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Acetazolamide Use and Effects of Acclimatization on High Altitude Ultramarathon Performance

Peter D. Marshall, MD, Morteza Khodaei, MD, MPH, and John C. Hill, DO. Affiliation: University of Colorado School of Medicine, Denver, CO.

Purpose: To estimate the frequency of acetazolamide use and other acclimatization practices in participants in a high altitude ultramarathon. The Leadville 100 mile Trail Run is a 100 mile (160.9 km) ultramarathon in Leadville, Colorado. The 50 mile out-and-back course ranges in altitude from 9,200 ft (2,804 m) to 12,600 ft (3,840 m). Of the forty-four 100 mile ultramarathons held in North America it ranks the 2nd highest.

Methods and Study Design: We distributed an anonymous, self-administered survey to all runners the day before the race. Major variables included information about acetazolamide or other altitude-adjustment medication use, altitude which runners lived and trained at over the past 6 months, arrival time in Leadville, prior race completion, goal finishing time, age, and gender. Out of 415 participants, 375 (90%) voluntarily gave us their bib number to track race results for secondary analysis.

Results: Out of 477 runners, 415 responded (87%) to the survey. Average age was 43.8 years. 82% of participants were male. Only 8 out of 188 people (4.3%) who lived at <5,000 feet used acetazolamide. Four of them (50%) finished the race in under the 30 hour cutoff compared to 154 (43.1%) of those who did not take acetazolamide or other medications (P = 0.76). Secondary variables found to positively correlate with finishing included: residing at altitude >5,000 ft (P = 0.015), prior completion of the race (P = <0.001), and male gender (P = 0.017). We found no relationship between age and finish time (P = 0.106).

Conclusions: In this high altitude event, the reported use of acetazolamide was low. Male gender, prior race completion, and residing at altitudes above 5,000 ft correlated with a better finish time in the race.

Significance of Findings: Our data provides insight into factors which correlate with decreased ultramarathon finishing times. Despite literature supporting the use of acetazolamide for primary prevention of altitude illness, the reported use among ultramarathoners at this prominent high altitude race is low.

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<td>Title</td>
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<td>Authors</td>
<td>John D. Baldea, Morteza Khodae MD, Sourav K. Poddar MD, John C. Hill DO, FACSM, Jennell Johnson MD. University of Colorado Denver, Denver, CO. Email: <a href="mailto:John.Baldea@ucdenver.edu">John.Baldea@ucdenver.edu</a></td>
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**PURPOSE:** Leadville Trail 100 is a 100 mile (160.9 km) ultramarathon in Leadville, Colorado. The course ranges in altitude from 9,200 ft to 12,600 ft. Our project was designed to determine the training patterns utilized by participants in a high-altitude ultramarathon, to estimate the usage of NSAID's by these participants, and to compare these variables to race performance.

**METHODS:** We distributed an anonymous, self-administered survey to all runners the day before the race during registration. Major variables included age, gender, training programs, frequency and duration of training, length of the longest training run in miles, use of NSAID's, altitude of residence and of training over the past 6 months, arrival time in Leadville, prior race completion, and goal finishing time. Out of 444 participants, 336 (75.7%) volunteered their bib number to track race results for secondary analysis.

**RESULTS:** Out of 444 runners, 351 (79.1%) responded to the survey. Average age was 43.3 years (range 21-71). Males comprised 82.1% of participants. Average training altitude was 4,997.6 feet, participants trained an average of 5.2 days per week, and the average longest training run was 51 miles. Respondents received training recommendations from numerous sources, but the majority (51.7%) trained based on personal experience. NSAID's were used before and/or during the race by 39.7% of respondents. There was no statistically significant correlation between age, gender, time of arrival at event location, duration of training, altitude of training, medication use, and actual race finishing time. There was a statistically significant relationship between altitude of residence and finishing time (p = 0.025), finishing goal and finishing time (p < 0.001), length of longest training run and finishing time (p = 0.007), and frequency of training per week and finishing time (p = 0.006).

**CONCLUSIONS:** In this high altitude ultra-endurance event, the altitude of the participants’ residence, their finishing goal, the length of their longest training run, and their frequency of training correlated with a better finishing time in the race. Over 1/3 of the participants reported using non-steroidal anti-inflammatory medications, and there was no statistically significant correlation between any medication use and finishing time.

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Influence of Training Patterns and In-Competition Weight Changes on Race Performance During a High-Altitude Ultramarathon

Rebecca A. Myers, MD, Morteza Khodaei, MD, MPH, Justin Lee, MD Jason Glowney, MD, John Hill, DO, and Douglas Yeakel, MD.

Affiliation: University of Colorado Department of Family Medicine, Denver, Colorado.

Purpose: To study training patterns and weight changes during a 100-mile (160.9 km) ultramarathon in Leadville, Colorado, with course elevation 9200 to 12 600 ft (2804–3840 m).

Methods and Study Design: An anonymous, self-administered survey about training patterns was distributed to all runners the day before the race. Runners were weighed pre-race, at the 50-mile point, and the finish line.

Results: Out of 501 participants, 496 (99%) completed the survey. The majority were male (421; 84%) and had never completed this race before (318; 63.5%). The mean values for competitors were: Age, 42.9 years (range, 21–72); Residence Altitude, 3780 ft (1152 m); Training Altitude, 4928 ft (1502 m); Training Time, 8 months; Training Days per Week, 5.2; and BMI, 23.2 (range, 17.0–36.6). Mean weight loss was 5.7 lbs (2.6 kg; 3.5%) of pre-race weight at the mid-point (50 miles) and 1.3 lbs (0.6 kg; 0.8%) at the finish line. Performance was categorized by distance the runner was able to advance or their finish time. About half (274; 54.7%) were able to finish. There were 188 visits to aid stations by 155 different runners (30.9%), and 5 people needed referral to ED. Factors that were positively correlated with race performance were not visiting the aid stations ($P < 0.001$), lower pre-race weight ($P < 0.001$), lower pre-race BMI ($P < 0.001$), younger age ($P < 0.001$), prior race completion ($P < 0.05$), and more training days per week ($P < 0.005$). Runners who did not finish lost more weight at the 50-mile point ($P < 0.001$) and were more likely to visit aid stations ($P < 0.005$). Among finishers, those who lived and trained at higher altitudes had better finish times ($P < 0.005$ and $P < 0.001$, respectively).

Conclusions: Age, pre-race weight, BMI, finishers’ residence/training altitude, training days per week, prior race completion, and weight loss at the 50-mile point significantly affected performance.

Significance of Findings: Weight fluctuation is significant during an ultramarathon, and serial weight checks may guide athletes’ fluid management.