Considerations in meal and nutrition planning for improved performance in trans-oceanic singlehanded sailing races.

Andrew Evans sailing Foolish Muse, Victoria, Canada

This paper should be considered as an addendum to chapter 15 of my book Singlehanded Sailing; Thoughts, Tips, Techniques & Tactics[i]*. In that chapter I completed a study on maintaining a winning attitude for the duration of a long distance singlehanded race.*

Singlehanded sailors, like all racers, are very quick to spend hundreds or thousands of dollars for miniscule percentiles of improvement in boat performance and speed. They will swap out polyester halyards for Dyneema to eliminate a few inches of stretch or replace sails with the latest composites to improve shape. Every year equipment manufacturers encourage skippers with the latest improvements to their products, always with the promise of better performance.

In 2012, I completed a study on racers in the Singlehanded Transpac[ii] that showed a very clear problem; lethargy, to a greater or lesser degree, is felt by all skippers. When asked the question: "What percentage of time did you feel lethargic?" Answers typically averaged up to 70% at day 4 of the race, and then fluctuated around the 50% range for the remainder for the following 3 weeks. The similar question "What percentage of awake time were you in the zone of sailing, able to concentrate on trimming, helming, etc and not get distracted by other things?" The vast majority answered less than 50% of the time, with the overall average at just 35%. Finally, to the question "If you had been in the perfect racing frame of mind and had sailed as fast as possible with your abilities, could you have increased your 12 hour average speed by 0 knots, 0.1 knots, 0.5 knots, 1 knot, 2 knots?" The majority of less experienced skippers indicated potential speed increases of 0.5 knots or 1 knot, with a substantial number at 2 knots.

It is abundantly clear from these results that the mental frame of mind of singlehanded skippers is playing a massive role in their speed and final race result. Although the mental state of skippers is the result of a number of discrete factors, I believe that, as with any other athlete in any other sport, appropriate meal and nutrition planning can have a significant positive impact, resulting in better speed and better placement by those who make a serious effort in this regard. So while singlehanded sailors will spend hours polishing their hull to a glossy shine, they should also spend hours on their own nutritional requirements with the specific goal of improving racing performance.

(Note that all of the studies referenced in this paper are properly conceived and undertaken scholarly studies, as opposed to "TV Doctor" pop-culture. All of these studies are available on the internet and readers are encouraged to use the references at the back of the paper to complete further research. Also note that the term "significantly" is used throughout this paper, particularly in terms of study results. This refers to "statistically significant" which has specific,

calculable measures and meanings. Thus if a result says “significantly reduced fatigue” it does not mean that the singlehanded skipper is going to swing from a sleeping zombie to a dancing fool. Rather, “significantly” means that the measured results of the study, when taken over the population of the study, showed a small but measurable improvement.)

We will start by looking at the various components of a standard meal plan, with specific interest in how these impact on energy, fatigue and lethargy:

Carbohydrates and Fibre:
There are two types of carbohydrates, simple and complex. Foods that are high in simple carbohydrates are known to cause a rapid rise in blood glucose levels followed by a corresponding rapid rise in blood insulin levels. Insulin helps the muscle cells extract glucose from the blood, which in turn causes a sudden drop in blood glucose levels.

The glycemic index of food is a measure of how much that food increases the blood glucose level. Foods that are high in simple carbohydrates have a high glycemic index, meaning a high rate of absorption of glucose in the stomach with resulting high blood glucose levels. Complex carbohydrates have a lower glycemic index and are digested much more slowly than simple carbohydrates. Thus they do not cause such a rapid rise in blood glucose.[iii]

Pasman et al[iv] compared hunger, satiety and mood in men after eating breakfasts of simple (S-CHO) versus complex (C-CHO) carbohydrates. The breakfasts were approximately 425 Calories each.

- S-CHO: white bread, low fat margarine, fruit flavoured cereal and milk.
- C-CHO: rye bread, low fat cheese spread, currant bread and low fat margarine.

At 30 minutes after breakfast, glucose levels and insulin levels were significantly higher in the S-CHO subjects

At 3 hours after the breakfast, subjects were asked to complete a Profile of Mood States (POMS) questionnaire. This is a test of 65 statements. For each, the subject can answer “not at all”, “a little”, “moderately”, “quite a bit”, “extremely”.[v] In this study, there were statistically significant improvements in depression, anger, fatigue and vigour as a result of eating the complex carbohydrate meals.

