



## Carbohydrate/Electrolyte Replacement Beverages

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Taking frequent drinks replenishes fluid lost through sweating.

Firefighting in a wildland setting, like any other activity involving intense physical exertion for long periods of time, exposes the person to substantial carbohydrate depletion and electrolyte loss, as well as fluid depletion through the process of sweating. Studies on the subject have shown that, while fluid replacement is the critical need, carbohydrate and electrolyte replacement benefits the worker, enabling greater sustained work output, especially when frequent breaks and meals are lacking. As this is a common condition on the fireline, the Missoula Technology and Development Center (MTDC) has studied the problem to determine if carbohydrate/electrolyte replacement beverages currently available are necessary to the firefighter on the line. Brian J. Sharkey, Ph.D., a leading authority on heat stress and health hazards associated with wildland firefighting, has this to say on the use of carbohydrate/electrolyte replacement beverages:

*"Commercially available carbohydrate/electrolyte (C/E) beverages have become popular as fluid replacements during endurance sports such as running, cycling and the triathlon. The beverages provide carbohydrate (glucose, sucrose, glucose polymers) replacement to sustain energy output, and electrolytes*

*(sodium, potassium) to replace those lost in sweat. Of course, the main ingredient is water, to replace fluid lost as sweat."*

He further states, "As noted in the MTDC booklet on heat stress, water is the crucial need for firefighters, especially since energy and electrolyte needs can be replaced with regular meals. Glucose snacks (candy) can be used to maintain blood glucose levels between meals. And well-planned meals provide for electrolyte needs via ample sodium (salt in food and use of the salt shaker) and potassium-rich foods (citrus fruits, bananas)."

*"However, studies show that workers are more likely to drink lightly flavored beverages, thereby insuring adequate fluid intake, and C/E beverages can help maintain energy and work output during long periods without food or snacks. A recent review of the need for C/E beverages in military operations suggests that C/E beverages may be useful when workers:*

- lose more than 8 liters of sweat daily
- are not heat acclimatized
- are performing a prolonged, continuous exercise bout (over 60 min.)



- skip meals, have meals interrupted or lose appetite
- experience a caloric deficit in excess of 1,000 cal/ day
- are ill with diarrhea.”

“Therefore, it would seem prudent to use C/E beverages when sweat losses are high; in the early stages of heat exposure; during prolonged heat stress; when meals are not available; and as an energy/electrolyte supplement for fluid-loss illness. Management solutions could include:

- distribute packets of C/E drink mix for use in special cases
- supply a portion (e.g. 25-50%) of fluid resupply via C/E beverages
- provide access to C/E beverages at all meals.”

“Available research does not identify one product or class of product as best suited for firefighter needs. However, C/E beverages which contain glucose polymers (clumps of glucose) provide more energy per liter. Generally speaking, use higher carbohydrate concentrations for energy (7.5-10 grams/liter), and lower concentrations (2.5-5 grams/liter) when fluid replacement is critical (e.g. in extremely hot conditions).”

Recent research indicates that urine production is reduced and fluid retention enhanced when fluid replacement beverages include some electrolytes. This insures a better plasma volume for cardiac output, and more water for temperature regulation via sweating. During work in the heat, workers can lose in excess of 1 liter of sweat per hour. Along with ample replacement of water, C/E beverages could help insure greater fluid intake, supplement energy needs, and insure electrolyte replacement. However, there is no need to substitute C/E beverages for water as the primary form of fluid replacement.”

In conclusion, Dr. Sharkey finds that C/E replacement beverages shouldn't replace water as the primary source of fluid replacement, but can provide a beneficial effect for wildland firefighters. The firefighter is more apt to drink a flavored beverage, and the fireline is one place where regular meal schedules are uncertain, so the firefighter could see some benefit by drinking C/E replacement beverages. Sharkey suggests that powdered concentrates would be the best form to carry in the field. That way the firefighter can dilute the drink to whatever strength personal taste dictates, and any supplemental carbohydrates and electrolytes ingested by the firefighter could help maintain prolonged work performance.



Powdered sport beverage mixes are a convenient source for carbohydrates and electrolyte supplement.



Pull-up tops for the standard canteens will soon be available, enabling the firefighter to drink without removing the cap.



Firefighters can share a drink without chancing the transmission of infection.

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