency department presentations), three Australian sports-injury treatment databases (sports medicine clinic attendances and medical coverage services) and one cohort study was undertaken to describe sports-related abdominal injuries (Finch, 2002). These analyses confirm that the risk of abdominal injury during sport is very low.

The situation may however be different in pregnant women because there is increased ligament laxity which may affect joint stability. This could increase the likelihood of falling, which might in

turn increase the risk of injury by a hard object to the protruding abdomen. There are however no data to support this theory and, even if trauma to the mother does occur, the actual risk of trauma to the developing foetus is very rare. Despite this it remains possible that risk to the foetus could occur as a result of damage to the placenta and disruption to the maternal placental interface. This risk should be discussed with pregnant women who are considering activities that involve contact or potential contact with hard or sharp objects. The potential risk increases with the duration of pregnancy and where there is a risk of high-speed blunt trauma (e.g. road cycling, downhill skiing). The inferred risk for court sports, particularly in the earlier stages of pregnancy, seems minimal.

The effects of exercise on birth weight

During the last five years, there has been accumulating evidence to suggest that participation in moderate intensity exercise throughout pregnancy may enhance birth weight (Clapp, Kim & Lopez 2000, Clapp 1998), while more severe exercise, maintained for longer into the pregnancy, may result in lighter babies (Pivarnik 1998, Bell 1995). In particular, more frequent exercise (more than 4 to 5 times per week) in the last trimester has been shown to be associated with lower birth weight. However, non-exercising women also tend to have lighter babies than moderate exercisers (Campbell 2001 and Clapp 1998).

This relative increase in birth weight may reflect increased placental vascular volume and greater extraction of substrates and oxygen by the developing foetus (Wolfe, Brenner & Mottola 1994). Conversely, reduced growth of foetal fat is estimated to account for a significant proportion of the differences in birth weight among active women who continue to exercise more frequently (> 4x/week) throughout the third trimester, compared with those who cease or decrease participation earlier in gestation (Clapp and Capeless 1990). There is also limited evidence to suggest that these leaner babies have less fat and advanced neurobiological maturation at age 5 years (Clapp 2000). The results of most of these studies are however confounded by lack of information about nutritional status and caloric intake and expenditure, and about gestational age at birth, which are strong predictors of birth weight. Many other factors, such as genetics, socio-economic status and environmental factors, are likely to have confounding effects on the outcome of studies such as these.

A note on post partum exercise

Consideration of stresses placed on the pelvic floor is required when advising about return to activity following childbirth. After a normal vaginal delivery, non-ballistic exercises can be commenced as soon as is comfortable, with particular attention being paid to the pelvic floor and abdominal muscles. Activities that involve an increased gravitational load on the pelvic floor such as running or high-impact aerobics should be delayed until there is resolution of some of the hormonal and physical effects of pregnancy and childbirth. Although this is usually about 6 weeks post partum, Clapp (1994) found return to aerobic activity at 2 weeks had no adverse effects at a twelve month follow-up. There is no evidence that sporting activities negatively effect lactation as long as there is an appropriate intake of food and fluid for an active, lactating mother (Dewey 1994, Clapp 1994).

Summary

- There are numerous benefits to pregnant women of remaining active during pregnancy. These include improved weight control and maintenance of fitness. There may also be benefits in terms of reduced risk of development of gestational diabetes mellitus and improved psychological functioning.

- Moderate intensity aerobic exercise has been shown to be safe in pregnancy, with a number of studies now indicating that for trained athletes it may be possible to exercise at a higher level than is currently recommended by the American College of Obstetricians and Gynecologists.
- Studies of resistance training, incorporating moderate weights and avoiding maximal isometric contractions, have shown no adverse outcomes. There may be benefits of increased strength and flexibility.
- The risk of neural tube defects due to exercise -induced hyperthermia that is suggested by animal studies is less likely in women, because of more effective mechanisms of heat dissipation in humans.
- There is accumulating evidence to suggest that participation in moderate intensity exercise throughout pregnancy may enhance birth weight, while more severe or frequent exercise, maintained for longer into the pregnancy, may result in lighter babies.
- There have been no reports of foetal injury or death in relation to trauma or contact during sporting activities. Despite this, a risk of severe blunt trauma is present in some sporting situations as pregnancy progresses.
- Exercise and lactation are compatible in the post-partum period, providing adequate calories are consumed. Considerations of pelvic floor function and type of delivery are relevant in planning a return to certain types of exercise at this time.

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