Section 10 :

Training Considerations

Ageing and Performance

By Harry Welsh

Physiological Decline

Irrespective of fitness level, physiological decline starts after maturity has been reached. For the highly trained athlete, however, the process can be held off until approximately forty years of age. These physiological changes take place in both the cardiorespiratory (CR) and cardiovascular (CV) systems and in muscular size and strength. There are other changes that will hamper performance but these are the ones dealt with here.

Respiratory Changes (cardiorespiratory)

The primary function of inspiration is to provide oxygen for the lungs to play their part in the cardiorespiratory process, while the purpose of expiration is to rid the body of waste products such as carbon dioxide. Within the lungs, a gaseous interchange takes place by way of the air sacs (alveoli). The efficiency of the lungs plays a vital part in aerobic endurance. The capacity of the lungs is physiologically divided into three areas:

- Residual air, which is air that is left in the lungs after full expiration.
- Tidal air, which is the ebb and flow of normal breathing.
- Vital capacity, which is the total amount of air that can be exhaled from full inspiration to full expiration.

With ageing the vital capacity of the lungs is reduced as residual air is increased. However, the total capacity of the lungs is not decreased, just the degrees of residual and tidal air. Between the early 20s and 50 years of age, the residual air within a person's lungs could increase from an average of 20% to around 30%, reducing the vital capacity of the lungs and consequently aerobic endurance. Other factors that reduce efficiency are to be found in the loss of elasticity in the lung tissue, and inflexibility of the rib cage. These changes contribute considerably to decline in lung function. For an inactive person, these changes are not detrimental to an ordinary life style.

In the case where regular endurance training is undertaken by the middle aged and older enthusiast, these losses are greatly reduced. There is only a slight decrease in pulmonary ventilation capacity in older endurance athletes. Some authorities consider that the losses in VO_2 max, as seen in older athletes could be, in part, the result of a reduction in the effectiveness of oxygen transportation, as with ageing, muscular tissue becomes less efficient in the extraction of oxygen.

Circulatory Changes (cardiovascular)

A notable feature of ageing is reduction in maximum heart rate (MHR). Irrespective of effort, the heart rate reaches a limit during exercise. The 220 minus age formula that is widely used for "guesstimating" MHR, can only be a rough guide, with a possible plus or minus of 15/20 beats per minute (bpm). A 60 year old would be estimated with a MHR of 160 bpm and work aerobically up to 80% of that (128 bpm), hence they would be working at a much lower heart rate than a 20 year old working at 80% of maximum (160bpm).

Reduction also comes about from the increased resistance offered by the peripheral blood vessels. Both the arteries and arterioles lose their elasticity and a reduction in their lumen (duct, or diameter). The circulatory system is responsible for the transportation of oxygenated blood to muscle tissue, and the removal of lactate from the tissues. Any deficiency in its function will adversely affect the aerobic level or oxygen uptake. Circulatory decline does equate with decline in endurance, with an estimated sedentary endurance rate loss of slightly less than 1% per annum, or 10% per decade, in sedentary people. The VO_2 max of the regular elderly trainer far exceeds that of the non-active person.

The elderly person who is actively engaged in exercise and training is not following a natural behaviour pattern; with ageing, the tendency is to reduce physical stress and effort. Animal studies confirm this inclination. Nonetheless, this deviation from the accepted pattern of activity does have a beneficial spin off in quality of life and health. Reactions to ageing that occur within the CV system affect the ability of the body to adjust the pressure within the arterial system. Inefficiency can result in restriction of blood flow to muscle tissue as can any restriction to the pumping action of the heart.

The heart is a muscle and responds beneficially to aerobic work. Though there are no claims for longevity, continued training into old age helps to delay considerably the onset of many of the problems that beset the aged and improves the quality of life.

Strength & Muscle Mass

With age there is a gradual decline in the ability to perform everyday tasks. Infirmity can be extremely physically demanding. One clear example of strength loss is weakness of the extensors of the knee joint, which results in difficulty in rising from a low seat and negotiating stairs. The increased participation in exercise groups and classes amongst the elderly does give rise to the assumption that they are becoming aware of the debilitating effects that inactivity in old age can bring. There is then much to be said for the continuation of exercise and activity in order to increase the quality of life.

