Hydration Guidelines during Exercise: What Message is the Public Receiving?  
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PURPOSE: To assess the quality of information currently available to the public about hydration needs during exercise. METHODS: Internet searches were conducted using the terms “hydration,” “hydration guidelines,” “drinking fluids” and “drinking guidelines” with “and” and “or”. From the first 50 websites for each search phrase, duplicates were removed yielding 145 unique websites. Websites were then categorized and examined for specific information and recommendations. RESULTS: Overall correct endorsement of current knowledge was as follows (reported as percent endorsing the concept relative to the number of sites addressing the issue): some weight loss should be expected during exercise (67.6% of 102), fluid consumption during exercise should be based upon thirst (9.4% of 106), electrolyte intake is not necessary during exercise (12.5% of 112), dehydration is not generally a cause of heat illness (6.9% of 58) or muscle cramping (2.3% of 43), exercise-associated muscle cramping is not generally related to electrolyte loss (6.7% of 15), and overhydration is a risk for hyponatremia (98.5% of 65). There were 7.1% (of 70 websites addressing the issue) indicating that any weight loss during exercise should be avoided. Comparison of website information from those in the categories of medical or scientific organization (15.9%), academic institution (9.0%), peer-reviewed publication (8.3%) and medical professional individual or facility (8.3%), with those in the categories of media (19.3%), sports organization or coach (9.7%), sports drink and/or electrolyte replacement manufacturer (3.4%) and other (26.2%) revealed no differences (p=0.38 to 1.0) in the frequency of endorsement of the criteria referred to above. CONCLUSIONS: Misinformation about hydration needs during exercise continues to be widely spread on the Internet. In general, those websites that should be most trusted by the public appear to be no better than other websites at providing accurate information, and the potential risk of hyponatremia is not often raised.

Weight Change and Hydration Status during a 161-km Ultramarathon  
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PURPOSE: Weight loss during ultramarathon competition is often considered a useful predictor of performance, hydration status, and hyponatremia. The validity of this assumption has not been well studied. This study was designed examine the correlation between weight change and performance, urinalysis and serum sodium in a 161-km ultramarathon. METHODS: Runners were weighed at pre-race check-in, the half-way point, and at the finish line. Height was self-reported at pre-race check-in. Willing finishers underwent urine analysis and provided a blood sample for serum sodium analysis. RESULTS: Out of 672 runners who started the race, 351 (52%) successfully completed the race under the 30-hour cut-off time. Weight was measured on 658, 518, and 344 runners at pre-race, half-way, and finish line, respectively. Urinalysis (dipstick) was done on 70 runners (51 finishers), and blood samples were obtained from 84 runners (66 finishers). Mean (±SD) weight and BMI were 73.1 ± 10.3 kg and 23.3 ± 2.3 kg/m², respectively. Mean weight change for runners was -2.1 ± 2.1% and -0.84 ± 2.3% of their pre-race weight at mid-point and finish line, respectively. Based on linear regression analysis, there was a significant correlation between percentage weight change from pre-race to finish line and finish time (P=0.016, r²=0.02). There was no statistically significant relationship between weight loss and urine specific gravity (P=0.124, r²=0.05), or between weight loss and serum sodium concentration (P=0.183, r²=0.03).

CONCLUSIONS: Significant weight fluctuation is common during ultramarathons. Our data show that weight change may be a weak predictor of race performance and that faster finish times tend to occur with more weight loss. Weight change is not a useful predictor of urine specific gravity, nor is it useful as a predictor of serum sodium. More study is needed to determine if weight change during an ultramarathon is correlated with adverse patient outcomes.  
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**Body Mass Changes and Fluid Consumption during an 80.5km Treadmill Time Trial**

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**PURPOSE:** Fluid consumption and maintenance of body mass is crucial to exercise performance particularly during ultra-endurance events. The current study aimed to assess body mass change and hydration status during an 80.5 km•h\(^{-1}\) treadmill time trial (TT). **METHODS:** Ultra-runners were recruited to complete 80.5 km•h\(^{-1}\) 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•h\(^{-1}\) 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 3294.9 ± 1402.9 ml with an average consumption of 386.9 ± 212.2 ml/h. Pre-running BM (72.59 ± 8.48 kg) was reduced throughout the TT. Overall exercise-induced BM loss averaged 2.78 ± 0.94 kg with a 4.01 ± 1.35% decrease over time, although some retention of BM occurred in the latter stages of the TT. Ambient conditions were maintained throughout with significant fluctuations in temperature (20.8 ± 0.2°C; P<0.05) or humidity (35.7 ± 1.3% P<0.05). Average time to completion was 7 hrs 28 min 9 sec ± 1 hr 25 min 12 sec at an average speed of 10.8 ± 1.5 km•h\(^{-1}\). **CONCLUSION:** The current study indicates that participants were unable to maintain running BM throughout the TT with an average BM loss of 4%. Consensus guidelines state to avoid BM losses of >3%, therefore this emphasises the importance of optimal hydration strategies in ultra-endurance running.

