The Anti-Inflammatory Athlete

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This book is not intended for the treatment of disease, nor as a substitute for medical treatment, nor as an alternative to medical advice. It is a review of sceintific evidence presented for information purposes, to increase public knowledge of developments in the field of sports. Although the information contained in this book was prepared from sources that are believed to be accurate and reliable, the publisher strongly advises readers to seek the advice of their personal health care professional(s) before proceeding with any changes in any health care program.

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Don't Use NSAIDs

One of the biggest obstacles to sports performance is inflammation and the discomfort and restriction of movement it causes. From Olympic champions to weekend warriors, inflammation from exercise ties you up with pain and stiffness, and slows you right on down. No surprise that many athletes try to combat this inflammation with non-steroidal anti-inflammatory drugs (NSAIDs).

The most potent NSAID is Toradol, **ketorolac tromethamine**, made by Roche. Its use is rife in professional and college sports. In the most notorious study, researchers surveyed the head physicians and the head athletic trainers of the 31 NFL teams. Thirty teams responded, of which 28 reported using Toradol throughout the season, at an average of 15 players per team. Most teams gave their players a weekly injection, and gave most injections

on game day. Most NFL medical staffs believed that Toradol provided 50% to 75% relief from pain that lasted 24-48 hours.[1]

Since that study was so widely publicised, leaving the NFL open to allegations of drug use to improve performance, sports medicine folk have kept quiet about Toradol, likely watching their backs. Others have dared to speak out. In October 2009, for example, Gene Sapakoff, in the **South Carolina Post and Courier** reported details of "rampant" use of Toradol in football teams throughout the country.[2] Toradol use has now spread into college football, hockey, track and field, and running, but is still almost ignored by athletic associations, including the NCAA.

Use of other NSAIDs is rife also. Many athletes ask the Colgan Institute which are the best over-the-counter NSAIDs to deaden pain and reduce inflammation. Usually they want to know about ibuprofen (Advil, Motrin), naproxen sodium (Aleve, Naprosyn), diclofenac (numerous trade names), ketoprofen (Orudis), etodolac (Lodine), celecoxib (Celebrex), or a combination of several.

Many endurance athletes use NSAIDs. In a study of the 2008 Brazil Ironman Triathlon, for example, almost 60% of entrants reported using NSAIDs. Two thirds of these (128 triathletes) used the drugs immediately before or during the race, not to treat current injuries, but to reduce pain and discomfort, and thus improve performance.[3] Other researchers put NSAIDs use at 70% in ultra-distance running.[4] Research shows clearly that NSAIDs mask pain, and, under painful conditions, improve performance. But it's a very bad way to go.

A large proportion of endurance runners mistakenly use NSAIDs to give temporary relief from the inflammation caused by running. They then suffer long-term damage from the drugs that reduce their performance, and prevent them reaching their potential. Much superior to use the strategies in this book to develop a body that is highly resistant to inflammation.

SIDE EFFECTS OF NSAIDS WILL SIDELINE YOU

The big problem with NSAIDs is side effects. They work to reduce pain and inflammation mainly by inhibiting hormone-like chemicals called prostaglandins, in what is termed the **cyclooxygenase-2 (COX-2)** pathway. But they also inhibit prostaglandins in the **cyclooxygenase-1 (COX-1)** pathway, what are called the "housekeeping prostaglandins." These are responsible for multiple protective functions, including protective mucus production and acid control in the gastrointestinal tract. By inhibiting COX-1, all NSAIDs increase gastrointestinal permeability, ulcerate the stomach, and allow bacteria to escape into the bloodstream to cause endotoxemia (bacterial infection in the blood).

As any rheumatologist will tell you, gastrointestinal damage and endotoxemia, are constant problems of NSAIDs that doctors confront

on a daily basis. They have nothing to do with sport. Habitual use of NSAIDs for any purpose, whether it is to improve sports performance, or to treat chronic pain of arthritis or other diseases, doubles your risk of a gastric ulcer. There is little gastrointestinal habituation to NSAIDs. Regular use of NSAIDs also greatly increases your risk of vascular disease, heart attack, and stroke. You remain at risk as long as you use them.[5-8]

