Food and Fluid Intake During Extreme Heat: Experiences From The Badwater Ultramarathon

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Objective.—The purpose of this paper was to document food and fluid intake of athletes during an ultramarathon held in extreme heat. Our study was conducted at The Badwater Ultramarathon, a nonstop 217-km run across Death Valley, California, USA, in 2012.

Methods.—This study recruited 4 male athletes. The parameters measured were energy intake, fluid intake, energy expenditure, and body mass. The variables were further compared to the athlete's ability to successfully complete a 217-km ultramarathon in extreme heat.

Results.—This investigation recruited 4 male athletes, average age of 43 ($\pm$ SD) ($\pm$ 7.35), range, 39 to 54 years. All 4 subjects completed the race with a mean finish time of 36:20:23 ($\pm$ SD) ($\pm$ 3:08:38), range, 34:05:25–40:51:46 hours and a mean running speed of 6.03 km/h ($\pm$ SD) ($\pm$ 0.05), range, 5.3–6.4 km/h. Our study found (mean and $\pm$ SD): energy intake 8036.5 kcal ($\pm$ 3453.1); fluid intake 33.8 L ($\pm$ 12.5); energy expenditure 23,920 kcal ($\pm$ 1749.3); and body mass 79.33 kg ($\pm$ 6.43). This study also determined body mass decreased 2.52% ($\pm$ 1.99) over the duration of the event. The maximum ambient air temperature was 46.6°C during the first day and 36.6°C the second day, with a low of 10.1°C during the evening.

Conclusions.—Our data reveal that our subjects were able to complete this event despite an energy intake deficit of 15 883.5 kcal (33.6% of energy expenditure) and a decrease in body mass of >2% during the race, which is in contrast to current recommendations, but in agreement with recent scientific literature. We conclude that the nutritional intake was adequate as our subjects completed the race and that success in longer duration events requires the ability to find a balance between maintaining the ideal hydration status and providing an adequate amount of fuel for each individual athlete.

Body Mass Changes and Fluid Consumption During an 80.5-km Treadmill Time Trial

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Objective.—Fluid consumption and maintenance of body mass is crucial to exercise performance, particularly during ultraendurance events. The current study aimed to assess body mass change and hydration status during an 80.5-km treadmill time trial (TT).

Methods.—Ultrarunners were recruited to complete 80.5 km on a motorized treadmill within an artificial laboratory environment. Body mass (BM) was determined prior to, at 16.1-km intervals, and on completion of an 80.5-km TT using bioelectrical impedance analysis (BIA). Ad libitum fluid intake was permitted during the trial, and total fluid consumption and gastrointestinal (GI) symptoms were noted throughout.

Results.—Total fluid intake was 3294.4 $\pm$ 1402.9 mL with an average consumption of 386.9 $\pm$ 212.2 mL/h. Prerunning BM (72.59 $\pm$ 8.48 kg) was reduced throughout the TT. Overall exercise-induced BM loss averaged 2.78 $\pm$ 0.94 kg with a 4.01 $\pm$ 1.35% decrease over time, although some retention of BM occurred in the latter stages of the TT. Ambient conditions were maintained throughout with no significant fluctuations in temperature (20.8° $\pm$ 0.2°C; P > .05) or humidity (35.7 $\pm$ 1.3%; P > .05). Average time to completion was 7 hours 28 minutes 9 seconds $\pm$ 1 hour 25 minutes 12 seconds at an average speed of 10.8 $\pm$ 1.5 km/h.

Conclusion.—The current study indicates that participants were unable to maintain prerunning BM following the completion of an 80.5-km TT with an average BM loss of 4%. Consensus guidelines state to avoid BM losses of >3%; therefore this emphasizes the importance of optimal hydration strategies in ultraendurance running.