A study by Smith et al[vi] looked at the similar topic of fibre. Fibre is a type of carbohydrate that the body does not digest. Though most carbohydrates are broken down into sugar molecules, fibre cannot be broken down and instead passes through the body undigested and helps to regulate the body’s use of sugars.[vii]

They used a sample of 142 men and women from 30-80 years of age eating high (29%) fibre, medium (15%) fibre or low (3%) fibre breakfast cereals. At the end of each week the subjects completed a fatigue questionnaire and reported on digestive symptoms.

Of note is that during the first week, the high and medium fibre subjects reported indigestion, pain in the bowels and bloating. However these symptoms were reduced by the second week. This would indicate that singlehanded racers should initiate a high fibre diet several weeks before the start of a race.

Of interest for our purpose is that ratings of fatigue were significantly lower for the duration of the test for the high and medium fibre subjects. Smith reported "The correlational results showed that a high fibre intake is associated with less fatigue, emotional distress and fewer cognitive difficulties." Reduction in fatigue was in the range of 10%. This result was apparent for subjects who had just started on the high or medium fibre diets, and also for subjects who had normally partaken of high fibre diets prior to the study.

From the above studies, we can see that complex carbohydrates and high fibre can significantly reduce fatigue in singlehanded racers.

Protein:

Zeng et al[viii] studied the influence of protein on fatigue. Subjects were served a high protein "HP" breakfast of 5:3:2 (5 parts protein, 3 parts carbohydrates, 2 parts fat) compared to a control breakfast of 1:7:2. The carbohydrate portion of the meals was of medium glycemic index.

Eating the HP breakfast resulted in a significantly higher satiety (fullness) over the following 4 hours than the AP breakfast.

Mood and alertness was measured using a self administered questionnaire assessing how subjects "feel at the moment." Subjects were asked to rate 15 items in relation to their mood. The items were clustered into 5 dimensions of negative effect (depressed, unhappy and queasy), positive affect (happy, well and cheerful), informational uptake (fascinated, interested and uninterested), arousal (calm, nervous and agitated) and alertness (tires, sleepy and awake). The answers were given on a 5-point rating scale. The results of the study showed positive effects on mood, informational uptake and alertness.

A "Continuous Performance Test" is a tool to test task vigilance and distractibility by allowing subjects to react to letters appearing for just ¼ second on a computer screen. The HP breakfast resulted in a statistically significant rise in the hit rate of the subjects and a decline in false returns.

The study made note of two issues. First, there was an additional 0.4°C raise in body temperature after the HP breakfast. Because the brain is very sensitive to changes in conditions, it is postulated that this increased temperature might have led to the desirable results shown. It has been reported that cognitive function is improved by increasing body temperature slightly above the 37°C norm. Second, the study noted that young healthy men (the subjects) are less sensitive to nutritional variables than older people, so the observed effects might be even more pronounced in middle aged singlehanded sailors.

From this study, singlehanded sailors can infer that a breakfast high in protein will result in less fatigue and a better reaction time than a high carbohydrate breakfast.

Fat:

A.S. Wells et al[ix] completed a study comparing alertness, mood and concentration in meals of high fat as compared to either just water or high carbohydrates. There were two parts to the study: In Part 1 the nutrition fat was introduced directly into the stomach through a tube in the nose and compared to simple saline water introduced in the same manner. In Part 2 the nutrition was eaten normally, with the fat or carbohydrates disguised into lasagna with identical taste and texture characteristics and with identical protein components. High fat lasagna calorie ratio: 64% fat, 18% carbs, 18% protein. Low fat lasagna calorie ratio: 7% fat, 75% carbs, 18% protein. (The study paper does not indicate whether the carbohydrates were simple or complex, however a medium range is assumed.)

Measures of mood and alertness were rated by each subject at hourly intervals throughout the day. Sustained attention was measured by means of a test with sustained demands on the capacity to pay continuous attention. This test will show if the subject is able to maintain speed and accuracy of performance in a complex mental task.

Results: For Part 1, (fat versus water) the subjects reported feeling significantly less alert as a result of the fat infusion when compared to the water. This result was irrespective of the time of day. For the sustained attention testing, the results were similar; the subjects receiving fat were unable to maintain efficient attention whereas the subjects receiving water were able to maintain attention into the final block of trials.