For athletes there are even worse effects. Muscle injury during sport, even microscopic injury that you hardly notice, results in tissue death. The inflammatory response enables the body to remove the dead tissue and allow muscle and other soft tissues to regenerate perfectly. But use of NSAIDs inhibits what is called the nuclear-factor Kappa-B system, which is critical for the normal inflammatory process and for recruitment of the immune system in healing.[6] NSAIDs delay removal of the damaged tissue, delay collagen deposition, and delay muscle and other soft tissue regeneration. With habitual use, NSAIDs cause malformed reconstruction of cartilage, tendons, ligaments, and muscles in athletes.[7]

I want to show you how to avoid the inflammation caused by sport without taking NSAIDs or other drugs. The secret in this book is a new nutritional method that grows a progressively anti-inflammatory body. If you follow it, you will develop a body quite different from that you have now. Within one year, you should become highly resistant to the pain and inflammation of sport.

If it sounds fanciful that you can completely change your physiology, you will see ahead that recent research supports it to the hilt. Much of the scientific base behind our new system is covered in my book **Nutrition for Champions**[9]. We have now proven the anti-inflammatory diet with many hundreds of athletes, from weekend warriors to world champions. Join us and become resistant to inflammation for life.

Robert Kipropir Kipchumba, of the Great Rift Valley in Kenya, wins the Xiamen International Marathon in China on 2 January 2011 in 2:08:07. You cannot run like this by using NSAIDs.

2

The Anti-Inflammatory Diet

To improve your cellular resistance to inflammation permanently, you have to adopt five specific dietary strategies.

1. Avoid foods that spike your insulin.
2. Avoid acidic foods.
3. Avoid foods that did not form part of our genetic heritage.
4. Eat a diet high in specific anti-inflammatory foods.
5. Eat a diet high in foods and supplements that support joint and soft tissue repair.

If you were raised in a sweet-tooth family like mine, where jelly doughnuts and ice cream formed the two favorite food groups, these changes to your diet may seem difficult. Once you make them,

however, and maintain them for at least12 months, so that your body has the time required for cell turnover to occur, the enhancement of your sports performance will yield much sweeter rewards.

Inflammation is the natural reaction of your body's immune system (white blood cells and other chemicals) to stress, injury, toxins, or infections. Your immune system mounts a defence by releasing various chemicals that increase the flow of blood and immune factors to the area, causing redness, swelling, heat, and pain. This acute inflammation also causes flu-like symptoms such as fever, chills, nausea, fatigue, congestion, and aching.

In healthy, active people on a healthy diet, acute inflammation goes away as soon as the immune system has done its repair work. In the average sedentary American, on a usual American diet, the inflammation does not go away. It continues to grow, silently, over decades until it causes serious, irreversible disease.

In March 2011, a large collaboration of scientists from many different universities published a review of 97 studies in the New England Journal of Medicine, covering 821,000 people, 52% male, and 48% female. This huge sample and the mass of data analysed, allowed highly accurate analysis. Overall, these studies showed that chronic inflammation causes many diseases, including numerous types of cancer, liver and kidney diseases, and many forms of degenerative disease. Overall, it shortens lifespan by 6-8 years. Chronic inflammation damages health to about the same extent as heavy smoking.[1]

Other recent research shows that chronic inflammation develops to repeated application of many stressful stimuli. One potent stressor

is food that causes a rapid spike in insulin. These foods did not exist when humans evolved. But, because of development of food processing during the last few hundred years, processed junk foods have now loaded our diet.[2] Changes in DNA to suit environmental changes in diet take 25,000 to 50,000 years. Paleontologists call it "the genome gap".[2] Our DNA has had insufficient time to develop the genetic mechanisms to control the processed food that now pervades the marketplace.

Inflammatory spikes in insulin occur in the Western diet primarily from eating processed sugars and starches.[2] You can check the complex biochemical mechanisms by reading my references for this chapter. Simply put, the chronic inflammation develops mainly from two sources. First, processed sugars and starches overwhelm and damage the genetic controls of our insulin system. Second, they cause what are called glycation reactions, in which sugars attach to proteins to form inert masses that interfere with the function of muscles and organs.[3-5]

