Important Warning!

Energy Management And CFS: The Art Of Doing More By Doing Less - Or At Least By Doing It Differently

First, a question: What is the body's preferred energy source? Now I understand that the average person won't have a clue, but those who have been educated by our current health and fitness revolution flavour will loudly and confidently say "glucose". Glucose is a good answer, but it is wrong! In fact any answer could be wrong because the question is incomplete. There is no "purpose" specified in the question. To be meaningful the question should be "what is the body's preferred energy source for a 400 metre run (answer - glucose) or 20km walk (answer - fats) or a power lift (answer - ATP/Phosphate)". The "educated" response to this imprecise question highlights a massive problem in our society; we are surrounded by too much information. So much so, that it is easier just to apply set solutions to problems rather than analyse the problem to find the most appropriate response. This information overload also plagues Chronic Fatigue Syndrome (CFS) knowledge and research.

Several papers[1] have specifically identified "aerobic[2] glycolysis" as the faulty energy pathway in CFS. We want to use this information to improve our lives with CFS but before we can do that we need to see where aerobic glycolysis fits in the body's scheme of energy production. We need to "bed it in", in context, with knowledge of the body's energy sources and systems for energy production. We also need to bed it in with the body of "common knowledge" experienced by almost everyone with CFS. I will not put forward any sort of theory as to what causes CFS. All I have mentioned is a faulty energy source that there is very strong evidence to support and no claims have been made that this experimental observation is the absolute cause of CFS.

The body has three major fuel sources and four major methods of extracting energy from the fuel. It is inappropriate to call any of them the "preferred" energy source or energy production method without specifying a purpose. If one were genuinely superior to the others than the body would stop wasting its efforts with the inferior and concentrate only on the superior. The body is a masterpiece of design and all the energy sources and energy production methods have purpose. We can only have a very quick review of the energy

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[1] Wong R Lopaschuk G Zhu G Walker D Catellier D Burton D Teo K Collins-Nakai R Montague T *Skeletal Muscle Metabolism in the Chronic Fatigue Syndrome. In vivo assessment by 31P nuclear magnetic resonance spectroscopy.* In: Chest (1992 Dec)

[1] McCully KK Natelson BH Iotti S Sisto S Leigh JS Jr *Reduced oxidative muscle metabolism in Chronic Fatigue Syndrome* In: Muscle and Nerve (1996 May)

[1] Riley MS O'Brien CJ McCluskey DR Bell NP Nicholls DP *Aerobic work capacity in patients with Chronic Fatigue Syndrome* In: BMJ (1990 Oct 27)

[2] Aerobic literally means "with air". Anaerobic literally means "without air". In both cases the vital ingredient in the air is oxygen. Aerobic energy production uses oxygen, anaerobic does not.

sources and production methods, but this is all we need. From the least amount of total energy stored to the most, the energy stores and methods are:

ATP/Phosphate (Adenosine Tri-phosphate and creatine phosphate) - This is the energy store that can be most rapidly converted into energy. At maximum effort this can be depleted in as little as three to six seconds. To release energy these molecules give up phosphate atoms and release electrons. The parent molecules are then recycled and recharged by taking up the phosphate molecules and electrons again. The energy for this recharging comes from the other energy systems. One advantage of this energy store is that it is rapidly regenerated during short periods of rest (measured in seconds).

Glucose - This is the most complex system we need to cover. Glucose is not stored in the body directly but is first converted into "glycogen". Glycogen is stored in the muscles and the liver and is easily converted back to glucose when the need arises. As an energy source glucose can be exhausted in as little as four or five minutes (an elite 1500 metre runner will fully exhausts the local muscle supplies in this time). Glucose is converted into energy by two distinct processes. The first process is called "anaerobic glycolysis". In this process glucose is quickly but incompletely broken down (without oxygen) to release energy. The waste product of this process is further processed and turned into lactic acid. Lactic acid causses the muscle "burn" that is associated with high intensity activities. Anaerobic glycolysis is inefficient in terms of total energy extracted from the fuel. The advantage is that the process is very quick and releases a large amount of energy in a short time.