Over the years there is a natural loss of muscle mass and a likely increase in subcutaneous fat (adipose tissue). Though a person may appear to have retained the same body weight, it is more possible that the balance between fat and muscle mass has changed. Weight training or progressive resistance exercise can be of great help in retaining a degree of muscle mass and tone in the middle aged and elderly.

Reduction in muscle mass can be viewed as being in two phases. The slow phase occurs between the ages of approximately 25 years and 50 years. This stage is hardly discernible in its early stages in those in hard training and the estimated loss is around 10%. The second stage is much more rapid, and by the age of 80 there is a possible 50% loss of muscle mass. Changes also occur between the fast and slow twitch fibres found in muscle tissue, with a loss of fast twitch fibres and an increase in the slow twitch fibres.

This change in the muscle composition helps to explain how performances requiring speed and reactions deteriorate with age. It could also explain the noticeable shift of the older athlete into sports and activities like distance running, rowing and swimming, where reaction and speed are not the prime requirement. Losses in muscle strength and mass are not confined to old age. Muscle tissue is highly elastic and will respond to use and disuse. This is seen in the disuse atrophy (decay) occurring after trauma, such as knee injuries and limbs encased in plaster. With judicious remedial treatment, losses can be rectified with recovery, success being relative to age.

Ageing itself does not prevent skeletal muscle gaining in tone and strength. Elderly people who take up regular training can and do show relatively good improvement. Regular training cannot completely eliminate age related losses, however, regular exercise and training can increase aerobic capacity and strength in the elderly. If practical proof of this was needed, the British and World Indoor Rowing Championships showcase elderly athletes who portray the benefits of continued exercise and training.

Training

A positive state of mind, and a considerable degree of self discipline and sacrifice may be required to adopt a fitness training regimen into old age. Providing one is physically sound, the benefits that can be accrued will be well worth the efforts. Quality of life is important at any age, but never more so than in old age. It is always prudent to have a regular medical check up and elderly participants in exercise and training must always be aware of their limitations, and constantly adjust aims and objectives.

VO_2 max decreases by 0.4ml/kg/minute/year on average. A man aged 25 who is at the peak of his fitness and weighs 80kgs has a VO_2 max of approximately six litres/min. If his weight remains the same and he continues to train, at the age of 50 his VO_2 max will have dropped to five litres/min. If, at his peak, his 2,000m best time is six minutes, this would fall to around six minutes 40 seconds by his 50th birthday as a direct result of the decline in VO_2 max.

This rate of decline is an average figure and includes sedentary people, but there are steps that can be taken to arrest decline. One of the first things is weight management. As explained above, muscle is lost through atrophy with increasing age. If you maintain your weight, then the ratio of body fat to muscle mass increases. Rather than just watching your weight, control your percentage body fat.

Muscle tissue burns oxygen while body fat reduces the VO_2 per kilo bodyweight. A correct nutritional calorie balance, which is adequate in carbohydrates and protein and low in fat, is essential (see Diet by Majorie Hagerman in Section 8 : Nutrition and Weight Management) and allied to strength retention (see Section 7 : Weight Training). Exercise is the best way to manage your percentage body fat.

Training still needs to be varied and should aim to cover all the energy systems from low intensity aerobic work, through lactate threshold training up to high intensity anaerobic workouts. It is also important to continue to carry out the core stability exercises (see Core Stability Training in Section 7 : Weight Training).

Older rowers should take care to maintain the wave training principle to reduce the risk of over-training whilst still looking for progressive increments. By sticking to non-weight bearing, non-impact exercises like the Indoor Rower you will reduce the risk of muscle and joint damage.

Training, Performance and the Menstrual Cycle

by Kareen Larkin

Women have always carried out heavy physical activity, but only relatively recently have they been allowed to compete in sporting activities to any great degree. As a result of this during the last 30 years increasing numbers of women have taken up regular participation in sport at a recreational and competitive level.