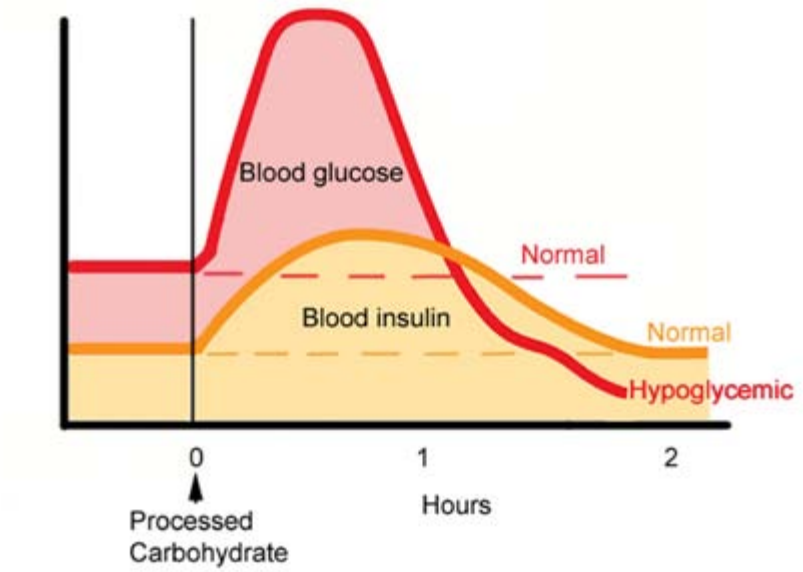
Researchers first confirmed this chronic inflammation that results from spiking insulin in overweight people in the 1980s. Since then, research shows that it is rife in people with adult-onset diabetes, cardiovascular disease, some forms of brain disease, and numerous forms of cancer. Over the last two decades, medical scientists have combined these disorders under an umbrella term, **the metabolic syndrome**.[4,5] The inflammation present in the metabolic syndrome never goes away. It grows progressively worse, interfering with every function of every organ, including the brain, and every movement its victims try to make.

CHRONIC INFLAMMATION IN ATHLETES

Recent studies show that healthy, active people of normal weight also develop chronic inflammation, if they eat a diet high in foods that repeatedly spike insulin. Over years of doing so, their bodies become chronically inflamed, with all the biochemical markers of the start of the metabolic syndrome.[3] When they run, or play sport, their already inflamed bodies react with pain, stiffness, rapid exhaustion, and even more inflammation.

One of the strongest markers of chronic inflammation is **C-reactive protein (CRP)**, now adopted as a measure of inflammation of the heart that is more accurate than lipid profiles. The body makes CRP from a powerful inflammatory chemical of the immune response called **interleukin-6 (IL-6)**. IL-6 is a key communication molecule. It tells the body's immune system to produce many other inflammatory substances. As blood sugar levels spike, so does insulin, and so do IL-6 and CRP. High CRP is incompatible with sport.

CRP does not occur in foods, but levels in your body are strongly influenced by processed sugars and starches. A recent review of many studies, by renowned expert on carbohydrates and disease, Simin Liu, of Harvard Medical School, found that people who eat a diet of high-glycemic carbohydrates, all have high CRP levels.[2,3] These foods include almost all breakfast cereals, white bread, baked goods, and white rice. We measure CRP in all athletes who come to the Colgan Institute. It is an accurate marker of a high intake of inflammatory foods in people who otherwise appear to be fit and healthy. It is not the way to be if you aim to excel in sport.



Blood insulin spike. Typical pattern in athletes who habitually eat processed carbohydrate. The extra blood glucose is produced by the carbohydrate, but the big extra bump of insulin has to be manufactured by your pancreas. Avoid processed carbohydrate foods.

STRATEGY 1. EAT A LOW-GLYCEMIC DIET

Most inflammatory foods are those that do not suit our DNA code. Foods that did not exist during the critical period of our evolution, from the first Homo sapiens about 180,000 years ago up to the beginning of agriculture about 11,000 years ago, are almost all inflammatory.[2]

These man-made derivatives of agribusiness include all processed grains, all processed sugars, especially high-fructose corn syrup, and all salt added to food.[2,4,5] Without exception, elite athletes that we work

with at the Colgan Institute watch out for these foods sneaking into their diet. When a jelly doughnut appears, they don't eat it, they just watch it. A bagel is not a sinless doughnut either. They watch that too.

You still need to eat foods you like. Otherwise, you will not be able to maintain the changes in your diet required to permanently improve your resistance to inflammation. Do not make the common mistake of switching to weird "diet" or "health" foods. Most of them are simply bad-tasting variations on processed sugars and starches.

