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College Reading and Writing

March 11, 2008

An I-Search with Hate as a Motive

¿Por qué? (That's Spanish for "why?")

This I-Search, as previously stated, is motivated by hate. A hate for the feeling you get when, a day after lifting for the first time in recent memory, you wake up and can barely move. The topic was an easy choice for me as the day this essay was introduced I had barely been able to make it to class due to the hellish pain in my legs. As possible topics were suggested to the class I realized that one thing I really want to know was "why the heck am I so sore right now?" This question lead me to my goal for this paper which is to figure out a way to stop myself from ever being sore again. I realize, of course, that never being sore again is a ridiculous goal that I will never accomplish but, nonetheless, I would like to be able to at least reduce my soreness. This is especially important because both the clubs I am a member of (UNI ultimate Frisbee team and the D4NC track club) will be stepping up training after spring break to gear up for the finales of their seasons. The practices from these two clubs tend to run back-to-back which ends up putting a lot of strain on my legs; I am hoping that the research for this paper will help to reduce the effects of the heavy strain on my legs.

What I Already Know.

I don't really know much at all about my topic other than stretching after a workout helps reduce soreness a good deal. I also know that if I were to start lifting weights tomorrow I

would not be able to lift any of my books without severe pain for around a week. To be more technical I know that running/lifting or just using your muscles in general causes lactic acid to build up in them which makes them tired and may affect soreness. I've also heard that when you work out what you're actually doing is tearing your muscles and then letting them heal stronger than they were before. I've also learned that, once over the initial soreness that comes with the first workout, one will generally not get anywhere near as sore from the subsequent workouts (done at the same level of intensity.) As I write this I find myself surprised at how little I know. After choosing this topic I assumed that my research would basically consist of clearing up a few details but, given my lack of knowledge going into my research, it appears I have quite a bit of work to do.

Story of the Search

To begin my search I decided that I would go with a source close to home; a UNI athletic trainer. Athletic trainers had been helping me heal all of my sports related injuries for the last four years of my life so it only seemed logical that I would go to an athletic trainer for a solution to, what is probably, the most common issue facing athletes today. Using my cell phone I called the WRC's front office and inquired if there was an athletic training office that I could possibly get in touch with. Thankfully, there was and the receptionist put me on hold. There was a pause and then music came blasting through my cell phone so loudly that I instinctively moved my hand a good two feet away from my ear. Making sure to keep the speaker a safe distance from my ear I returned the phone to the side of my head and was greeted by the ridiculous sounds of a pop/Latin piano sounding song. The music kept me entertained for the next minute

or so as my anticipation for the upcoming interview grew. Eventually the music stopped and a lady named Amy answered the phone. I asked if there was an athletic trainer I could possibly interview about soreness for a few minutes and she (Megan I later found out) responded "I can probably help." Megan's response worried as she did not sound excited in the least. I pressed on though, hopeful that this interview would confirm what I already believed to be true about muscle soreness. Megan explained to me that the two main causes of soreness were micro-tears in the muscle and lactic acid build-up in the muscle each occurring on a greater scale as the muscle was worked longer. I then asked Megan for ways to prevent soreness and she listed stretching and ice baths as two ways to prevent soreness. I asked for an explanation and she told me that stretching primarily helps with muscle elasticity (if muscles can stretch farther they won't tear as easily) and that taking an ice bath will help your body remove lactic acid from the muscles that get worked thereby decreasing soreness. The interview was concluded at this point and as I hung up I was left with the feeling that I knew more than I initially thought.

For the next phase of my research I decided to conduct a survey to see what methods people used to prevent soreness. Of the thirty people who took part in the survey ten believed that some sort of protein shake or foods high in protein after working out would help reduce soreness. Twenty-five people listed stretching as a way to reduce soreness and three people listed "don't work out" as their method to avoid being sore. As with the results of the interview the results of the survey did not surprise me very much. I was a little surprised at the number of people that believed that protein would help alleviate their soreness; I knew that protein is an important in muscle building but it never occurred to me that it would help get rid of soreness. I reasoned, though, that if soreness was caused by micro-tears in muscles then extra

protein may help rebuild the tears faster. Once I was done analyzing the survey though I realized that to fully understand this issue I would eventually have to start looking into the biological process behind soreness (i.e. understand how muscles tear and how lactic acid is built up in the body.)

To begin my scientific research I went to the one website I am constantly told never to use as a source: Wikipedia. My intent thought was not to use Wikipedia as a direct source but rather use the references that are found and the bottom of most Wikipedia web pages. The first credible source I found was the website for the Scientific American magazine. The article was called "Why does lactic acid build up in muscles? And why does it cause soreness?" by Stephen Roth. The title of the article was promising and seemed to confirm my previous beliefs along with the beliefs of Megan (the athletic trainer.) The article begins by describing the process in which glucose is broken down by the body for energy in the muscles. To produce energy for the body glucose is initially broken down into substances called pyruvate and ATP (energy). As the body works harder it begins to need more oxygen to break down the glucose into pyruvate more quickly (to supply energy to the muscles faster.) Eventually, though, the body cannot supply enough oxygen and begins to produce lactate (or lactic acid) in place of pyruvate. Glucose can be broken down into lactate quicker than pyruvate can be and it can be done without oxygen. The problem is as lactate builds up in the muscles it begins to create an acidic environment in the muscles in which glucose cannot be converted to energy. Lactate can be produced for about 1-3 minutes at high rates before the conversion of glucose (and thereby energy) begins to slow greatly. Once the point is reached where glucose is no longer being

easily converted into energy the muscle begins to have a burning sensation and the workout becomes much more difficult.

