
PRACTICAL APPLICATION

International Journal of Sport Nutrition and Exercise Metabolism, 2002, 12, 490-494
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Feeding Ultra-endurance Athletes: An Interview With Dr. Helen O'Connor and Gregory Cox

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The study of Glace et al. in the current edition of *IJSNEM* illustrates some of the challenges involved in managing the nutritional needs of ultra-endurance activities. Ultra-endurance athletes can expect to face extreme nutrient demands and a variety of practical hurdles to achieving their fuel and fluid replacement goals. In this column, we speak with well-known Australian sports dietitians, Dr. Helen O'Connor and Gregory Cox about case histories involving ultra-endurance sports presented at the 2002 Australian Conference of Science and Medicine in Sport.

Begin by telling us a bit about the athlete you worked with and his specific event. How did the opportunity arise to be involved in this project?

Helen: Pat Farmer is a well-known Australian ultra-marathon runner, aged 37 at the time of this run in 2001. He had previously made a name for himself in a variety of multi-day running events, including breaking records for running across the Simpson Desert in Australia. On another occasion, he achieved the feat of running up 101,934 stairs in a 24-hour period—this is considered to be the equivalent of climbing Mt. Everest! My first opportunity to work with Pat occurred on his second attempt at the Simpson Desert run. After a disastrous first attempt, he called for assistance from sports scientists from the University of Sydney, and we were able to help with pre-run acclimatization training (running at 50 °C in our heat chamber!) and dietary advice. In 2001 he set out to complete a round-Australia run in celebration of the Centenary of Federation of Australia. His aim was to run 14,500 km around the perimeter of Australia—including Tasmania—breaking the existing record of 217 days. He wanted to do this as a continuous run, with a small support crew of family and friends traveling with a caravan and two vehicles. To achieve this he would need to run 70–80 km a day for over 6 months, and I was able to work with him to plan his nutrition support.

Greg: I worked with a local mountain bike enthusiast. Richard B. Richard was a very well-trained but “recreational” cyclist who had volunteered for a couple of dietary intervention studies undertaken by our Department at the Australian Institute of Sport. Richard entered a 24-hour mountain bike race as a solo competitor,

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with the goal of riding as many laps as possible of an all-terrain loop course. Since he had literally given us his blood, sweat, and tears in our studies, I felt pleased to be able to provide expert nutrition advice for his racing challenge. This race would involve about 1300 competitors, competing in teams or as individuals, with refueling and rehydration opportunities being provided by the competitors' support crews.

What did you consider to be the main nutritional goals of the event, and what did you anticipate to be the practical challenges to achieving these goals? What were the features of the nutrition plan devised to tackle the situation?

Helen: The most notable feature of Pat's dietary requirements was his high energy needs—we worked on the basis of providing 200–300 kJ of energy per kilometer run each day, which would mean a typical daily intake of 16–24 MJ of energy. In addition to meeting total energy needs, we worked on supplying adequate carbohydrate for muscle fuel requirements and a protein intake to minimize loss of muscle mass over the run. The high energy density of fats and oils intake would be useful in evening meals (post-running). Fluid needs during each day's run would vary due to extreme differences in the prevailing environment and would be monitored via changes in body weight, but we anticipated a general drinking plan of 500–1000 ml per hour while running. Meals would also need to provide for Pat's increased requirements for micronutrients, including sodium, minerals, and anti-oxidants.

The nutrition plan had to be organized against the background of Pat's food likes and dislikes—taking into account that he was a near vegetarian, eating only fish, eggs, and dairy foods. The logistics of the run meant that his food had to be purchased, prepared, and transported along the route, much of which was through Australia's vast empty stretches. Hygiene issues were a challenge over many parts of Australia, with concern for food storage and for a supply of clean water. Food availability was often a challenge, ranging from the general availability of supplies in the area, to the need to arrange Pat's meals around, or to include, the numerous speaking engagements and civic receptions that were organized along the route. We needed to be creative to keep the menu interesting over a day, then from day to day over 6 months.