For Part 2, the fat versus carbohydrates lasagna study, the results were less significant, but still indicative. By 2½ hours after lunch, the decline in alertness was more evident in the high fat group versus the high carbohydrate group. The high fat group also were less cheerful, with no difference in calmness reported. For the sustained attention test, both the speed and accuracy of responses were harmed by the high fat meal; there was a sharp decline in accuracy between the 1st and 2nd testing blocks, followed by a leveling out of results. For the high carb group, the decline in results was more gradual.

Cunliff et al[x] found similar results. He separated fatigue into two divisions: Peripheral fatigue is represented by impaired capacity to perform work, as indicated by muscle function testing; Central fatigue is experienced more as a diffuse sense of weariness originating at the level of the central nervous system. For our purposes, we are more concerned with the "central fatigue" that is stopping a singlehanded skipper from actively racing the boat. The study compared 400 Calorie meals of pure fat (vegetable oils), pure simple carbohydrates or a control meal of 55% carbs, 30% fat and 15% protein. The meals were all delivered as milk shake type drinkable.

Central fatigue was measured using a Flicker Fusion Frequency (FFF) testing, in which an LED light is flickered very rapidly (200 times per second, which is invisible in normal circumstances). The flicker rate is slowly reduced until the subject reports seeing the flicker. It is known that increased fatigue is accompanied by reductions in FFF score, i.e. by a slower flicker rate being noticeable.

Results: Both the fat and carbohydrate subjects showed a significant decline in FFF score compared to the control (balanced meal) group. In addition, the FFF scores of the fat meal subjects were significantly lower than the carb subjects.

However, Peripheral fatigue results were reversed, with the fat meal group having statistically higher grip strength than the carb meal group.

It is often discussed that there are "good fats", such as polyunsaturated, and "bad fats" which are saturated. However, this differentiation does not appear in the above studies. In terms of fatigue, both have equal effect. The terms "oil", "fat" and "lipid" are often confused. "Oil" normally refers to a fat with unsaturated fatty acid chains that is liquid at room temperature, while "fat" may refer to fats that are solid at room temperature. "Lipid" is the general term which includes both.[xi]

I believe that after looking at the above studies, we can conclude that meals high in fat content will result in greater central fatigue.

Unfortunately many of the freeze dried meals that are appealing to singlehanders because of simplicity of preparation are also very high in fat content.

- Mountain House eggs with bacon breakfast: 56% of calories from fat
- Alpine Aire scrambling omlet egg mix: 58% of calories from fat
- Mountain House beef stroganoff dinner: 38% of calories from fat
- Alpine Aire creamy beef with noodles dinner: 38% of calories from fat

These meals might be perfect for hiking in the mountains where the user is highly active, but they do not seem appropriate for a singlehanded sailor who is sitting in his cockpit hour after hour.

However, if we look carefully we can find freeze dried meals that are low in fat content:

- Mountain House chicken breast & mashed potatoes dinner: 17% of calories from fat
- Alpine Aire homestyle beef gravy with mashed potatoes dinner: 13% of calories from fat
- Alpine Aire mountain chili dinner: 7% of calories from fat

Other items should also be looked at for fat content:

- Eggs: 74 Calories - 54% from fat
- Whole grain bagel: 340 Calories - 7% from fat
- Tuna in water: 6%
- Lean ground beef: 35%
- Canned salmon: 38%
- Uncle Ben's Instant Brown Rice: 9%
- MREs: 38% from fat

Many sailors snack on bags of nuts through the day. However nuts are also very high in fat (up to 50% of calories or more). These studies would show that this high fat level is not appropriate for reducing fatigue. However, a trail mix of nuts, raisins, dried fruit, etc might fall into the low fat range that we are seeking. It is important for the skipper to closely examine the nutritional facts on the package of every food taken onboard.

Beef jerky, turkey jerky or pork jerky can be good sources of protein. However once again the skipper is reminded to closely examine the nutrition label on the package. Often, beef jerky has up to 50% or more of the total calories from fat. Krave Jerky (amongst others) makes several low fat varieties. They bake, rather than dehydrate their meats to achieve fat levels of just 15% which is well within acceptable ranges.