Energy Cost of Running During a Bout of 80.5-km Treadmill Running

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Objective.—Success in ultraendurance running is composed of many inter-related variables. Notably the involvement of the cardiovascular system has been proposed to explain variance in performance. At present, there is limited data on the

changes in the energy cost of running (Cr) during bouts of ultraendurance running. Therefore, the purpose of this study was to identify changes and adjustments in Cr and respiratory variables over an 80.5-km treadmill time trial (TT).

Methods.—Participants were instructed to complete 80.5 km on a motorized treadmill and to cover the distance in the fastest possible time. Respiratory variables ($\dot{V}O_2$ [oxygen consumption], $\dot{V}CO_2$ [carbon dioxide production], and RER [respiratory exchange ratio]) were measured via indirect calorimetry every 16.1 km at a set speed of 8 km/h. Running speed and heart rate were continually monitored throughout the 80.5-km TT.

Results.—Average run time to completion was 7 hours 28 minutes 9 seconds $\pm$ 1 hour 25 minutes 12 seconds at a mean speed of 10.8 $\pm$ 1.5 km/h (pace, 5:34 $\pm$ 1:04 min/km). $\dot{V}O_2$ increased by 21.8% from the start of the TT to completion (31.19 $\pm$ 2.89 vs 38.0 $\pm$ 6.41 mL $\cdot$ min⁻¹ $\cdot$ kg⁻¹, respectively), while RER decreased from the start to 32.2 km whereupon RER plateaued. There was a significant increase of 24.2% in Cr (P < .001) from the start to completion of the TT.

Conclusion.—The current study indicated adjustments in $\dot{V}O_2$, Cr, and substrate utilization during an 80.5-km treadmill TT. Results indicated a shift to fatty acid oxidation as a main fuel source over a bout of 80.5 km, which corresponded with the increase in Cr. These findings may influence pacing strategies and overall success of performance in ultraendurance events.

In-task Assessment of Psychological Changes During an Ultramarathon Race

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Objective.—The primary aim of this study was to collect “real time data” on the psychological experience of runners during an ultramarathon race.

Methods.—Runners were recruited from a 50-mile trail race held in the Northeast region of the United States. Seventeen runners volunteered to provide in-task data at 2 data collection points on a 25-mile loop course. Single-item measures were used to quickly assess the pain, fatigue, energy, affective valence, attentional focus, motivation to finish, and confidence to finish during the previous segment of the race. Participants responded to each item on an 11-point scale (ie, 0–10).

Results.—Full data sets were obtained from 10 runners. Compared to runners who finished the race, nonfinishers reported higher scores for pain and fatigue at 10 miles. Finishers reported having more positive affect at 10 and 25 miles, having more energy at 10 miles, and having greater confidence in their ability to finish the race at 25 miles than did nonfinishers. Faster finishing times were correlated with less reported pain at the finish and more reported internally related thoughts halfway into the race. Participants reported increases in pain and fatigue, decreases in energy, decreases in positive affect, and a more associative attentional focus as the race progressed.

Conclusion.—According to in-task data collected during a 50-mile trail race, the psychological demands of the race were apparent in eventual nonfinishers as early as 10 miles into the race, particularly in terms of pain, fatigue, and affective valence. Faster runners reported significantly lower pain scores at the finish than slower runners, perhaps because of the additional time that slower runners had spent on their feet on-course. In-task data collection may prove useful for researchers to more accurately assess the dynamic physical, affective, and cognitive changes that runners experience during an ultramarathon event.

Would You Stop Running if You Knew It Was Bad for You? The Ultramarathon Runner Response

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Objective.—The Ultrarunners Longitudinal TRacking (ULTRA) Study is a longitudinal health study initiated in 2011. Herewith are some results from the first follow-up questionnaire distributed in 2014 comparing selected characteristics between those answering “yes” and “no” to the question, “If you were to learn, with absolute certainty, that ultramarathon running is bad for your health, would you stop your ultramarathon training and participation?”

Methods.—ULTRA Study participants who had completed an ultramarathon since study enrollment or intended to run ultramarathons again received the question.