**Would You Stop Running If You Knew It was Bad for You? The Ultramarathon Runner Response**

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**PURPOSE:** The Ultrarunners Longitudinal TRAcking (ULTRA) Study is a longitudinal health study initiated in 2011. Here we present 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 100% 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. Updated information was obtained on current number of biological children, marital status and average weekly running distance in the prior 12 months, and the Motivations of Marathoners Scales was completed. **RESULTS:** Among the 1,349 runners receiving the question, 349 (25.9%) answered “yes”. Those answering “yes” accepted the following answers “no” were older (median age 47.3 vs. 43.3 years, p<0.0001), more likely to be married (76.2% vs. 69.6%, p=0.019), had more children (median number 2 vs. 1, p=0.0095) and ran less (median 48 vs. 56 km/week in past year, p<0.0001), but did not differ in sex (70.5% vs. 67.6% men, p=0.35). The Motivations of Marathoners Scales showed significant group differences with those answering “yes” to the question having a higher health orientation (median 5.7 vs. 5.3, p<0.001), and lower personal goal achievement (median 5.0 vs. 5.2, p=0.006), psychological coping (median 4.4 vs. 4.8, p<0.0001) and life meaning (median 4.6 vs. 4.9, p<0.0002) scores. **CONCLUSION:** Ultramarathon runners find benefit from participating in ultramarathon running to the extent that most indicate they would not stop doing it even if it was bad for their health. Not surprisingly, those indicating they would stop were older, more likely to be married, more children were running less, were more health oriented, less were achievement oriented, and had less psychological motivations for running. Supported by the Western States Endurance Run Foundation.

**Energy Cost of Running during a Bout of 80.5km Treadmill Running**

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**PURPOSE:** Success in ultra-endurance 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 ultra-endurance running. Therefore, the purpose of this study was to identify changes and adjustments in Cr and respiratory variables during an 80.5 km•h\(^{-1}\) treadmill time trial (TT). **METHODS:** Participants were instructed to complete 80.5 km•h\(^{-1}\) at a set speed of 8 km•h\(^{-1}\) to cover the distance in the fastest possible time. Respiratory variables (V\(_{O_2}\), V\(_{CO_2}\), Cr, and RER) were measured via indirect calorimetry every 16.1 km* at a set speed of 8 km•h\(^{-1}\). Running speed and heart rate were continually monitored throughout the 80.5 km•h\(^{-1}\) TT. **RESULTS:** Average run time to completion was 7 hrs 28 min 9 sec ± 1 hr 25 min 12 sec at a mean speed of 10.8 ± 1.5 km•h\(^{-1}\). V\(_{O_2}\) increased by 21.8% from the start to completion (31.19 ± 2.89 vs. 38.0 ± 6.41 ml•min\(^{-1}\)•kg\(^{-1}\) respectively), while RER decreased from the start to 32.2 km•h\(^{-1}\) whenupon RER plateaued. There was a significant increase of 24.2% in Cr (P<0.001) from the start to completion of the TT. **CONCLUSION:** The current study indicated adjustments in V\(_{O_2}\), Cr and substrate utilisation during an 80.5 km•h\(^{-1}\) Treadmill TT. Results indicated a shift to fatty acid oxidation as a main fuel source over a bout of 80.5 km•h\(^{-1}\), which corresponded with the increase in Cr. These findings may influence pacing strategies and overall success of performance in ultra-endurance events.

**Wednesday, June 24, 2015 1:00-1:45 pm**

**The Development and Initial Assessment of a Novel Heart Rate Training Formula**

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**PURPOSE:** To present the initial data behind a running gait-determined training heart rate and the resulting 180-Formula as an exercise intensity guide. **METHODS:** In Group 1, 223 male and female non-injured, experienced adult runners underwent extensive clinical evaluation and running gait analysis to determine the highest heart rate associated with an optimal running gait. Athletes were assigned a training heart rate using the methods above, while 39 controls maintained their previous weekly mileage at or below their assigned heart rate. Pre and post-study 5 kilometer races were performed on certified courses. In Group 2, 38 participants were assigned a training heart rate using the methods above, while 39 controls maintained their previous weekly mileage at or below their assigned heart rate. The described training method and corresponding 180-Formula appear to be a safe and effective gauge of exercise intensity. The target heart rate training method studied here deserves further exploration in endurance athletics and rehabilitation.