The second process involving glucose is much more efficient. This process is called "aerobic glycolysis". In this process glucose undergoes the same processes as in anaerobic glycolysis, but then the incompletely broken down glucose is not converted into lactic acid but is moved into an additional long series of chemical reactions. This total process releases more than five times the energy of the anaerobic process alone. The difference between the processes is that because of the much longer series of chemical reactions the aerobic process releases energy more slowly than the anaerobic process.

Fats - This is the easiest system to understand. Fats are transported from the body's fat stores into the muscles and by a long series of reactions similar to the second phase of aerobic glycolysis, "burnt" with oxygen to release energy. This process is called "Beta metabolism" and it has the drawback of being the slowest of all systems when it comes to releasing energy. With the amounts of fat stored on even a slim individual, energy production from fats is often considered "inexhaustible".

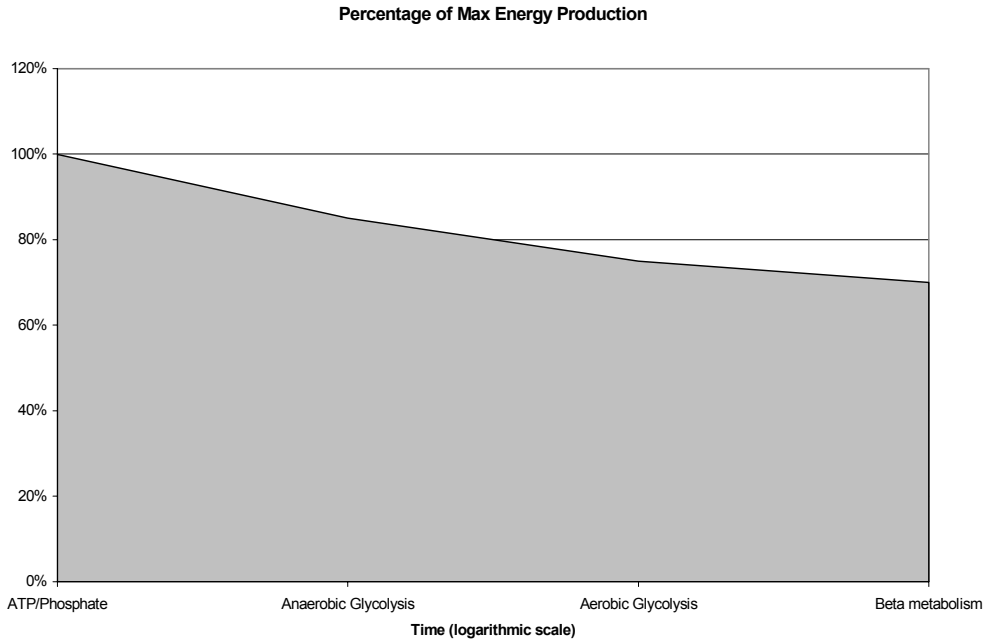
That is enough about energy sources and production methods. The common knowledge we need to consider is not controversial. In particular we are referring to the following observations –

When your CFS is acute or you are having a relapse any exercise seems to make your condition worse. The only exercise or activity that can be recommended here is to go immediately to bed and staying there until you improve. Also, when you are "well" moderate exercise such as swimming or moderate walking can cause a relapse in as little as five to ten minutes[3]. Somewhat perversely, some forms of exercise that would normally be regarded as "intense" or "strenuous" such as unloading a trailer full of boulders, may not cause problems at all. If you have not experienced this for yourself it will be hard to believe, but it is true.

[3] For this article we are defining "moderate exercise" as exercise that makes considerable use of aerobic glycolysis and "low level" or "low intensity" exercise is where the vast majority of energy comes from Beta metabolism (the fat stores).

When we combine the established experimental results with the common knowledge we gain the first piece of information, which is really useful. We can reasonably infer that not only is aerobic glycolysis "faulty" as is shown by a reasonable number of experiments but also some aspect of this type of exercise actually causes a CFS sufferer to relapse.