“So that explains my soreness” I thought to myself as I read through the article feeling as if I did, in fact, know everything I need to know about soreness. Then I read one fatal line of the article *“Contrary to popular opinion, lactate or, as it is often called, lactic acid buildup is not responsible for the muscle soreness felt in the days following strenuous exercise... Researchers who have examined lactate levels right after exercise found little correlation with the level of muscle soreness felt a few days later.”* (Roth, Stephen). NOOOOOOOOOOOOOO!!!!!! Talk about crashing a party, I read this sentence multiple times before I actually believed what it was saying and still, I was skeptical. I needed more proof than just one article by a professor at University of Maryland! Surely four years of athletic trainers and coaches could not have been lying to be about why my muscles were sore! In his article Roth refers to the muscle soreness experienced 24 hours after exercise as Delayed-Onset Muscle Soreness or DOMS.

From here I continued on without Wikipedia to try and find out what exactly was DOMS. After a bit of research on About.com and WebMD I learned that the soreness I refer to at the beginning of this paper is, actually, DOMS. As it turns out DOMS has been proven to be caused by small microscopic tears in the muscles (good call, Megan.) Though these tears end up occurring with most physical activity studies have shown that eccentric contractions cause the most soreness and therefore the most tearing of the muscles. An eccentric contraction occurs when your muscle is attempting to contract but is being stretched out. Easy examples include: running downhill, the downward motion of a squat and push-up and sprinting can also qualify

as an eccentric contraction. It is also important to note that muscles tears are always more like if the exercise is relatively new to the muscle which explains why after running for the first time in two months walking is a difficult task. As the muscle tears it also becomes inflamed and swells which causes it to be more sensitive than it would normally be. Eventually, if given the proper time to recover, the muscle will repair its' "micro tears" and in fact overcompensate making the muscle bigger and stronger than it was before.

Once I knew what caused DOMS it was time to investigate some treatments. Thankfully, almost every article I found relating to DOMS was, in fact, more specifically about the treatment of DOMS. Based on my previous statement one might assume that I now had a ton of information about the treatment and prevention of DOMS at my fingertips but, sadly, every source at some point said the same thing: nothing has been proven to treat DOMS. Most sources though pointed to promising studies in which warming up before a strenuous physical activity seemed to reduce the effects of DOMS. A number of websites and online journals also stated that a good "cool-down" (a cool down is a 10-15 minute period where the heart rate and body temperature are slowly returned to resting by jogging or just staying moving...generally includes mild stretching, too) after working out is a great way to reduce DOMS but, once again, nothing has been proven. It is also commonly believed that greater flexibility will reduce soreness and athletic performance in general. This seems to make sense as muscles would be much less likely to tear if they were more elastic (capable of stretching farther.) Another option for treatment is anti-inflammatory drugs such as Ibuprofen. The drugs, though effective at diminishing the pain, have not been proven to help muscle growth/healing at all and in fact studies have shown that they may actually slow muscle growth.

With all of my data from the internet collected it seemed like there was only one option left: my own research. Weightlifting has never really been my thing and without a high school sport to keep me motivated I had not touched a weight since April of 2007. Since I had not touched a weight since high school essentially any weightlifting I would do would cause a multitude of micro-tears in my muscles leaving me with one of the worst cases of DOMS I had ever experienced. I set my sights on two lifts that were commonly mentioned in almost all of the articles I read, bench press and squat. Because the focus of this essay was DOMS prevention I formed a plan in which one day I would do a proper warm up and cool down before bench pressing and the next day I would walk into the weight room, sit down (to ensure my legs were in no way warmed up) for two minutes, and promptly start squatting with no warm-up at all. To ensure I did around the same amount of work I began each day by using three lifts to determine what my maximum output would be (ex. 150lbs, 200lbs, 210lbs max.) Once I had determined my maximum I lifted 85% of my max three times and waited a minute until lifting my max as many times as possible; I would then wait a minute and lift my max as many times as possible again to ensure myself plenty of micro-tears. Turns out I'm not as strong as I used to be. After getting over the depressing fact that I am much weaker than I was 6 months ago I began waiting for the soreness to hit. Unsurprisingly, six hours or so after squatting, I began to have trouble getting up stairs. By the next morning I was avoiding stair like death as I had managed to give myself the worst case of DOMS I had ever experienced; I started off the morning by taking four Ibuprofen, this helped for a while but by noon the Ibuprofen had subsided and I had reentered my DOMS hell. The upshot of this was that my chest (muscle mainly worked by bench press) did not hurt anywhere near as badly as my legs. I

would venture to say that my chest actually hurt about half as bad as I thought it would (from previous lifting experience.) My chest pain, though still present and painful, was tolerable and unlike the pain in my legs allowed me to carry on normal everyday activities without too much difficulty.

What I Learned.

The most surprising thing I learned was: lactic acid plays no role in long term muscle soreness. This was so surprising because every coach or trainer I have had made mention to lactic acid as playing a key role in soreness experienced the day after a workout. To answer my question (“why the heck am I so sore right now?”) I now understand that when I workout small microscopic tears occur in my muscles and, along with the inflammation caused by these tears, this causes the hated DOMS. Sadly my search led me to discover that there is not actually a proven cure for DOMS and it seems that most techniques only alleviate the pain caused by DOMS and do nothing to speed the healing of the tears in the muscles. To end on a bright note I did discover that for me a proper warm-up and cool-down before and after the exercise can significantly diminish the DOMS I experience. Lastly I learned that I can write an eight page paper without dying. Actually I have one more thing; I learned that research doesn’t always have to be a long arduous process and, when interesting something that interests you, can actually be enjoyable.

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