We have, thankfully, come along way from the times of Pausanias, 2nd century AD. He wrote 'On the road to Olympia…. there is a precipitous mountain with lofty cliffs…. the mountain is called Typaeum. It is a law of Elis that any woman who is discovered at the Olympic Games will be pitched headlong from this mountain.' Indeed women had a festival of their own at Olympia, Heraia, which were games held in honour of Hera. At these games there was only one event, the foot-race. Religious conservatism has been stated as the probable reason why no other competitions were ever introduced for women at Olympia, but by the Christian era, most of the major Greek Games incorporated women's events. Spartan women were said to have undertaken the same athletic exercises as boys, for the reason that tough, strong mothers were believed to produce good Spartan soldiers.

There were no female events at the first modern Olympiad in 1896, they were first included in 1900 with tennis. Since then there has been a steady increase in participation by women (zero women participants in 1896 to 4,069 in the 2000 summer Olympics). With this increase in participation from women the level of interest in the effects of the menstrual cycle on performance have also grown, and some of the earlier myths regarding detrimental effects of exercise on the female reproductive system have been dispelled.

The Menstrual Cycle

Girls tend to start their adolescent growth spurt around the age of 11 years, about two years before boys. Menarche (the beginning of menstruation) generally occurs between age 12 and 14.

A normal menstrual cycle varies between 23 and 35 days, the average being 28 days. The cycle represents a complex interplay of hormones and typically has three phases; the follicular phase where the follicle matures, the ovulatory phase in which the egg is released, and the luteal phase where the lining of the womb prepares for implantation of the fertilised egg. If implantation does not occur, the womb lining comes away and menstruation begins.

This cycle is regulated by luteinzing hormone (LH) and follicle stimulating hormone (FSH), secreted from the pituitary gland in the brain. This in turn is under the control of another pulsed hormone. Any disruption to this delicate balance of hormones can cause hypothalamic pituitary axis suppression (HPA) and result in oligmenorrhoea or amenorrhoea (irregular, or absence of, periods).

Menstrual Irregularities Associated with Exercise and Training

Menstrual abnormalities are extremely common in both athletic and non-athletic adolescents and women. Physically active females increase the likelihood of experiencing changes to their menstrual cycle such as delayed menarche (onset of menstruation), oligomenorrhoea (irregular menstruation occurring with only three to six cycles per year), and amenorrhoea.

Irregular menses have been reported to range from 1 to 66% among athletes, compared with 2 to 5% in the general population. The higher levels have been seen in groups such as distance runners. The wide

range of reported menstrual abnormalities stems from the different groups studied and the different criteria used to define the condition. Exercise related menstrual abnormality is linked with HPA dysfunction.

Many theories involving this hypothalamic pituitary axis suppression have been suggested as the cause of exercise-induced menstrual irregularities:

- Critical body weight.
- Critical body fat.
- Endogenous opioids.
- Nutritional deprivation.
- Rapid body weight changes.
- Training intensity/volume.

The interplay between nutrition, exercise intensity and volume, body mass index, and psychological stressors contribute to normal menstrual function. Individuals vary greatly in their ability to tolerate changes in these factors, which explains why two athletes of similar body composition may have different menstrual responses to the same training volume and diet, or why athletes of 'normal' weight may still experience menstrual dysfunction.

HPA is a diagnosis of exclusion i.e. other potential causes should be ruled out first. Apart from HPA suppression, other conditions that might cause oligomenorrhoea or amenorrhoea include pregnancy, thyroid abnormality, prolactinoma, polycystic ovary syndrome and premature ovarian failure.

Many athletes find that not having periods is convenient and may not be concerned about this. However, the lack of oestrogen associated with HPA suppression can lead to osteopenia and osteoporosis i.e. bone thinning. There is much evidence to show that bone mineral density directly correlates with the duration and severity of menstrual dysfunction. Therefore, if you suffer from menstrual abnormalities you should seek medical assessment and advice. This should include a thorough evaluation for the 'female athlete triad' i.e. amenorrhoea, osteoporosis and eating disorders.

