Feeding strategies of a female athlete during an ultraendurance running event

Moran, Siobhan T.; Dziedzic, Christine E.; Cox, Gregory R.

Published in:
International Journal of Sport Nutrition and Exercise Metabolism

DOI:
10.1123/ijsnem.21.4.347

Feeding strategies of a female athlete contesting an ultraendurance running event.

Key words: carbohydrate, fluid intake, sodium

Siobhan T. Moran[1], Christine E. Dziedzic[1], Gregory R. Cox[1]

[1]Sports Nutrition, Australian Institute of Sport, Belconnen, ACT, Australia.

Address for correspondence: Gregory R Cox

Department of Sports Nutrition

Australian Institute of Sport

C/- Queensland Academy of Sport

PO Box 956

Sunnybank

Queensland 4109

AUSTRALIA

Email: greg.cox@ausport.gov.au

Abstract

The aim of this case study was to describe the race nutrition practices of a female runner who completed her first 100 km off-road ultraendurance running event in 12 h 48 min 55 sec. Food and fluid intake during the race provided 10 890 kJ (736 kJ/h) and 6150 ml (415 ml/h) of fluid. Hourly reported carbohydrate intake was 44 g with 34% provided by sports drink. Hourly carbohydrate intake increased in the second half (53 g/h) compared to the first half (34 g/h) of the race, as the athlete did not have access to individualised food and fluid choices at the early checkpoints, and felt satiated in the early stages of the race after consuming a pre-race breakfast. Mean sodium intake was 500 mg/h (52 mmol/L), with a homemade savoury 'stock' and sports drink (Gatorade Endurance) being the major contributors. The athlete consumed a variety of foods of varying textures and tastes with no complaints of gastrointestinal discomfort. Despite thinking she would consume sweet foods exclusively, as she had done in training, the athlete preferred savoury foods and fluids at checkpoints during the latter stages of the race. This case study highlights the importance of the sports nutrition team in educating the athlete about race-day nutrition strategies and devising a simple, yet effective system to allow the athlete to manipulate her race-day food and fluid intake to meet her nutritional goals.

Introduction

Ultraendurance running events are becoming increasingly popular among recreational and elite competitors. Athletes contesting these events are faced with a unique set of nutritional challenges as they compete for long periods of time and encounter extremes in environmental conditions and terrain. The North Face 100 (NF100) is one such event held in the Blue Mountain Region of New South Wales, Australia (www.thenorthface.com.au/100). Due to the logistical issues in undertaking research protocols that reflect such events, nutritional advice provided to these athletes requires the sports nutrition professional to interpret current sports nutrition guidelines for endurance activities. Furthermore, in offering advice, the sports nutrition professional must consider issues that will influence the athlete's acceptance of foods and fluids throughout the event, as well as logistical issues such as access and portability of preferred options (O'Connor & Cox, 2002).

There are several nutritional priorities on race-day for athletes undertaking ultraendurance running races. Current recommendations suggest athletes consume 1-4 g carbohydrate/kg, 1-4 h before exercise (Burke, Cox, Cummings, & Desbrow, 2001) to optimise muscle and liver glycogen stores. During the event, the athlete's nutritional priorities are to 1) drink appropriately to maintain euhydration, 2) consume adequate carbohydrate to maintain blood sugar levels and provide an alternative fuel for exercising muscles, and 3) incorporate foods, fluids or supplements that provide sodium (O'Connor & Cox, 2002).

Despite several studies reporting food and fluid intake practices of male athletes contesting single day foot-races (Fallon, Broad, Thompson, & Reull, 1998; Glace, Murphy, & McHugh, 2002) and multiple day foot-races (Eden & Abernethy, 1994; Rontoyannis, Skoulis, &

Pavlou, 1989) studies have failed to report intakes of female athletes contesting such events. Therefore, the aim of this case study was to provide a detailed outline of the food and fluid intake of a recreational female athlete undertaking an ultraendurance foot-race.