Now a graph of maximum energy production Vs energy production method may look a little like this



These types of graphs are often used by athletes to achieve maximum performance. Take the example of a 100-metre sprinter. At the start, the first three to six seconds they are being powered mainly by energy from the ATP/Phosphate system. By the end of the race (ten - twelve seconds) it will be energy predominantly from anaerobic glycolysis. If our athlete is turning in a poor performance this chart may show what needs improvement. If acceleration and starting speed is poor we can deduce that training aimed at improving the whole ATP/Phosphate system would help[4]. If the start is good but the athlete is run down in the latter stages than we know to emphasise training that improves anaerobic glycolysis.

What this particular chart is not good at showing is that there is considerable overlap between the sources of energy production. For example in our 100 metre race, at the two-second point the ATP/Phosphate system may be producing the most energy but there is also some energy production coming from the anaerobic glycolysis system. As the 100 metre race continues anaerobic glycolysis becomes even more prominent. Well before any system is depleted there is significant activation of the next available system. This gradual changeover occurs with all the energy production systems and most significantly for CFS sufferers this includes a change over with the anaerobic glycolysis and aerobic glycolysis systems. This is a limitation we have to bear in mind.

Like the athlete, we can use the graph too. Rather than maximum performance, our need is to avoid exercise the draws on aerobic glycolysis as much as possible. The simplest approach is that if you are faced with a task that requires a moderate level of exertion, by breaking the

[4] This assumes that technique and the other aspects of sprinting are satisfactory.

task down into components of no more than thirty to sixty seconds it is possible to complete more of an activity than otherwise possible. After each "work" component it is necessary to rest for two or three minutes which means the task will take more time but the benefit is there is much less negative effects from the activity - if you want to you can do it all again tomorrow. As an example activity, if hanging out washing is causing problems, taking a chair to sit on and working for only a minute at a time and then sitting for two or three minutes for rest will allow you to complete the job with little or no ill effects. It takes longer but you can get the job done compared to maybe not being able to complete the task and suffering ill effects for hours or days latter.

This graph also suggests why a strenuous but short duration activity might not cause problems; strenuous type activity uses the ATP/Phosphate energy systems[5] almost exclusively.

There is one more thing that can be done for a CFS sufferer and that is to turn the entire thinking process and the graph upside down. Think again of the sprinter. When they are sitting around waiting to be called to the blocks, what is the major source of energy? The answer is fats. Fats and the beta metabolism involved don't cause problems like aerobic glycolysis.[6] The body is a cross between a lazy and an efficient organism. If it can, it will use the most efficient method of energy production possible with the fuel that has the maximum availability, this means beta metabolism from fats. We can apply this to many activities including the most basic - walking.

The energy for normal walking comes from a combination of beta metabolism (fats) and aerobic glycolysis. We want to avoid aerobic glycolysis as much as possible and we can do this by the simple method of dawdling. By deliberately walking at half or even a third of the pace that normally seems comfortable to you[7] allows you to travel much further with far fewer negative effects than from comfortable walking. Everyone has concentrated on "maximum performance" so graphs of maximum energy production similar to the one above have held the spotlight in out thinking. This has clouded out other possibilities. Fats will almost exclusively provide the energy for low intensity activities such as a slow walk. Of course it takes more time but if you allow for that you can do more with fewer side effects. Learning to dawdle is actually quite hard to do in or hurry up, instant world.

A short summary -

Strenuous activities will not cause problems only if the duration of activity is very short (four to five seconds absolute maximum) and there is a period of recovery of at least ten to 120 seconds between exertions.

Moderate activity will always cause trouble unless the task can be modified in one of two ways. Either keep the periods of exertion to less than a minute and allow at least two to three minutes for recovery between exertions or go much slower and turn the activity into a low intensity activity - lower than what would normally seem comfortable to you even with CFS.

Low level activity which makes extensive use of Beta metabolism can be considered safe unless you are in the acute stages of CFS or having a relapse. In those situations you should only try to get as much rest as possible.

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[5] This is referring to picking up and putting down in a few seconds with a pause of a several seconds between exertions. This is not picking up and carrying the boulder for a significant period time.

[6] If it did than CFS sufferers would live constantly in a state of relapse.

[7] Comfortable to you with CFS, not your pre-illness pace.