Sugar-free chocolate cake for example, tastes like dog-do, and still converts to sugar. "Light" and "unsalted" cookies, chips, sticks, and bits are still insulin bombs to your blood, without the taste satisfaction. One of the worst "health foods" is rice cakes, which almost instantly become sugar in the bloodstream, and spike insulin out of sight. Better to eat the packet. With a sprinkle of salt and pepper, cardboard tastes about the same as a rice cake.

You have to have foods that satisfy your taste and appetite. Otherwise, dietary change will be short lived. For me, poached eggs, are OK, poached animals not so much. Sashimi is good, except you eat it with knitting needles. But frozen diet dinners. Who bothers to even cook them? They taste the same if you suck them straight from the freezer.

Salads are good to eat while waiting for the sirloin. But some fruit and veges, Yuk. For me, cucumbers should be sliced thin, doused in vinegar, then tossed in the garbage. Turnips make a good splatter if dropped from tall buildings, and watermelon is just a bad way to eat, drink, and wash simultaneously.

One simple way to find good anti- inflammatory foods is by their Glycemic Index. First developed by David Jenkins in 1981, to assist diabetics to stabilize their blood sugar, the Glycemic Index measures the magnitude of the blood sugar response to different foods. Pure glucose, one of the worst foods, is used as the standard, representing a 100% blood sugar spike.[6] All other foods get a Glycemic Index score in relation to glucose.

White, brown, and raw sugars all have a Glycemic index of 100. Habitually eating foods with a Glycemic Index over 55 produces a highly inflammatory body, the worst type of body for athletes.

Some politically doubtful Glycemic Index lists proclaim white bread as the 100% mark, which give glucose a Glycemic Index Score of 138-142, depending on the authors. So the various lists you see may not agree with each other. The glucose 100% standard is the one to use.

Another wrinkle appeared in 1997, a Glycemic Load Scale, which multiplies the Glycemic Index of a food by the carbohydrate content

of an average serving.[7] You can look that up from my reference. The Glycemic Index, however, is easy to understand and backed by a lot of research, so we will stick with it here. All you need to know, is that **foods with a Glycemic Index score of 55 or less are low-glycemic**. If you want to be an anti-inflammatory athlete, the first strategy is to **eat a low glycemic diet**.

In general, foods with a low glycemic index include all fresh vegetables, except potatoes and pumpkins, all fresh fruits, except dates and raisins, all seeds and nuts, old-fashioned, slow-cooked oatmeal, and a few mixed whole-grain breads. Eat these foods for your carbohydrates. The Colgan Institute shortlist of low-glycemic foods is given below.

Colgan Institute Short Glycemic Index

Low Glycemic Foods: Below 55 Eat These Foods		High-Glycemic Foods: Above 56 Avoid These Foods	
Bakery Items	**GI**	**Bakery Items**	**GI**
Apple Muffin	50	Croissant	67
Vanilla Cake (Betty Crocker)	46	Doughnut	76
Banana Cake	55	Angel Food Cake	67
Chocolate Cake (Betty Crocker)	41	Cookies	80
Plain Sponge	52	Crackers	72
Vita-wheat Crispbread	55	Buckwheat Pancakes	102
		Scone	100
		Rice Cakes	80
Breads	**GI**	**Breads**	**GI**
Barley Kernel	40	Baguette (white)	102
Fruit Loaf (white)	55	Hamburger Bun (white)	62
Muesli Bread	55	Kaiser Roll	72
Oat Bran Bread	50	Gluten-Free Bread	76
Pumpernickel	46	Coarse Oat Bread	65
Wheat Kernel Bread	54	Rice Bread	70
Bulgur Bread	54	Spelt Bread (white)	74

