RECENT DEVELOPMENTS IN SPORTS NUTRITION

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The standard of performance at the 2012 London Olympic and Paralympic Games will be higher than ever and those who stand on the podium will be truly exceptional human beings. In every event, the margin between victory and defeat will be small: the bitter taste of defeat is separated from the joy of victory by only a tiny fraction. Every athlete will be genetically gifted and highly motivated and will have trained over many years in pursuit of success. Success may be determined by other factors that, in themselves, have only a small effect on performance. Nutrition is one of those factors. A good diet will not turn a mediocre athlete into a champion, but inappropriate food choices will prevent the potential champion from performing at their best. This recognition of the importance of the athlete's diet has led to a search for nutritional strategies that may provide an advantage.

At the London Games of 1908, nutritional science was in its infancy, and the food choices of athletes were often dictated by a combination of the food preferences of the most successful athletes and of the blandishments of the snake-oil salesmen. In some respects, little has changed, but we now have a much better, though still imperfect, understanding of the nutritional basis of successful performance.

The quantity of food that an athlete eats is driven by the energy demands of training and competition and by the physique that the athlete seeks to achieve. Endurance athletes may consume 6-8,000 calories per day, or even more, and yet have body fat levels that are as low as is consistent with good health. In some cases, body fat may even be so low as to pose a risk to health. At the other extreme, in some highly technical sports where extreme leanness is considered desirable, such as gymnastics, the energy demand may be very low: in spite of long hours in training, the exercise expenditure is low, so energy intake is correspondingly low. Treading the thin line between too much and too little food intake requires careful monitoring.

The main fuel used by muscles during exercise is carbohydrate, especially during high intensity exercise. Athletes are therefore encouraged to eat a high carbohydrate diet with a relatively low fat intake. This is consistent with the public health message that reducing fat intake and increasing intake of carbohydrates is consistent with good health, and the successful athlete can be a good role model for public health campaigns.

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Traditionally, athletes, especially those in strength and power events, have been concerned to achieve a high protein intake, as protein is associated with the growth and repair of muscle. Recent evidence shows that this belief is to some extent true, though the body accommodates over time: a high protein intake may

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High levels of lactic acid cause pain! Buffering the acidity can improve performance in events where acidosis in muscle may be a limiting factor.

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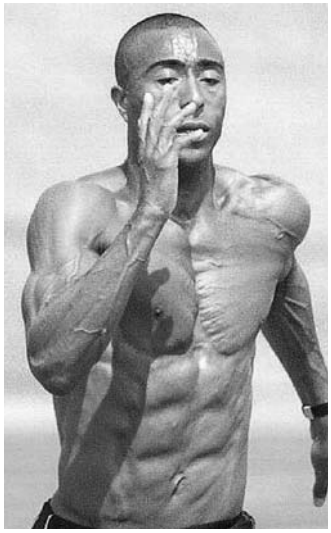
therefore be beneficial, and even necessary, in the early stages of an intense training program, but the body adapts and after a period of months or years, a high protein intake may be less necessary. The primary aim of training is to remodel the muscle tissue: the strength athlete wants more of the proteins that generate force within the muscle but the



The elite athlete is genetically gifted, highly motivated and trains to the limit of what is humanly possible. When all these factors are equal, the food choices that an athlete makes can make the difference between success and failure.

marathon runner has a different aim – the production of more of the proteins that are involved in energy generation in the muscle. This is achieved by the different training stimulus that is applied. The application of more invasive techniques that require sampling of muscle tissue has now shown that the intake of small amounts of protein just before, during or just after a training session may help stimulate the process of adaptation taking place in the muscle in the hours and days after each training session. Some proteins seem to be more effective that others, and whey protein, which is derived from milk, seems to be particularly effective. These findings are now being applied to the rehabilitation of patients after muscle injury and to the reversal of the decline in muscle function that accompanies the ageing process.

In extreme heat, which is possible, albeit unlikely, in London, maintaining hydration can be a challenge when sweat losses are high. Athletes are encouraged to develop a hydration strategy that meets their individual needs, as sweating rates vary greatly between individuals. The coincidence of the London Games with the Muslim holy month of Ramadan, where Muslim athletes would normally abstain from food and fluid intake during daily hours has thrown into sharp focus the issue of nutrition, and more especially of hydration, and performance. Those Muslim athletes who fast while competing in London will be very aware of this issue.

The use of dietary supplements is widespread in sport, as it is in the general population. Athletes use a wide variety of supplements in the pursuit of success and this raises a number of issues. Of the many thousands of different supplements on sale, only a handful are supported by good evidence of efficacy and of safety. Athletes, of course, are often more concerned with the former than the latter, but those who have responsibility for the wellbeing of the athletes must be concerned that supplements pose no risk. A few supplements will be in common use among athletes in London. Creatine is popular with strength and power athletes as it can help increase speed and strength and can also help gain muscle mass. Caffeine is also widely used: it can help delay fatigue and increase both mental and physical performance. Buffering agents that can resist the negative effects of lactic acid formation are used in high intensity sports such as middle distance running, track cycling and rowing, all events where the United Kingdom has a strong tradition of success. Nitrate is a relative newcomer to this arena, but remarkable evidence is emerging to show nitrate supplements, which are often taken by athletes in the form of beetroot juice (beetroot is naturally high in nitrate), can reduce the oxygen cost of exercise and thus improve performance in events where oxygen supply is limiting. This applies particularly to events lasting a few minutes or more. This clearly also has implications for patients with a range of cardiac, pulmonary or vascular conditions where oxygen supply to tissues is compromised. Remarkably too, there is evidence of a reduction in blood pressure in hypertension. There are other examples where the development of strategies for the Olympic athlete may lead to clinical applications.

Elite sport has been blighted in recent years by the use of drugs, and the promise is that the London Games will be the cleanest ever due to improved testing methodologies. Improved sensitivity of testing brings some issues, though, and there is evidence of the widespread contamination of the human food chain with doping agents that are used illegally to promote growth in animals. These drugs have the same effect in humans and are therefore prohibited by the anti-doping rules. At a recent international football tournament in Mexico, traces of clenbuterol were found in109 of the 208 urine samples tested. Some dietary supplements also contain doping agents that are not declared on the label. These may arise from cross-contamination during manufacture or from deliberate adulteration intended to transform otherwise ineffective products into something that the consumer will see to be effective. This extends to the presence in weight-loss supplements of anorectic drugs, such as sibutramine, that have been withdrawn from sale because of safety concerns. While we must prosecute the guilty athletes, we must also protect the innocent.

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