From the above figures we can see that some freeze dried meals or MREs can be bad on their own, while others can be fine. While a breakfast of bacon and eggs will have an unacceptably high fat content, a breakfast of 2 eggs with a whole wheat bagel is fine. Likewise a tin of salmon is high in fat, but a dinner of salmon with brown rice will have an overall low fat content.

Caffeine:

Coffee is a contentious issue for sailors. Many singlehanders do not take any caffeine during a race as a matter of principle. However, significant research has shown that this attitude might be mistaken.

Sharwood et al[xii] completed a lengthy study on long-haul truck drivers in Australia. The results were startling: Nearly half of drivers reported consuming caffeine (coffee, tea, tablets, energy drinks) for the express purpose of staying awake. These drivers who consumed caffeine had an amazing 63% reduced likelihood of accidents compared to drivers who did not take caffeine. Sharwood concludes that "the use of caffeinated substances could be a useful adjunct strategy in the maintenance of alertness while driving."

A study by De Valck and Cluydts[xiii] found similar results, in particular for drivers who were sleep deprived. They compared drivers using slow release caffeine or a placebo with 4½ hours of sleep against drivers with 7½ hours of sleep. Driving performance was measured on a simulator. Again, the results were startling; in the 4½ hour sleep group, the caffeine counteracted the increase in lane drifting and resulted in lower speed deviation and accident liability. Even under the more optimal conditions of 7½ hours of sleep, caffeine led to performance improvement, albeit to a lesser extent. "The beneficial action of caffeine on driving performance was observed 1 hour after administration and was still present after 5 hours."

I think that long distance trucking is the closest real world comparable to singlehanded sailing. Thus from these studies, singlehanders can conclude that caffeine can reduce fatigue and improve reactions and overall performance. A 2014 study by Souissi et all[xiv] showed that even after 36 hours of sleep deprivation "caffeine is an effective strategy to counteract the effect of 36h of sleep loss on physical and cognitive performance."

However, we want to guard against caffeine spikes and subsequent crashes. So when we speak of caffeine intake, we are not talking of the 20oz Starbucks Vente. Rather, we should go back to the 1970's, when a cup of coffee really meant a cup, i.e. 8oz. A study by Ruxton[xv] concluded that the range of caffeine intake that appeared to maximise benefits and minimise risk is up to 400 mg per day, equating to 4 cups of coffee or 8 cups of tea. Likewise a study by Gonzalez et al[xvi] looked at slow release caffeine compared to quick ingestion: The results suggest that the rate of caffeine absorption following time-release ingestion was slower and more sustained over 8 hours, which may prolong the effects of caffeine and limit the acute crash state. Thus it is better for the skipper to drink several 8 oz cups of coffee spread throughout the day. If 8 oz is not enough of a nice hot drink, then perhaps 16oz mugs of black tea would be better, giving the same amount of caffeine. I keep a thermos of coffee handy in the cockpit and have several small cups during the day. Of interest, research suggested that habitual coffee drinkers appeared to experience greater improvements in cognitive or mood effects compared to non-drinkers, which is surprising as tolerance would be expected to blunt the effects. This was even the case when the caffeine was given as tablets, rather than in coffee or tea.

Caffeine is often thought of as a diuretic, leading to net fluid loss through urination. But this has proven to be a myth, particularly at moderate consumption levels.[xvii] The most valid published

studies offer no support for the suggestion that consumption of caffeinated beverages as part of a normal lifestyle leads to fluid loss in excess of the volume ingested. Therefore there would appear to be no clear basis for refraining from caffeine in situations where fluid balance might be compromised.

I do not offer the same level of support for caffeinated energy drinks such as Red Bull. These drinks are loaded with sugar, the most simple of simple carbohydrates. An 8oz Red Bull contains 27g of sugar, nearly 7 teaspoons full.[xviii] Likewise some coffee drinkers put 4 or 5 teaspoons of sugar into their mug. Both of these situations will only lead to the fatigue problems of simple carbohydrates mentioned elsewhere in this paper. A study by GE Gilles et al[xix] offered a similar opinion: "The cognitive effects of glucose (i.e. sugar) were limited to slowing reaction time.... " However, in particular at study by Mainauskis et al[xx] looked at students who used energy drinks to stay awake. Amongst subjects who used 3 or more cans for one situation (such as studying for a major test) 57% suffered jolt and crash episodes (an increase in energy followed by a sudden drop in energy) as well as headaches and heart palpitations.