Colgan Institute Short Glycemic Index

Low Glycemic Foods: Below 55 Eat These Foods		High-Glycemic Foods: Above 56 Avoid These Foods	
Wholewheat Sourdough	54	White Bread	71
Nine Whole Grain Bread	50	Enriched Bread (Wonder)	72
Ploughman All Whole Grain	48	Pita Bread	57
Cereals	**GI**	**Cereals**	**GI**
Bran Buds (with psyllium)	47	Bran Flakes	74
Muesli (whole grain)	54	Cheerios	74
Toasted Muesli	53	Coco Pops	77
Oat Bran (Quaker)	50	Corn Chex	83
Old Fashioned Oat Porridge	53	Cornflakes	77
All Bran	42	Nutri Wheats	66
Barley Cereal	30	Nutrigrain	69
Buckwheat Groats	45	Puffed Wheat	67
Rice (long grain)	50	Shredded Wheat	77
Whole Rye	37	Instant Rice	78
Fettuccine	40	Rice Pasta	72
Nuts and Snacks	**GI**	**Nuts and Snacks**	**GI**
Peanuts	20	Popcorn Plain (microwave)	89
Cashews	27	Pretzels	83
Low Fat Yogurt	27	Snickers Bar	68
Peanut, M & Ms	34	Cheese Twisters	76
Dark Chocolate	40	Potato Chips	67
Sugars	**GI**	**Sugars**	**GI**
Lactose	48	Glucose	100
Fructose	40	Honey	58
		Sucrose (table sugar)	65
Raw Fruits	**GI**	**Raw Fruits**	**GI**
Apples	30	Apricots (raw)	57
Pears	38	Pineapple	63
Grapes	46	Watermelon	78
Grapefruit	29	Raisins (dried)	66
Kiwis	49	Dates	103
Oranges	45	Mango	57
Plums	48		

Colgan Institute Short Glycemic Index

Low Glycemic Foods: Below 55 Eat These Foods		High-Glycemic Foods: Above 56 Avoid These Foods	
Strawberries	44		
Vegetables	**GI**	**Vegetables**	**GI**
Peas	48-53	Roast Potato	85
Asparagus	20	Boiled Potato	93
Lettuce	15	Pumpkin	75
Sweet Potato	44	Parsnips	97
Yams	43	French Fries	86
Artichoke	17	Broad Beans	70
Tomato	15		
Soy Beans (Edaname)	16		
Legumes	**GI**	**Legumes**	**GI**
Baked Beans	43		
Butter Beans	32		
Kidney Beans	24		
Lentils	32		
Beverages	**GI**	**Beverages**	**GI**
Pure Apple Juice (from concentrate)	44	Gatorade	91
Fresh Carrot Juice	46	Milk	56
Grapefruit Juice	48	Quick Strawberry (Nestle)	72
Tomato Juice (canned)	42	Coca Cola (regular)	63
Pure Pineapple Juice	46	Fanta	74
Soy Banana Smoothie	33	Lucozade	100
Yogurt drink (fruit flavored)	44	Orange Juice (reconstituted)	59
Soy Milk (3% fat)	49	Lemon Squash	60
Tea (with lemon)	0-4	Orange Cordial	66
Coffee (black)	0		

Kenyan from the Great Rift Valley, Patrick Makau winning the Berlin Marathon, 2010 in 2:05:08. You have to have an anti-inflammatory body if you want to run this fast.

Patrick Makau again, seen here leading the Rotterdam Marathon 2010, which he won 2:04:47.

3

Eat Alkaline

It's worth knowing this little scrap of chemistry. The abbreviation **pH** stands for power of hydrogen. It measures the concentration of hydrogen ions in a solution. The pH Scale runs from 0 -14. A solution with a pH of 7.0 is neutral. Pure water has a pH of 7.0. Above pH 7.0 is alkaline. Below pH 7.0 is acid. Like the Richter Scale for earthquakes, the pH Scale is logarithmic. That is, each number is 10 times different from the next. So a pH of 5.0 is ten times more acid than a pH of 6.0.

Sodas have a pH of 2.5-3.5, pretty acid. Remember the school chemistry class where you hung a steel nail in a coke and it gradually dissolved. No fish can live in a liquid as acid as a soda. Some pH values of common foods are given in the figure on the next page. The pH values given are for the net result of the food after digestion. So they will not agree with scales giving direct measurements of the acid level in the food. Here we are concerned with the effect of the food. Does it produce acid ash after digestion, or alkaline ash? We want about 80% of our food to produce alkaline ash because healthy human

blood is alkaline at a pH of 7.35-7.45. Your blood is designed to work best in this alkaline range, and tries to maintain it at all times.[1]