Bone mineral density assessment should be considered for any athlete who has been amenorrhoeic for more than a year or has had a stress fracture.

Exercise related menstrual irregularity is not a reason in itself to stop training and regular exercise, however, it should trigger an evaluation of one's training schedule and diet. There are various treatment options depending on the abnormalities found, such as reducing training volume, increasing weight and maintaining an adequate energy intake until normal menses occur. Some studies advocate the benefits of the oral contraceptive pill.

Effects of the Menstrual Cycle on Training and Performance

The female sex hormones exert a range of physiological effects on many metabolic, thermoregulatory, cardiovascular and respiratory parameters that may influence athletic performance. For example, oestrogen has been shown to have:

- Effects on the cardiovascular system:
    - altered blood stickiness.
    - cholesterol level changes.
    - vascular smooth muscle changes.
    - regulation of substrate metabolism (body fuel).

- Effects on regulation of substrate metabolism:
    - increased liver and muscle glycogen storage and uptake - possibly increasing endurance performance.
    - glycogen-sparing through increased lipid (fat) production, muscle lipid breakdown, and greater use of free fatty acids.
    - decreased insulin-binding ability-decreased glucose tolerance and insulin resistance.
      i.e. Low levels of oestrogen (in the follicular phase) favour the break down of the muscle glycogen for high intensity training and racing, whilst high levels of oestrogen (in the luteal phase) favour fat burning, lower lactic acid concentrations and glycogen sparing. For this reason during the follicular phase high intensity work may feel slightly easier whilst long low intensity sessions may be more difficult. During the luteal phase long low intensity workouts may feel easier whilst high intensity workouts will feel harder. This does not mean that you should avoid long duration low intensity training during the follicular phase and high intensity training in the luteal phase but you should be aware that there is a reason that you may not feel as good as usual whilst training.

Other effects:

- Deposition of fat in breasts, buttocks and thighs.
- Increased blood pressure.
- Increased calcium uptake in bone.
- Changes in neurotransmitters (brain chemicals) - possible improved cognitive function and memory.

Progesterone has been shown to have the following actions:

- Increased core body temperature 0.3 to 0.5°C.
- Increased minute ventilation, and enhanced ventilatory response to low blood oxygen and high blood carbon dioxide i.e. During the week before menstruation and the week after ovulation increased levels of progesterone stimulate the brain's respiratory centre and cause an increase in breathing rate making exercise feel more strenuous, but not necessarily affecting performance.
- Post-ovulatory fluid retention via effects on the kidneys' hormone system.
- Actions on insulin receptors leading to peripheral insulin resistance.
- Metabolic effects, resulting in a greater dependence on fat as a substrate.

Although the above physiological effects have been shown to occur, results from studies so far varies, and there is, as yet, no convincing evidence that performance is significantly affected, positively or negatively, at any particular stage of the menstrual cycle. Some anecdotal evidence from athletes on differences in performance, particularly in the pre-menstrual or menstrual phases, has not been confirmed by scientific studies. World best performances have been recorded at all stages of the menstrual cycle.

Dysmenorrhoea (Painful Periods)

Painful periods is a common phenomenon, most prevalent in the teenage years and later 30s age group. For most women the symptoms are mild and easily treated with the use of simple painkillers if needed. For some women the painful cramps, and often heavy blood flow, can adversely affect training or competition. There are beneficial treatment options available that can be discussed with your doctor.

The Pre-Menstrual Syndrome (PMS)

'The presence of emotional and/or physical symptoms occurring cyclically, commencing some days prior to menstruation and disappearing with the onset of menstruation', may include anxiety, depression mood swings, headaches, fluid retention, breast soreness/enlargement. Exercise may indeed reduce the severity of PMS. These should be discussed with your doctor and careful consideration of the International Olympic Committee (IOC) list of prohibited substances should be adhered to if training and performing at a high level.