**In-task Assessment of Psychological Changes during an Ultramarathon Race**

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**PURPOSE:** 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 two 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 (i.e., 0 to 10). **RESULTS:** Full data sets were collected from 10 runners. Compared to runners who finished the race, nonfinishers reported higher scores for pain and fatigue at 10 miles. Finishes 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 half-way 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.

**Medical Care and Runner Characteristics at a 161-km High Altitude Ultra-Endurance Run in Colorado, 2014**

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**PURPOSE:** To examine reported medical events, medical care provided, runner training and experience characteristics at a high altitude ultramarathon run. **METHODS:** Medical personnel reported all significant events to the Race Medical Director during and after the event. Significant medical events were followed up after the race by either the Medical Director or another race medical provider. 74 runners completed an online post-race questionnaire regarding their experience during and after the run, training characteristics, medication use, hydration and fueling strategy, injuries during both the run and in prior ultramarathons. Associations between the medical problems experienced during the race and the runner’s hydration, training, and experience were examined. **RESULTS:** 54% of runners reported >10 161-km races, 51% had more than 20 years of running experience, and >75% had more than 7 years of ultramarathon experience. Years of running and years of running ultras were not significantly associated with any of the medical outcomes. Peak training miles per week was significantly negatively correlated with shortness of breath (r=-0.316). 50% of racers drank to thirst only, 39% on a time schedule and 16% by urine color or amount. The most frequent medical problems experienced during the race were nausea and vomiting (37%), blisters (34%), and shortness of breath (24%). 23 racers reported using pain medication during the race, mainly NSAIDS. No definite serious altitude illness was reported despite the high altitude during much of the race. No runner received intravenous fluids during or after the race. **CONCLUSION:** This group of experienced runners appeared to tolerate high altitude within the race, by report. Medical issues were largely minor in nature. Running altitude did not correlate strongly with reported symptoms. More study is needed, at
this distance and altitude, regarding runner acclimatization practices, serum sodium, body weight and ADH levels as relates to hydration strategy and the possible effects of NSAIDS on the development of altitude illness.

Utility of Urine Dipstick for Detecting Runners with Acute Kidney Injury Following a 161-km Ultramarathon

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PURPOSE: To evaluate the incidence of acute kidney injury (AKI) during the Leadville 100 ultramarathon held at high altitude (2800–2800m) and the utility of urine dipstick at detecting AKI. METHODS: This was a prospective observational study. Blood and urine samples were collected from voluntary athletes before and immediately after the Leadville 100 mile race in August 2014. RESULTS: Post-race dipstick urinalysis was done on 70 runners (51 finishers) and a post-race blood sample was obtained from 84 runners (61 finishers). Both pre-race and post-race samples were collected from 37 participants which were included in the analysis. AKI was defined as a serum creatinine increase (≥1.5 times or ≥0.3 mg/dl from baseline) according to Kidney Disease: Improving Global Outcomes (KDIGO) Group. Eighteen runners (48.6%) met the criteria for stage 1 AKI. Using a binary logistic regression, the only factors statistically correlated with likelihood of AKI were runners who lost more weight at the finish line and male gender (p<0.05 and p=0.05, respectively). Age, race time, race completion status, use of NSAIDs before or during the race, BMI, and post-race creatine kinase and sodium levels were not correlated with presence of AKI. Using urine appearance (color ≥4 out of 8 or not-clear) or specific gravity (≥1.025) criteria predicted those meeting the stage 1 AKI criteria with sensitivity of 81.3% and specificity of 37.5%. Using urine protein of at least 1+ predicted those meeting the stage 1 AKI criteria with sensitivity of 43.8% and specificity of 87.5%. CONCLUSIONS: Incidence of stage 1 AKI was relatively high in this ultramarathon. There was a higher rate of AKI among those who lost more weight at the finish line and male runners. Urine dipstick may be a useful screening tool for AKI. We thank the Leadville Race Series. Funded in part by the ACSM Clinical Sports Medicine Endowment Grant.