Ginseng:

Ginseng is known to have some level of positive impact on patients with chronic fatigue[xxi], idiopathic chronic fatigue[xxii] and cancer[xxiii]. However, 2015 research[xxiv] notes that patients with chronic fatigue face a 1.3 fold higher baseline blood levels in total reactive oxygen species, and fourfold higher levels of malondialdehyde, another oxidative stress marker. Panex ginseng significantly deceased blood levels of total reactive oxygen and other markers of oxidative stress compared to the placebo after four weeks of treatment. Thus it is considered that ginseng acts as an antioxidant for patients facing oxidative stress. However, there appears to be little or no evidence that ginseng offers any benefit to healthy patients, even when sleep deprived. (Sleep deprivation does not lead to oxidative stress.) AJ Hartz et al[xxv] noted "overall efficacy was not demonstrated." And Lieberman[xxvi] noted "the evidence that ginseng has such properties is exceedingly weak."

Vitamin B3, Niacin, NADH:

Nicotinamide adenine dinucleotide (NADH) offers the most interesting results to singlehanded sailors. Marketed under the brand names ENADA or ENADAlert, this non-prescription supplement has passed through two properly performed scholarly trials:

Margaret Moline et al completed a study on the effectiveness of NADH in alleviating effects of acute sleep deprivation in healthy middle-aged adults.[xxvii] In the study, 25 healthy men and women, aged 40-59 were tested. During each laboratory session, subjects underwent complete sleep deprivation for one night. The next morning, at 30 minutes past their usual wake-up time, they were then given either 20mg of ENADAlert or a placebo. One hour later they were given subjective ratings of alertness and mood, cognitive assessment and objective sleepiness

measurements. Despite the level of sleepiness detected, subjects taking NADH demonstrated superior cognitive test performance without noted side effects. "Subjects who received NADH performed significantly better than subjects who received placebo on measures of cognitive and psychomotor functioning.... NADH may have an important role in mitigating the effects of unavoidable sleep deprivation."

A study by Kay et al[xxviii] looked at the effect of NADH on sufferers of jet lag, in my opinion a condition much like fatigued singlehanders face. 35 subjects were flown on the overnight "red-eye" from the US West to East coasts. On arrival, they received either 20mg NADH or a placebo. They then completed computer administered testes to assess changes in cognitive functioning, mood and sleepiness in the morning and afternoon. The results: Jet lag resulted in increased sleepiness for over half the participants and deterioration of cognitive functioning for approximately one third. Subjects experienced lapses of attention in addition to disruptions in working memory, divided attention and visual perception speed. Individuals who received NADH performed significantly better performance on 5 of 8 cognitive and psychomotor test measures and showed a trend for better performance on the other three measures. Subjects also reported less sleepiness compared with those who received the placebo. Conclusion: NADH significantly reduced jet lag-induced disruptions of cognitive functioning with no adverse side effects.

A non-scientific test had 6 people going clubbing for three consecutive nights. It noted that "The NADH[xxix] definitely took the edge of everyone's tiredness. About half of us felt a strange sense of well being and a generally brighter outlook on the day. The NADH was noticeably different from caffeine; no feelings of being wired and no crash at lunchtime."

NADH is a form of vitamin B_3 commonly referred to as niacin. It is a coenzyme that enhances or is necessary for the action of all enzymes in the body. A deficiency of NADH will result in an energy deficit at the cellular level, which causes symptoms of fatigue. The more NADH a cell has available, the more energy it can produce. Unfortunately, the production of NADH in our bodies declines as we age, and so does the production of NADH-dependent enzymes, particularly those enzymes involved in energy production.

Vitamins and Iron:

A study by CF Haskell et al[xxx] looked at cognitive function and mood/fatigue in women during a multi-tasking situation. Those who took the multi-vitamins showed a reduction in the negative effects of an extended task on mood/fatigue. Multi-tasking performance across this group was also improved in terms of accuracy across all tests, with both faster and more accurate results. The study concluded that healthy members of the general population may benefit from augmented levels of vitamins/minerals.