Manipulation of the Menstrual Cycle

Those women/competitors who are, or perceive that they are, adversely affected by the pre-menstrual or menstrual phases may wish to manipulate the menstrual cycle to avoid that stage of the cycle coinciding with a major event. This should really be reserved for major events. This can most effectively be done using the oral contraceptive pill in a particular pattern, under the guidance of a doctor.

References and Recommended Reading:

- **G Harmon Kimberly MD, *Evaluating and Treating Exercise-related Menstrual Irregularities***
  The Physician and Sportsmedicine 30 (3):, 2002
- **RJ Frankovich and CM Lebrun, *Menstrual Cycle, Contraception, and Performance***
  Clinical Sports Medicine 19 (2): 251-271
- **K Bennell, *The female athlete***
  Clinical Sports Medicine by P Brukner and K Khan
  McGraw-Hill Education - Europe
  ISBN: 0074711083
- **Judith Swaddling, *The Ancient Olympic Games***
  British Museum Press, 1999
  ISBN: 0714121614
- **Elzi Volk, *Planet Estrogen Part III: The Menstrual Cycle and Athletic Performance***
  http://www.thinkmuscle.com/articles/volk/planet-estrogen-03.htm

Training During Pregnancy

by Kareen Larkin

Many pregnant women enjoy regular exercise/training in pregnancy and, for most women, regular exercise during pregnancy is beneficial. The majority of pregnancies are normal. As a general rule, regularly exercising women are able to continue exercising at a mild or moderate level during pregnancy as long as the pregnancy is uncomplicated. The information in this section is carefully researched but does not replace the need for personal guidance from your physician or midwife who know your medical and obstetric history. This is very important, as there are some risks as well as benefits of exercise in pregnancy, and exercise is not recommended for women with serious or potentially serious complications of pregnancy. Some examples of the conditions that are "absolute" contraindications to exercise are; active heart disease, uterine bleeding/ruptured membranes, high blood pressure, history of pre-term labour, incompetent cervix/cerclage, intrauterine growth retardation and suspected foetal distress. Some examples of the conditions that are "relative" contraindications to exercise in pregnancy are; anaemia, thyroid disease, diabetes, excessive obesity or excessively underweight, breech presentation in the last trimester. Relative contraindication means that after full medical assessment of the individual case patients may be engaged in medically supervised exercise programmes.

Some examples of risks/theoretical risks of maternal exercise to the foetus (baby) are:

- Direct trauma to the foetus. This is very rare. Contact sports should be avoided.
- Changes in foetal heart rate may occur in response to exercise, depending on the stage of pregnancy, and the exercise intensity, duration and type. This may relate to decreased uterine blood flow during exercise, causing blood to be shunted away from the foetus to the working muscles. The clinical significance of these changes in foetal heart rate observed is uncertain.
- Intense exercise by the mother during pregnancy has been noted in some studies to result in a small decrease in average birth weight of their babies. There are no reports of any adverse outcomes on pregnancy.
- There is a "theoretical" risk of premature labour associated with the level of certain hormones causing uterine irritability, but these have not been seen in practice.
- One particular area of concern for the health of the foetus is hyperthermia (overheating). Data on animals has shown abnormalities with maternal core temperatures above 39°C. Some studies in humans however have shown an increase in the incidence of neural tube defects (early developmental abnormalities) with maternal high fever. This goes along with the general pregnancy advice of avoiding saunas, steam baths, hot tubs etc.

Risks of exercise to the mother include:

- Prolonged standing, or exercising in the supine position (lying on ones back), can lead to hypotension (low blood pressure).
- There is a potential increase in susceptibility to musculoskeletal injuries such as lower back pain. Relaxin, a hormone produced in pregnancy, loosens ligaments and this, along with an alteration in the centre of gravity and an increase in the lumbar lordosis (arch in the lower back) that occurs in pregnancy, predispose to this problem.