Presentation of the athlete

The subject was a 25 year old recreational female athlete (body mass – 48.0 kg; height – 156.5 cm) who was experienced at Olympic distance triathlons and half marathon races. The subject made a commitment three months before the 2010 NF100 to undertake the event, having never completed an ultraendurance running race. Through informal conversations with the first and second authors, the subject requested specific advice about pre-race and race nutrition strategies that could be implemented. The subject provided written permission for publication of the case study having read the manuscript before the original submission date which conforms to the principle that has been approved by the Human Ethics Committee of the Australian Institute of Sport.

Personal and training history

Before deciding to undertake NF100, the subject was training at least once daily. This involved a combination of swimming, cycling and running sessions to accommodate daily work commitments. Running sessions were slowly progressed from 3-4 to 7-10 per week over a three month period before the race. Duration of training sessions was also increased, with two long runs over 4 h included each week in the final month. Furthermore, the program was adapted to incorporate more challenging terrain to reflect that of the course, although the subject did not include any stair climbing in her training program.

During the three months before the race, the subject lost approximately 3.7 kg, with an associated decrease in sum of seven skinfolds from 80.0 mm to 58.3 mm. The subject reported changing her daily food and fluid intake in the two months before the event to "eating more healthily". More specifically, she reported eating less energy dense snacks such as chocolate and reducing the size of her mid-day meal.

Race Information

NF100 is a challenging all-terrain foot race held in Australia. Athletes are required to traverse mountainous terrain including a large number of steps and two cliff face descents via tarros ladders. There are five race checkpoints (17km, 38km, 54km, 67km and 89km) along the course with a small variety of fluids and foods available for athletes. These items were limited to water, pre-made sports drink, fruit, confectionary, muesli cookies, and a savoury snack (Kraft Vegemite snackabouts). Support crews were able to provide food and fluid at checkpoints 3, 4 and 5. In 2010, 553 solo runners (459 males and 94 females) completed the event with an average race time of 17 h 29 min 23 sec. On race-day, temperatures ranged from 3.8-15.4°C at the start/finish point according to www.weatherzone.com.au. The subject in this case study completed the course in 12 h 48 min 55 sec to finish third in the female solo division (26th overall solo competitor).

Overview of Nutrition plan/intervention

Dietary collection methodology

On the day of the event, a Sports Dietitian (SM) was present to record all foods and fluids consumed. At three of the five checkpoints a record was kept of all food and fluid consumed, as well as foods and fluids taken by the subject for the next stage of the race. There was no support team access at checkpoints one and two, therefore the athlete carried all food and sports drink that had been planned for her to consume between the start of the race and checkpoint three. The support team then clarified with the athlete which foods she had consumed when she arrived at checkpoint three and whether any additional foods or fluids provided at the earlier checkpoints had been consumed. Within 24 h of the race finish, the subject was asked to verify her intake, and note any discrepancies against the food record. Any foods that were consumed other than that provided by the support team, as well as any foods that were lost en route, were noted.

Before the race, all foods and fluids for the subject were packaged by the support team into single serving sizes for easy access and identification. Using nutrition information panels, the serving size was approximated, and the nutrition content determined. All individual packs were labelled with the amount of carbohydrate (g) rounded to the nearest 5 g. If a product was deemed high in sodium, this was marked on the packaging using a large red star. At checkpoints 3-5, foods and fluids were placed on a large mat divided into sweet and savoury sections, so the subject could easily identify the foods available. The subject carried a 3L capacity camel pack during the race. The fluid (sports drink) contained in the camel pack was made up to the subject's preferred concentration, and was measured by filling it with a known-volume drink bottle at each checkpoint.

Total energy (kJ), carbohydrate (g), fat (g), protein (g), dietary fibre (g) and sodium (mg) of all foods and fluids were estimated using FoodWorks Professional Edition, Version 6.0.2539, © 1998-2009 (Xyris Software, Brisbane, Australia). Data analysis was performed by a Sports Dietitian (SM). Food composition data were compiled from Nuttab 95; AusFoods; Australian AusNut and nutritional information from food manufacturers entered into the database. On completion of analysis, data entries were verified against the original records provided by the Sports Dietitian (SM) at the time of collection.

