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CALORIE AND FLUID REPLACEMENT DURING TRADITIONAL ALPINE CLIMBING

This is a very important seminar topic for the traditional mountaineer. Hard hiking, long distance backpacking, scrambling, snow climbing, and summiting peaks are endurance sports similar to long distance running, adventure racing, bicycling and Nordic skiing. Calorie and fluid replacement is a basic requirement in the endurance sport of alpine mountaineering.

Basic to advanced:
I hope I can help some folks with the basics with this writing, and get others to want to learn for themselves, more than I can briefly cover here. I know that most folks will never experience severe dehydration and they will never really BONK because they will not want to *or have to* push their endurance that far.

You will need this information:
However, almost everyone runs the risk of getting lost, having to run from a storm, getting hurt or having to return exhausted from a difficult summit and they may have to go beyond their comfort zone, indeed calling on all of their mental and physical reserves. Twice, I have observed severe dehydration requiring twenty-four hour re-hydration in hospitals and several times I have observed folks BONK and I have come very close to it myself more than once.

And certainly, this basic information on calorie and fluid replacement can help the traditional mountaineer at any level, to hike and climb better, be more comfortable and to have more fun.

What happens when I become dehydrated?
While few climbers may die of dehydration, even a 3% drop in optimum hydration will cause a serious drop in mental ability, balance and physical performance. A muscle dehydrated by 3% looses 10% of its contractile strength and has an 8% reduction in speed. Dehydration of 5% can cause a 30% decline in performance according to Mark Twight and James Martin in their book *Extreme Alpinism.*

What happens when I run out of fuel (bonk)?
Depletion of the essential chemical fuel glycogen stored in the big leg muscles, can slow the fastest, most gifted and conditioned endurance athlete to a wobbly walk. Perhaps you saw the favorite female marathoner in 2004, leading, slow to a walk at about 20 miles and wobble over in tears to sit on the curb as bystanders watched in quiet respect.

What exactly is "energy"?
The uninformed refer to "energy" in a simplistic way, saying, "I ran out of energy". Many folks confuse "energy" with say, the effects of caffeine, saying silly things like "here chew this coffee bean, it will give you energy". Energy is sometimes perceived to be a state of mind: "She is energetic!"

Energy results from the burning of fat and glycogen in the presence of oxygen in a muscle:
Energy is "useable power" according to the dictionary. The bio-chemical reactions that enable the big muscle contractions of traditional mountaineering are fueled by the "burning" of glycogen alone (anaerobic), or by burning a combination of glycogen and fat in the presence of oxygen (aerobically). A byproduct of these large muscle contractions is heat.

Fat stores can be seen:
Fat fuel stores on the body are easily seen and are sometimes enormous. Genetically, males carry their fat in and on their bellies, while females tend to store fat on their hips and thighs. (Marilyn Monroe had genetically placed fat cells that emulated real muscle and that may have looked great to some for a short while.)

Glycogen stores are limited and unseen:
Glycogen fuel stores are very limited and unseen, stored mainly in molecular strings ("g-strings") within the muscles themselves. The amount of glycogen stored in the muscles can be enhanced to a limited degree by training and the by manipulating the ingestion of carbohydrates. Being able to store large amounts of glycogen in the leg muscles is mainly a genetic gift (like so many other things).

Where does glycogen come from?
Carbohydrates (complex or simple) ingested into the stomach become glucose to be carried in the blood stream and stored in the form of glycogen in the liver for the use of the brain and core body functions and in molecular strings inside the muscles. The working muscles cannot utilize stored liver glycogen; the liver will not give-up it's glycogen to the working muscles. Glucose can be dripped in solution into the blood stream under the supervision of a medical doctor.

What is "bonking"?
Bonking is a popular name for a serious condition caused by running out of the stored glycogen in the large muscles that are used for endurance activities like traditional mountaineering.

Fat stores are virtually limitless:
Typical body composition of 15% fat provides the 150-pound climber with 22.5 pounds of fat. This is 78,750 calories of fat, enough fat fuel for many typical weekend peak climbs. (One pound of fat in the body contains 3,500 calories of stored fuel.) Fat is hard to digest and need not be replaced on say, a weekend climb in the North Cascades. Consuming a can of Vienna sausages (250 calories, 70% fat) with your macaroni at the evening meal has benefits related to eating enjoyment and staying physically warmer at night due to the on-going heat producing chemical reactions of digestion and a higher rate of metabolism during the extended period needed to get the fat processed out of the stomach and into the bloodstream for distribution to the genetically placed fat cells, and is not necessary for fuel replacement.

Glycogen stores are limited and are easily depleted causing The Bonk:
While the fat stores of the average climber are virtually limitless, the glycogen stores of even the most gifted and trained athlete can run out easily. Runners back in the pack often "hit the wall' at about 20 miles into a marathon and drop to a wobbly walk. Bicycle riders can "bonk" at perhaps 80 miles of a century ride and crash trembling and weeping on the curb. Everest climbers (and traditional mountaineers) can bonk on the summit after a long approach and become unable to descend.