Research has shown the following benefits are common:

- An improved general physical and psychological well being in the mother.
- Women who exercise prior to pregnancy and continue to do so in pregnancy weigh less, gain less weight and deliver slightly smaller babes than sedentary women.
- The discomfort of pregnancy and labour may be more easily handled.
- It may be easier to get back into pre-pregnancy shape and weight after the birth.

Once you have the all clear from your doctor to exercise the following guidelines should help you to ensure that no damage to mother or baby occur whilst training.

Remember there will always be time to do another 2,000m test after the pregnancy. If you need time off take it - there is nothing more important than the safety of mother and baby. Not even your result at BIRC!!!

General Guidelines

- Drinking plenty of fluids is very important during pregnancy and especially during the first trimester. The baby has no way to control its own temperature so over heating should be avoided at all cost. This can be done by ensuring adequate hydration and avoiding training in hot humid conditions. Remember that if swimming you still sweat but might not notice, so stop regularly to rehydrate.
- For women who trained regularly before pregnancy regular exercise is preferable to sporadic sessions. As a general rule, mild to moderate exercise for 20 to 40 minutes, three times a week, at a heart rate up to approximately 140 beats per minute, has been recommended. Prescriptive guidelines however can be unhelpful (producing frustration, rebellion and guilt in many physically active women), and now it is generally considered as important to encourage pregnant women to modify the intensity of their exercise according to their own feelings of fatigue. Exhaustive exercise should be avoided. Unfortunately, there is a lack of clear scientific evidence to rely on at higher exercise intensities and further research is needed. Pregnancy is not the time to commence anything other than a very mild exercise programme (those serious athletes who wish to continue intense training should be individually and carefully counselled as to the best approach for them).
- You should always be aware of the reduced oxygen availability during pregnancy and moderate your training accordingly. We recommend using a heart rate monitor to ensure the correct intensity, and not to rely on your pre-pregnancy pace as a guide. Above all, even if your heart rate appears to be within your normal range, listen to your body and stop exercising if you do not feel comfortable.
- Pregnancy requires approximately an extra 300 calories per day. These requirements are greater for women who exercise regularly. This should be carefully observed and training should be stopped if there is an insufficient weight gain (less than 1kg per month) during the last two trimesters.
- Avoid exercise where a loss of balance or physical contact could occur, especially in the third trimester.
- Dress for exercise wearing loose fitting clothing, with a good support bra and comfortable shoes. You can keep the one-piece row-suits in the cupboard for a few months!
- Avoid exercising in the supine position (on your back) after the first trimester since this is the time that the uterus grows out of the pelvis and this position causes the uterus to weigh down on the vena cava so reducing the blood and oxygen flow to the baby.
- Non-weight bearing exercise like swimming, cycling and indoor rowing are recommended, but, if doing weight bearing exercise, avoid bouncing and jerking exercises and deep knee bends as the

hormone relaxin released during pregnancy softens the ligaments and this can increase the likelihood of injury. For the same reason, be careful when stretching during warm up and cool down, especially avoiding excessive and ballistic stretches.

- Avoid standing stationary for long periods of time.
- Weight training may be continued by experienced athletes but avoid heavy weights. Concentrate more on high repetitions with low weights. Avoid the valsalva manoeuvre (holding breath until half way through the lift) at all times.
- Exercising at altitudes of greater than 3,000m (10,000ft) may be unadvised, as rates of pregnancy complications are higher, and birth weights are lower, at high altitudes. In comparison, there have been no reports of problems associated with exercise at moderate altitudes.

Indoor Rowing

If you are a regular user of the Indoor Rower pre-pregnancy there is no reason why you should not continue rowing throughout your pregnancy, subject to the following guidelines:

- Be aware that as your pregnancy progresses you will need to re-evaluate your goals - more in line with staying fit than trying to work towards a personal best.
- Be particularly careful with the intensity of your workouts in the first and last trimesters. For example, whilst Professor Clapp (see below) concludes that continuing aerobics and running during the first trimester does not increase the incidence of miscarriage, it is important to remember that, to some degree, indoor rowing utilises the abdominal muscles. Given this crucial time in the development of the foetus, it is therefore vital that the rower adopts the correct technique, utilising predominately the leg muscles with less emphasis on the upper body and abdominal region. If in doubt ask a Concept 2 instructor or personal trainer to review your technique.
- In relation to training throughout pregnancy Professor Clapp recommends stationary cycling, swimming and walking but he suggests that other forms of exercise are either contraindicated, or require modification. Indoor rowing would fall into the latter category and, apart from ensuring correct technique, the appropriate modifications could involve the lowering of your damper setting/drag factor to a minimum and, as above, ensuring that there is a minimum amount of stress placed on the upper body/abdominal region at the conclusion of the Drive phase of the stroke.