Iron supplements are widely recognized to reduce fatigue in patients with anemia. However, there is little evidence that iron on its own will help to reduce fatigue in healthy patients. A study by Verdon et al[xxxi] found that women with unexplained fatigue may benefit from iron supplementation, but the effect may be restricted to women with low or borderline serum ferritin concentrations.

So while we cannot offer specific evidence to recommend iron supplements for normally healthy singlehanded sailors, we can recommend that all skippers undertake a normal multi-vitamin with iron regime for at least one month prior to a race in order to ensure that they have reached peak levels of all necessary vitamins and minerals. During my own study of the 2012 Singlehanded Tanspac,[xxxii] one of the tested subjects was requested to undertake such a program. His reported results for energy and lethargy were vastly better than any of the other skippers in the race. With only one subject, this was obviously not a scientific study, but it is indicative that good general vitamin and mineral levels should be considered a prerequisite to every race.

Amphetamines and pharmaceutical solutions:

Several prescription pharmaceutical drugs are available to combat lethargy, such as amphetamines, methylphenidate or dextroamphetamine**.** I have not examined these for two reasons; first I consider singlehanded sailors to be athletes and subject to the same anti-drug use rules facing all athletes. Second, when looking at amphetamines, I came across the statement "The author describes the histories of 13 persons who committed homicide while intoxicated with amphetamines. In most cases the events leading to the homicidal act were directly related to amphetamine-induced paranoid thinking, panic, emotional lability, or lowered impulse control."[xxxiii]

Singlehanded sailors are facing some of the toughest emotional states possible. As mentioned elsewhere in the book, we are subject to lengthy bouts of crying, hallucinations, and from our experience with Donald Crowhurst, even suicide. Thus I believe that adding a substance that might possibly increase these tendencies would be nothing short of foolhardy.

Water:

Water is the simplest and most accessible method of combating fatigue for the singlehanded racer. Numerous studies have been published showing the negative impact of extreme dehydration suffered by long distance athletes or in combat situations. But we are more concerned with the impact of mild dehydration, of the level of simply not drinking enough water during a normal sailing day. Two studies covered this topic in particular.[xxxiv] Both of these used 40 minutes of walking on a treadmill at just 5-6kph to simulate mild exercise. The results of the studies were essentially identical for men and women: Mild dehydration in men induced adverse changes in vigilance and working memory, and increased tension/anxiety and fatigue; in

women, degraded mood, increased perception of task difficulty, lower concentration, and headache symptoms resulted from 1.36% dehydration.

It is easy for us to understand the necessity for water once we are sailing in the tropical heat. But we must recall that singlehanders face the greatest level of fatigue during the first days of the race, when we are still leaving France during a Trans-Atlantic or still leaving San Francisco during a Trans-Pacific. The weather is likely to me much cooler, the seas much rougher, and the winds much more on the bow. It will be necessary to force ourselves to drink more liquids than we might think in these cold, wet conditions in order to combat fatigue at its strongest point.

Of course hydration can come from many sources beyond simple bottled water; coffee, tea, herbal teas, hot chocolate are good sources in cold waters. Oranges, apples, any other juicy fruit or vegetable, including my favorite carrots (which will also improve your night vision[xxxv]) are excellent sources of hydration and fibre. In hot weather, it would be best to stay away from sugary drinks loaded with simple carbohydrates. I use Crystal Lite to flavour water and make it easier to drink numerous bottles each day, even if not with ice. Studies have not shown any fatigue impacts from artificial sweeteners.

Heat:

Singlehanders pass through the very hot tropical regions in both Trans-Atlantic and Trans-Pacific races. Several studies have proven the energy sapping nature of heat, particularly with regard to seamen working below decks on naval vessels in tropical regions.[xxxvi] Ellis found "according to psychological tests, sedentary watch keepers, stripped to the waist and engaged on semi-automatic semi-skilled work, such as Morse code reception, are less efficient when the basic effective temperature is somewhere between 27.2°C and 30°C." He went on "lethargy, mental retardation, reduced powers of concentration and sense of responsibility, irritability and mild changes in personality and forgetfulness." It is because of Ellis's work immediately following WWII that naval vessels, including nuclear submarines, are now equipped with air conditioning.