Nutrition plan

To minimise gastrointestinal discomfort and meet the subject's expectations, the timing, amount of carbohydrate and sodium, and overall composition of the pre-race meal was individualised (Rehrer, van Kemenade, Meester, Brouns, & Saris, 1992). We recommended that the subject consume her usual carbohydrate-based breakfast 1-4 h before the race start. In addition, specific foods and fluids were included to increase her carbohydrate, fluid and sodium intake. A caffeine-containing beverage was included also, as this was part of her typical training breakfast.

In considering the duration and intensity of the event along with the subject's tolerance for food and fluid intake during the race, we suggested a target carbohydrate intake of 40 g per hour (Rodriguez, DiMarco, & Langley, 2009). No specific fluid target was provided to the subject as it is thought that in cool environments, as was expected, performance and physical well-being may not be affected by body water losses amounting to 2% of body weight (Coyle, 2004). It was still emphasised that a 'regular fluid intake' was consumed throughout the event, and that this fluid contain carbohydrate and sodium. Sodium rich fluids and foods were included to achieve a sodium intake of 500-1000 mg per hour (Clark, Tobin, & Ellis, 1992).

Implementation and outcome of the plan

A pre-race breakfast meal comprising rice porridge, sports drink and coffee was consumed two hours before the race, with additional fluids (cola drink) consumed ~30 min before the race start (Figure 1). The pre-race meal provided ~1000 kJ, 57 g carbohydrate (1.1 g/kg), 750 mg sodium, 850ml fluid and ~82 mg caffeine (1.7 mg/kg). The carbohydrate content of the pre-event meal could be considered relatively low compared to current guidelines (Burke et al., 2001). However, due to the opportunities to consume food and fluid throughout the race, it was felt that familiarity and the subject's gastrointestinal comfort with foods and fluids were the priority. Additionally, the subject had undertaken a 'modified' carbohydrate loading program, and consumed a carbohydrate-rich meal the night before the event. At the subject's request, caffeinated beverages were made available pre-race and at checkpoints as an alternative to other carbohydrate containing fluids. The inclusion of caffeine was not as a performance enhancing aid but rather a familiar training beverage choice. The use of concentrated caffeine supplements were not incorporated into the race-day nutrition plan as the subject did not feel comfortable introducing these products during the final stages of training for the race.

Total food and fluid intake during the race provided 10 890 kJ (736 kJ/h), 558 g carbohydrate (44 g/h), 6150 ml (415 ml/h) fluid and 7403 mg (500 mg/h; 52 mmol/L) sodium (Figure 1). The subject did not complain of any gastric discomfort throughout the event, suggesting that foods and fluids consumed during the event were well tolerated. Overall, hourly carbohydrate intake was slightly above the set target of 40 g/h and similar to that reported in an earlier account of male athletes (42.8 g/h) contesting a 24-h foot-race (Fallon et al., 1998). Of interest, the subject in our case study consumed 34 g/h during the first half of the race, compared with 53 g/h during the second half. The difference in carbohydrate intake throughout the event was likely due to the subject's appetite being satisfied during the early stages of the event following the pre-race meal. Although the pre-race meal only provided 1.1 g/kg, this is similar to that previously observed in male subjects competing in a long-distance road cycling event who consumed 1.0 g/kg (Havemann & Goedecke, 2008), In addition, it is probable that limited access to *individualised* food and fluid choices at checkpoints one and two further contributed to the lower carbohydrate intake early in the race.

Insert Figure 1.