Greg: In events of 8–24 hours, it isn't necessary (or practical!) to meet total energy expenditure. Instead, I feel the main goals are to match muscle fuel needs for carbohydrate, and replace sweat losses of fluid and sodium. I've experimented successfully in other events, such as Ironman triathlon races, with the carbohydrate intake guidelines of 1–1.5 g per kg body mass per hour. In the cycling legs of these races, it is relatively easy for the athlete to transport his or her own carbohydrate supplies and to consume them while riding—it is certainly easier to eat while (road) cycling than on the run leg of triathlons. However, in a mountain bike race, the course is generally too technical to allow much opportunity for feeding. Therefore, the competitors are more reliant on feed stations provided by their support crew at the completion of each lap. Fluid intake must be matched to rates of fluid loss. In shorter "endurance" races like marathons and Olympic Distance triathlons, the typical problem is that sweat rates exceed the possible rate of fluid replacement. However, in longer events undertaken with a lower workload and a lower rate of sweat loss, it is possible for an athlete to overhydrate. Fluid balance monitoring via monitoring of body weight changes can help the athlete to gauge a suitable drinking

plan. Sodium losses also need to be replaced to avoid the problem of hyponatremia, and I try to work to the guideline suggested by a number of experts of replacing around 1 g of sodium per hour. One of the major challenges of this race was the lack of catering and suitable food supplies out on the course. Each competitor needed to provide his own race provisions and to rely on a support crew to achieve a race eating plan.

So how did you translate your nutrition plan into food choices and eating practices? Was there a need for special sports foods or nutritional supplements?

Helen: Pat started each day around 4–5 AM with a breakfast of porridge, a liquid meal supplement, and toast or pancakes. He would then run around 40 km before his next big break, having sandwiches with protein fillings or a rice/pasta or instant noodle meal for lunch. Other snack choices included muffins or pikelets, cereal bars and sports bars, fruit in various forms—fresh, dried, or canned—iceblocks, confectionary, and sports gels. During the run itself, Pat refueled and rehydrated with water, Gatorade, fruit juice, or soft drink, and when running slowly, carbo-lode drinks, milk shakes, and liquid meal supplements. We provided plenty of choices to keep things interesting—at times, he even drank the juice from canned vegetables! At the end of the day’s run, Pat would consume an evening meal based on cheese, tofu, eggs, nuts, and fish for protein, and large servings of carbohydrate-rich foods—for example, 4 cups of pasta and 6–8 slices of bread. We were often restricted to using canned vegetables. A typical day’s intake provided about 25 MJ (6000 kcal) of energy, 180 g protein, over 1 kg of carbohydrate (!), and 120 g fat. Intakes of vitamins and minerals were generally 2–3 times the RDIs. We used a large range of sports foods to make up this dietary plan, including liquid meal supplements, sports bars, sports gels, carbohydrate loader supplements, and sports drinks. These sports foods are so practical because they’re easy to consume, portable, and have good storage characteristics. We also supplied Pat with an anti-oxidant supplement (vitamins C and E), a multivitamin/mineral supplement, iron supplementation, and salt replacement, in view of his increased requirements for micronutrients and the uncertainty of the food supply in some areas.