Thus, we are left to understand that reducing heat is not simply a matter of comfort, but will actually produce a more alert, more efficient and overall better singlehanded racer. Unfortunately, races normally cross the Tropic of Cancer at the very time of year when the sun is directly overhead, making shade from the sails impossible during the hottest part of the day. The skipper should consider additional means to provide shade, such as an awning or beach umbrella. At the very least, sunscreen with zinc or titanium dioxide particles actually reflects sunshine away from the body and has a measurable cooling effect on the skin.[xxxvii]

Timing of Meals:

A 1997 meta-study by Robin Kanarek[xxxviii] looked at the timing of meals on subsequent performance tasks. Paraphrasing these findings:

Breakfast: Recent studies suggest that breakfast intake can influence cognitive behavior in adults. University students who did not eat breakfast did more poorly on memory tests, free recall and recognition memory tasks. Furthermore, marginal pre-existing nutritional deficiencies may make individuals even more susceptible to the adverse consequences of skipping breakfast.

Lunch: Observation and experimental studies have established that consumption of a mid-day meal can impair mental functioning. Reductions in alertness and efficiency are observed shortly after lunch relative to morning or late afternoon hours. For example, errors by shift workers, falling asleep while driving and lapses of attention by locomotive engineers reach a maximum at approximately 14:00. Laboratory testing has shown feelings of lethargy and decrements in performance in mental tasks following lunch. Lunch intake did affect performance on vigilance, memory tasks and mood. Subjects typically report decreases in feelings of alertness and anxiety and an increase in fatigue. In contrast, subjects who abstain from eating lunch describe feeling more alert and anxious in the early afternoon than they had in the late morning.

The impairment caused by lunch appears to be related to the size of the lunch compared to the subject's normal lunch size. Subjects who ate a larger than normal lunch made more errors on attention and search tasks than those who ate similar or smaller than normal lunches. Similarly, performance improved to a greater degree after the small lunch of subjects who typically ate a heavy lunch than in those who typically ate a light lunch.

Snacks: Subjects responded significantly faster on attention tasks and remembered more digits in a memory test when they had consumed a high-energy snack than when they had drunk a no-energy soft drink.

Supper: After 1-3 hours, subjects who ate a standard evening meal reported feeling stronger, more proficient and more interested and performed better on a logic reasoning test than subjects who did not consume supper.

From these tests, we can conclude that breakfast and supper are important for improved performance, while only a light lunch, or two or three mini-lunches should be eaten, followed up with afternoon snacks.

Meal Planning:

I do not intend to prescribe specific meals. However, from my interviews with other skippers, and my own experience, I can make a few general assumptions.

First, convenience is vital. For many skippers any effort greater than boiling water would be unacceptable. Dehydrated meals are a mainstay of the Mini Transat and Singlehanded Transpac races. However we have learned above that typical purchased dehydrated meals are created for

hikers who are burning tremendous amounts of energy on their walks, and are not subject to the fatigue facing singlehanders. Thus I believe that skippers would be well served to create their own dehydrated meals.

Virtually any good food can be dehydrated, including low fat meats, vegetables, legumes, complex carbohydrates like whole wheat pasta, (and instant brown rice has already been dehydrated.) Instead of purchasing off the shelf meals, skippers should dehydrate and vacuum pack their own breakfasts and suppers. There are many websites that provide instructions on this process. Only in this way will singlehanders get meals that are custom built for us.

Second, a large mouth thermos with a handle is a must. Any dehydrated meal can be dumped into the thermos. Add a cup or two of boiling water and in 10 minutes dinner is served.

For the long day, including the most fatiguing 2:00pm slot, a number of small snacks are preferable to a meal. Skippers often mention nuts, but these are high in fat. A variety of foods, including trail mix, oranges, apples and jerky meats would be better.

Finally, all studies assume that the subjects want to work during the day and sleep at night. This is not necessarily the case for singlehanders. There is nothing wrong with planning a 1 hour sleep at the 2:00pm slot, or any other time on the clock. There is nothing wrong will falling asleep at 10:00pm and waking for a couple of hours at 2:00am to sail in the squalls of the tropics. Each skipper is working with his own circadian rhythms, and should adjust his meal and nutritional requirements to best meet his own needs.

Conclusion:

Serious singlehanded racers have gone to incredible lengths to improve the performance of their boats. This study has shown methods of improving the performance of their own bodies in the area of greatest concern to our group – fatigue, with the same expected result of an overall increase in speed and improved race ranking.

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