Warning Signs

Stop training immediately and seek medical advice if you experience any of the following symptoms:

- Vaginal bleeding or leaking of amniotic fluid.
- Swelling of the ankles, hands or face.
- Persistent headaches or visual disturbances.
- Shortness of breath when not exercising.
- Dizziness, faintness, pins and needles or numbness.
- Nausea and vomiting.
- Excessive fatigue.
- Palpitations or chest pains.
- Persistent contractions (more than six per hour) or unexplained abdominal pain.

Post-Delivery

Pre-pregnancy exercises should be resumed gradually and gently after birth, based upon your doctor's advice and your physical capabilities. The body changes that occur during pregnancy take time to return to normal, so care should be taken, particularly in the first six weeks after delivery. Breast-feeding women should take care regarding adequate fluid and calorific intake (breast feeding requires an increased calorific intake of approximately 500 calories per day). In relation to caesarean birth, current medical opinion would suggest that you do not resume gym-based activity until you have been given the all clear from your medical practitioner at your six to eight week check up, weight training may be deferred for longer.

Recommended Reading

For more information please see the following websites and publications:

- **American Collage of Sport Medicine,** ***www.acsm.org***
- **James F Clapp,** ***Exercising through your Pregnancy***
  Addicus Books, 2002
  ISBN: 1886039593
- **Dr Karen Nordahl,** ***Fit to Deliver: Prenatal Fitness Program***
  Fit to Delivery Intl, 2000
  ISBN: 0968730507, and
  Warne Books, 1999
  ISBN: 0446673986
- **Thomas W Hanlon,** ***Fit for Two; the Official YMCA Prenatal Exercise Guide***
  Human Kinetics, 1995
  ISBN: 0873228286
- **Renee Garrick (Foreword), Greg Waggoner, Doug Stumpf,** ***From Baby to Bikini: Keep Your Midsection Toned Safely During Pregnancy and Flatten Your Abdominals Fast After You Have Your Baby***
  Warner Books, 1999
  ISBN: 0446673986
- **Kim Bennell,** ***"The Female Athlete" in***
  P Brukner P and K Kaln, ***Clinical Sports Medicine***
  McGraw Hill Education - Europe, 2002
  ISBN: 0074711083
- **Carl DeCrée,** ***Safety Guidelines for Exercising During Pregnancy in***
  The Lancet
  Volume 351, Issue 9119
  Page 1889

Adaptive Rowing

Concept 2 can now provide a range of products to help disabled rowers use the Indoor Rower, including the Adapt 2 Row Seating System. The two types of seat allow rowers with a range of disabilities, from those who require a little more support than the standard seat can offer to those who require full postural support, to exercise on the Indoor Rower.

Adaptive rowing, both on-water and on the Indoor Rower, has grown in popularity greatly in the last decade and in 2002 for the first time the World Rowing Championships incorporated adaptive rowing events. Indoor rowing is a fully inclusive sport and, while the British Indoor Rowing Championship does not have separate adaptive categories, a wide range of disabled athletes regularly compete.

Training Opportunities

For anyone interested in or currently working with people with physical, sensory and learning impairments the YMCA Fitness Industry training programme offer a course - 'Exercise & Fitness for Disabled People'. This is a 3 day course covering general disability awareness training.

Further details may be obtained from:

Customer Service
YMCA Fitness Industry Training
111 Great Russell Street
London WC1B 3NP

Telephone: 0207 343 1850