Anaerobic climbing quickly depletes glycogen stores:
Anaerobic climbing can quickly deplete the finite glycogen stores, because in the absence of oxygen, mainly glycogen is burned in the muscles. A byproduct of anaerobic metabolism is lactic acid. The build up of lactic acid in a muscle will cause it to cease to function. Short busts of anaerobic climbing followed by short rests which may be required by a less gifted, older, less experienced or less conditioned climber trying to "keep up" should not be permitted as it can put the climber and the group at risk from a serious bonk because his/her stored glycogen has run out.

Muscles should burn about 70% fat and 30% glycogen in aerobic climbing:
The glycogen stores must be replaced before the climber can continue at more than a minimal pace. Fat does not metabolize "or burn" in the absence of oxygen and available glycogen. Optimum fuel consumption by a trained individual in an aerobic state (able to talk with you) is about 30% glycogen and 70% fat by calories.

Eating carbohydrates as you climb can avoid The Bonk:
Carbohydrates consumed while mountain climbing go directly through the blood stream to fuel the working muscles. Marathon runners cannot munch on a bagel as they run along during a race. Bike riders can munch on bagels, bananas and more as they ride. Adventure racers eat carbohydrates constantly. Traditional mountaineers can eat a ClifBar or the equivalent each hour to replenish their glycogen as they hike and climb, set belays and scope the route.

The ClifBar is about the right mix of carbohydrates and protein:
The ClifBar contains a good mix of carbohydrates, protein, fat and other nutrients to refuel the climber. The latest research shows that it is important to ingest a little protein with your simple and complex carbohydrates to aid in their utilization. Sophisticated adventure racers know the Glycemic Index of their simple and complex carbohydrates to completely manipulate and control their continuous refueling.

Gorp contains unnecessary fat:
GORP is a traditional mix of Good Old Raisins and Peanuts, often called "trial mix" with the addition of M&Ms and more fancy nuts and fruits that are often cooked in oil, rather than dried (check the required label on those banana chips. What's "wrong" is that GORP and "trail mix" are mostly FAT. We need to replace burned carbohydrates not fat. We all carry plenty of fat; some carry several months supply of fat.

Gorp cheats the climber of carbohydrates:
A climber who stuffs down 200 fat rich calories of GORP per hour may be getting only 50 calories of needed carbohydrates. Studies show the climber should eat at least 200 calories of carbohydrates per hour. A typical ClifBar contains 240 calories of fuel including only 35 calories from fat. We read on the Nutrition Facts Label that 40 of the total calories are from protein. Swig a little Gatorade or Gookinaid and your carbo replacement plan should be right on the target of 200 calories per hour of hard mountain climbing.

Tips of the month:
ClifBars are not hard to peal if you snip the edge of the foil when you pack them and they tend to not break your teeth unless frozen very hard. Carry them in your pockets.

Replace your glycogen as you climb and within one hour after stopping:
Did you know that there is a window of perhaps only one hour, after hard climbing activity stops, to eat carbohydrates and some protein to optimally replenish the specific muscle glycogen that has been burned? This is an established fact well known to today's serious endurance athletes around the world. This enables them to train hard for hours every day, day after day.

Food eaten after one hour will take 24 hours to replenish the large muscles:
Food eaten after this one-hour window will take up to 24 hours to replenish the glycogen lost from specific muscles! You must eat mainly carbohydrates and some protein as soon as you stop or you will start climbing 8 hours later with less than a full tank of glycogen. (Perhaps this is why PCT through hikers who set up camp and take photos, then eat before sleeping, slowly "wear down" and must take a rest day to catch up.)

Read the label on your freeze-dried dinner:
Note: Beware the outrageous claims on the front of your dinner package of freeze-dried food. Look at the FDA required Table of Nutrition Facts on the package! You may find your big hungry-man dinner contains only a few more calories than a ClifBar! You will usually find that most of the freeze-dried dinner calories are from fat and you are being shorted on the carbohydrates that your muscles must have in order to utilize the available fat you already store.

You must drink when you eat:
How does the ClifBar get from the stomach to the blood stream for distribution? The stomach does this amazing work bio-chemically, as it dilutes the food with fluid. Where does the fluid come from? Either from a couple of good swigs of water or Gatorade carried by the climber or from the climber's blood stream, thus temporarily dehydrating and thickening his blood. The thicker and more dehydrated the blood, the less efficient it is in distributing the chemicals and oxygen needed for work.

Bottle or bladder?
You must drink a good amount of water as you eat the ClifBar or your body will divert blood from work to digestion. It seems to me, that if you have been sipping water compulsively from a bladder on your back that you will need to over-drink when you stop to eat. I am not a fan of bladder drinking; I want to see what and how much I am drinking. I am sure a lot of bladders are pretty gnarly on the inside.