Sweet (Gatorade Endurance) and savoury (stock) high sodium (84 mg/100 ml and 240 mg/100 ml, respectively) fluids were made available to provide a reliable source of sodium, drive thirst and provide varied taste options. The majority of fluid consumed during the race was carried by the subject in a camel pack, and was refilled at each accessible checkpoint. Her intake of sports drink (Gatorade Endurance) remained consistent throughout the race although, as the race progressed, the subject requested it be diluted as the sweetness was becoming less tolerated. In the early stages of the race, the concentration of sports drink was ~5 per cent, but decreased to ~3.5 per cent at the last checkpoint. A total of 3850 ml of Gatorade Endurance was consumed, providing 2835 kJ, 189 g carbohydrate and 2700 mg sodium. This contributed 26% of total energy intake, 34% of total carbohydrate intake, 37% and 63% of sodium and fluid intake, respectively. Cola made up a further 14% of total fluid intake (850 ml) and 16% of total carbohydrate intake (91 g). The consumed volume of cola also provided ~83 mg of caffeine throughout the race. The 'stock' (a stock cube dissolved in warm water) contributed 20% of the total fluid consumed and provided the greatest amount of sodium (3000 mg; 41% of total sodium intake) during the race. Together, these three fluids provided 50% of the subject's overall carbohydrate (280 g), 78% of sodium (5796 mg) and

97% of total fluid (5950ml) intake. Of note, the subject did not request water at any stage during the event.

As previously mentioned, a range of solid snack foods were available to the subject throughout the race. Choices offered were based on the subject's regular training foods as well as others suggested by the sports nutrition team. Sweet foods (such as snack bars, confectionary, PowerBar Gel Blasts) were consumed more frequently during the early stages of the race, with savoury/salty choices becoming more popular as the race progressed (Figure 1). Despite the subject relying on confectionary regularly during longer training sessions, they were not well tolerated during the race (Figure 1). The subject had preconceived ideas about the types of foods she would 'crave', and maintained that she would exclusively consume sweet foods. As illustrated in Figure 1. the subject had a wide range of food flavours, including several savoury fluid and food choices. These options were suggested by the sport nutrition team to avoid the issue of 'flavour fatigue', which may arise when only consuming sweet tasting foods and fluids (O'Connor & Cox, 2002).

Sodium intake increased in the latter part of the race, due mainly to the intake of the 'stock' solution. Although the subject had not trialled the 'stock' in training, she requested this at checkpoints three, four and five (Figure 1). As the race progressed, she preferred the savoury flavour of the 'stock' compared to the sweet tasting fluids. Although the aetiology of muscle cramps remains unclear, the perception that sodium intake would help resolve cramps also drove the subject to consume salty food and fluids after she complained of calf cramps in the early part of the race. The wide selection of high sodium fluids and foods provided adequate sodium (52 mmol/L) to meet current sodium intake guidelines (30-50 mmol/L) suggested for ultraendurance events (Rehrer, 2001).

Reflections

The sports nutrition team played a key role in influencing the variety of foods and fluids offered at checkpoints throughout the race. Despite the subject intending to rely entirely on sweet tasting foods and fluids, savoury options contributed significantly to the overall intake of carbohydrate, sodium and fluid. Before the race, the support team educated the subject on fuelling for performance. Additionally, verbal encouragement was given to increase the amount of food and fluid consumed at each checkpoint, as well as the provision of extra foods in addition to what the subject chose for each leg of the race. The subject responded well to encouragement when it was related to how it could improve performance, and as the race progressed, the subject was more responsive to our suggestions. It is likely the subject would have failed to meet hourly carbohydrate and sodium intake goals had it not been for the variety of foods and fluids provided and the encouragement offered by the sports nutrition team.

The organisation of provisions at checkpoints, particularly the labelling of food and fluids, allowed the subject to easily identify her choices. The labelling system provided a simple way to approximate carbohydrate intake for both the subject and the support team, as well as indicate when 'high salt' options were consumed, which allowed for continual modification of the nutrition plan. It also provided a timely reminder of important nutrients that needed to be consumed. The subject's ability to select from a wide range of flavours throughout the race allowed her to maintain a consistent carbohydrate and fluid intake, which was important in determining her eventual success.