Greg: I worked with Richard to put together a food and drink pack from which his handlers could provide a number of items on the completion of each lap. I packaged each item into handy serve sizes, and guided both the support crew and Richard on achieving nutrition goals via certain numbers of servings of each item. The key nutrients we targeted were carbohydrate, fluid, and sodium. The food choices varied from “real” foods such as cereal bars, chocolate bars, candy, potato crisps, and bread, to specialized sports products such as Powerbars, sports gels, and liquid meal supplements. There was a range of drink options, including sports drinks, diluted fruit juice, Coke, and liquid meal supplements. I was really concerned with “flavor fatigue” over the course of 24 hours, whereby Richard would get sick of the same items or the same tastes. It was important to alternate between sweet forms of carbohydrate and savory choices. Real foods, especially the savory choices, offered a good potential for sodium intake. Many ultra-endurance athletes don’t realize that typical sports foods and supplements—for example, gels, bars, and even sports drinks—are quite low in sodium. We used some specialized products such as Gastrolyte (oral rehydration solution) and Gatorlytes (satchels of sodium and minerals to add to Gatorade) to replace salt during the event, but food choices such as a Vegemite sandwich (Aussies grow up on these!) also supplied a good intake of salt.

How successful were your athletes in completing their events, and how well did they manage their nutrition plan? Were there any unexpected problems or challenges that were greater than anticipated?

Helen: Pat Farmer completed his run around Australia in record time, reaching Parliament House in Canberra after 191 days and 14,602 km (an average of nearly 77 km per day). Over the course of the run, he lost 5 kg, but otherwise the food plan was successful in fueling him to achieve this amazing feat. Some scientific colleagues (Hill and Davies, *Med. Sci. Sports Exerc.* 31:148-151, 2001) undertook a doubly-labeled water study of his energy expenditure during a 2-week portion of the run and estimated his daily energy expenditure to be 26,548 kJ (6,321 kcal). His water turnover was found to be around 6 L per day, although these measurements were made during his time in the temperate eastern coast of Australia. Over such a long period of time, you expect highs and lows to occur with the nutrition support. One of the major problems we found was that the catering at official functions was insufficient to look after Pat's evening meals. In the end, he resorted to 3 meal "sittings"—our provisions before the function, food at the function itself, then leftovers when he got home.

Greg: Richard powered home to win the solo section of the mountain bike race. Overall he completed 20 laps of the course, about 400 km of difficult mountain riding, in the 24-hour period. He was impressed with his nutrition program, and ate consistently over the race according to the plan. On analysis we worked out that he consumed 1794 g of carbohydrate, 12.3 g of sodium, and 13.5 L of fluid over the 24 hours. One of the best features of the plan was the wide range of choices provided, giving him lots of flexibility. Funnily enough, some of the items he liked to eat in training didn't appeal during the race, while other of his less favored choices suddenly seemed to "hit the spot". In fact, he ran out of some of these choices. His race involved inclement weather and mechanical difficulties, but the food pack remained intact during these troubles.

Do you have any general comments about working with ultra-endurance athletes?

Helen: I think you need to be prepared to deal with uncharted territory! It is important to think of food as fuel for the body—but also fuel for the mind. Food becomes a highlight of the day, an incentive to get to the next aid station or feeding point, and likes and dislikes change over time. It is important to work with the support crew as well as the athlete, and to establish a routine of feeding and monitoring intake. Over long races, it helps to change over support crews to keep them fresh—things fall apart then the support crew becomes tired and irritable! Of course, the athlete needs to practice with the plan and to develop faith in it. The culture of many ultra-endurance athletes is to "do it tough" and ignore creative ideas or advanced science. You need to develop good rapport before your ideas can be taken on board.

Greg: I think it is important to appreciate that ultra-endurance athletes have a unique personality—the longer the race, the more likely it is to find an athlete who is compulsive and obsessive. You also need to be creative in assessing the needs and opportunities to provide nutrition support to the athlete. And there is a big difference in working with the athletes who are racing to win and those who are competing to finish. At one end of this spectrum are the athletes who have to create opportunities,

at race pace, to refuel and rehydrate. These athletes need to be encouraged to meet the minimum nutritional requirements for good performance. At the rear of the race, however, you will find athletes whose progress is much slower and who have the opportunity to over-consume the nutritional supplies available. These athletes often need to be taught to manage their opportunities to keep at a sensible pace relative to their needs. A defined plan for feeding and drinking is a key strategy, but you still need to be flexible and open to change if things don't go according to plan.