Analyze your hydration requirements:
Serious athletes often weigh themselves before and after the race or game. The weight loss is mainly water lost from respiration and sweat. The hydration lost from heavy rapid breathing and sweat loss depends in part on the conditioning of the athlete and mainly on the intensity of the work and on the temperature and moisture content of the air. Adventure racers plan carefully to have maintained their starting weight when they have finished a long practice run.

Dehydration in traditional mountaineering:
Traditional mountaineers usually climb in very dry and often very cold air. They have learned to carefully regulate sweating by actively managing layers of clothing, so as not to become wet from sweat and vulnerable to heat loss and hypothermia when the climbing activity stops. However, a lot of heavy breathing and a little sweat loss can add up to a lot of dehydration.

How much water is needed?
Mark Twight and James Martin in Extreme Alpinism, suggest climbers must drink 5 to 6 quarts of water in a 12-hour climb, and note that even this may only provide 50% of the hydration that is theoretically required. Since it is often practical to carry only 2 or 3 quarts (4 to 6 pounds of starting water weight), it is necessary to carry a pot, lid, stove and fuel to replenish our favorite Nalgene water bags from snow. It is also possible to catch significant water from snowmelt trickles in the spring and summer. Few peaks have nice streams running from the summit. Don't eat the snow, it will take many calories to warm the water to body temperature. Put it in the wide-mouth top of your winter Platypus or Nalgene water bags.

Drink and drive!
This may be a good place to suggest that folks Drink and Drive. Often, traditional mountaineers drive many hours to get to the trailhead. It is advisable to drink water and to eat as you drive. Also, always insist that everyone drink as much as they can just as they leave the car. Leave a water bottle in the car to start the re-hydration as soon as the adventure is over. Don't drive impaired by dehydration!

Hydration for Wildland Firefighters:
"As an EMT I have often been assigned to rehydrate firefighters at fires. Needless to say we go through many gallons of water and Gatorade. This is such an important survival activity for firefighters that there are now new and updated Federal regulations for rehabilitating exhausted dehydrated men and women of the fire service. These regulations stress pre-hydration (Drinking liquids before a strenuous event) in addition to rehydration after the event. I have incorporated this into my outdoor activities.

Prior to hitting the trail I take several big swigs of water. This is in addition to the generous supply of water in my pack. I always have an extra water bottle in the car so that I can replenish my liquids as soon as I return from the hike. (One more thing about those Federal regulations; they make it very clear that beer is not an acceptable rehydration fluid.)"
-- John Edison, quoted from The Mountaineers website in August 2009.

Re-hydration can take 24 hours:
It can take more than 24 hours to rehydrate a person. In a hospital setting, fluid can be dripped directly into a vein. One cannot drink a lot of water and become re-hydrated in a short time. It just will not work. The excess fluid is just sent (from the bladder?) to the bladder.

Hydrate on the approach:
In the Cascades, often a long approach is required to reach the final climb to the summit. There is lots of available water along the way. Unfortunately, it is often necessary to make the water "potable" or risk serious illness. (Potable water is drinking water; Sterile water requires long boil times and special filter

systems. Backpacking filters provide Potable water. Do not use it for transfusions, operation, etc.) The **PUR Hiker filter** has been the standard for weight, ease of use and compact user-friendly design providing lots of potable water, for many years.

Katadyn Mini filter:
Katadyn, a German firm well established worldwide, has acquired PUR. At the Outdoor Retailers Summer Market, a Katadyn sales manager recommended I use their Mini filter. It is much lighter and smaller than the Hiker and it has a cleanable ceramic filer element. The ceramic filter will last much longer than the Hiker filter, I was told. The Hiker has a paper filter that I have had to replace each season at a high cost. It seemed to grow moss even though I washed and pumped it in Purex and stored it disassembled. **However, the Pur Hiker filter puts out a lot more water than the Mini. If there are two of you, carry a Mini and a Hiker.**

Tablets are not practical:
Some folks say they use special tablets to make their water potable. Unfortunately, it takes from a half to one hour for the tablets to work in a liter of water and the colder the water, the longer it takes. I do not want to wait and I do not like the chemicals. While they are cheaper and easier to carry than a filter, I do not think tablets are the answer. I use a filter. Perhaps the tablets are a light and fast emergency backup, OK as long as you never have to use them.

Melt snow for water high on the mountain:
High above the water line, I depend on a friendly snow bank for water. I carry a two-quart pot and lid and my favorite stove the **MSR Dragonfly**. Why? Because the Dragonfly can be turned down to a simmer while we are eating and drinking. It does not have to be restarted for each pot of snow. This is group equipment and the weight can be broken down to pot and lid, stove and lighter and fuel and fuel bottle. Personally, I try to carry the heavier fuel. It might not hurt to have a backup stove, say the MSR Micro and a canister of special MSR gas. Some suggest carrying a filter to purify the melted but not boiled snow.

Not finished as yet!
Figure out what is best for you and your trip and stay carborated and hydrated. I plan to return to this topic soon to make corrections and additions. Email your comments to: info@traditionalmountaineering.org . Thanks!