Solids and liquids were equally important in providing a source of carbohydrate during this event. This is an interesting observation, as in shorter endurance events athletes have been shown to reduce carbohydrate intake from fluids in cooler race conditions (Cox, Snow, & Burke, 2010). Therefore, in devising a nutritional plan for ultraendurance athletes, it is important to ensure that hourly carbohydrate intake guidelines can be achieved with a varied hourly fluid intake.

Having not competed in an event such as this before, the athlete's expectations were not set on a top three finish, but just to 'walk as little as possible.' The athlete was 'thrilled with the result' and believed the implementation of the nutrition plan helped maintain her energy levels throughout the race. The athlete felt that muscle pain and cramping were a challenge towards the end of the race rather than fatigue, and on reflection commented that more training on stairs would have been beneficial given the tough terrain.

Nutritional support during an ultraendurance foot race requires the athlete to become familiar with race-day food and fluid choices during daily training. Although we had limited time for nutrition consultation, the success of our planning was partly achieved by incorporating the athlete's food and fluid preferences, within the selection of choices available. Furthermore, careful planning of race-day provisions based on set guidelines is important, however sufficient flexibility should be allowed so the athlete can modify the plan according to their tolerance and opportunities for food and fluid intake, as well as the environmental conditions on race-day.

Acknowledgements

The authors wish to thank the subject who volunteered for this case study. We would also like to thank the support crew who willingly assisted with data collection and the provision of foods and fluids on race-day.

References

Burke, L. M., Cox, G. R., Cummings, N. K., & Desbrow, B. (2001). Guidelines for daily carbohydrate intake: do athletes achieve them? *Sports Med, 31*(4), 267-299.

Clark, N., Tobin, J., Jr., & Ellis, C. (1992). Feeding the ultraendurance athlete: practical tips and a case study. *J Am Diet Assoc, 92*(10), 1258-1262.

Cox, G. R., Snow, R. J., & Burke, L. M. (2010). Race-day carbohydrate intakes of elite triathletes contesting olympic-distance triathlon events. *Int J Sport Nutr Exerc Metab, 20*, 299-306.

Coyle, E. F. (2004). Fluid and fuel intake during exercise. *J Sports Sci, 22*(1), 39-55.

Eden, B. D., & Abernethy, P. J. (1994). Nutritional intake during an ultraendurance running race. *Int J Sport Nutr, 4*(2), 166-174.

Fallon, K. E., Broad, E., Thompson, M. W., & Reull, P. A. (1998). Nutritional and fluid intake in a 100-km ultramarathon. *Int J Sport Nutr, 8*(1), 24-35.

Glace, B., Murphy, C., & McHugh, M. (2002). Food and fluid intake and disturbances in gastrointestinal and mental function during an ultramarathon. *Int J Sport Nutr Exerc Metab, 12*(4), 414-427.

Havemann, L., & Goedecke, J. H. (2008). Nutritional practices of male cyclists before and during an ultraendurance event. *Int J Sport Nutr Exerc Metab, 18*(6), 551-566.

O'Connor, H., & Cox, G. (2002). Feeding ultra-endurance athletes: an interview with Dr. Helen O'Connor and Gregory Cox. Interview by Louise M. Burke. *Int J Sport Nutr Exerc Metab, 12*(4), 490-494.

Rehrer, N. J. (2001). Fluid and electrolyte balance in ultra-endurance sport. *Sports Med, 31*(10), 701-715.

Rehrer, N. J., van Kemenade, M., Meester, W., Brouns, F., & Saris, W. H. (1992). Gastrointestinal complaints in relation to dietary intake in triathletes. *Int J Sport Nutr, 2*(1), 48-59.

Rodriguez, N. R., DiMarco, N. M., & Langley, S. (2009). Position of the American Dietetic Association, Dietitians of Canada, and the American College of Sports Medicine: Nutrition and athletic performance. *J Am Diet Assoc, 109*(3), 509-527.

Rontoyannis, G. P., Skoulis, T., & Pavlou, K. N. (1989). Energy balance in ultramarathon running. *Am J Clin Nutr, 49*(5 Suppl), 976-979.