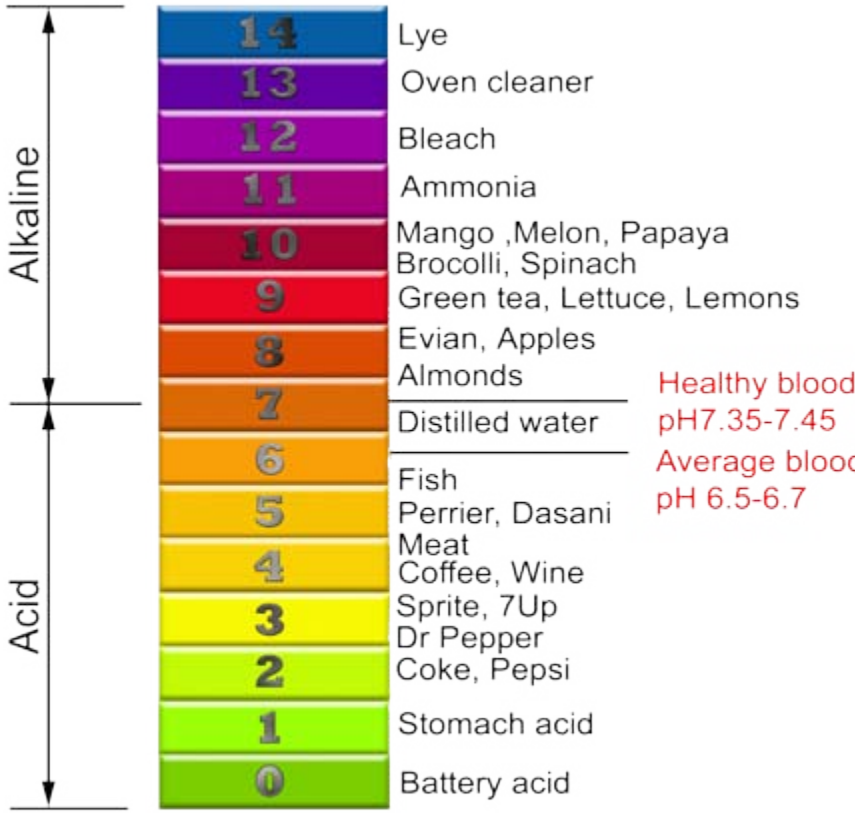
Our ancient diet before agriculture was alkaline.[1,3] That is how evolution designed our blood pH at 7.35-7.45. This design is built into your DNA. We gradually lost our alkaline diet after agriculture began about 11,000 years ago. Farming led to production of cereal grains, dairy foods, and the multiple high-acid processed foods that occupy the bulk of supermarkets today.

No surprise then that the average American and Canadian diet is acidic. Thus, the average citizen is constantly in a state of acidosis at a pH of 6.5-6.7.[1-5] That is why antacids make $7 billion a year in the US, and rising. If you eat an alkaline diet, you will never need antacids.

Chronic acidosis causes a lot worse problems than heartburn. When blood becomes acidic, as is does when you eat a diet of processed foods, it causes inflammation. It then draws calcium and other acid-buffering minerals from your bones, in order to raise the pH back to its healthy alkaline range.[4,5] If your body fails to bring the blood back to an alkaline state, it will continue to draw calcium from your bones, thereby weakening them. In athletes, an acid diet is a rocky road to stress fractures during sport. In everyone, chronic acidosis promotes numerous diseases as we age.[3, 5]

The strenuous exercise you do as an athlete also turns the blood acidic. As you know, if you go too hard, your muscles become so acidic that they tie up and will no longer function, until your circulation removes some of the acid. If you stop exercising and drink a soda, as we see many athletes do, the drink produces more acidity, and the body takes

longer to return to normal. A coke for example has a pH of 3.0, very acid. By the simple choice of drinking iced green tea, or Evian water instead, both of which are alkaline, you can speed recovery from exercise considerably.



The pH Scale showing the acidity and alkalinity of common foods after digestion. Note that the normal pH of human blood is 7.35-7.45. The blood of the average American, however, is acidic, at pH 6.5-6.7, because of the acid load from processed foods. You cannot develop an anti-inflammatory body while in this state.

You can minimize the acidic effects of exercise by maintaining an alkaline system with your food. Eating an 80% alkaline food diet, gradually changes your cellular structure so that it can resist inflammation. A resting alkaline balance also facilitates free movement of muscles and joints, and improves bone strength.[5,6] Performance then improves automatically, and strenuous sport becomes a lot more comfortable. An alkaline balance also improves insulin metabolism and lipid profiles, and reduces your risk of injury.[8]

Dump the Acid

You can get a good estimate of your own acid/alkaline balance with **pHydrion strips** from your local pharmacy. Measure your first urine in the morning, midstream. It should range between pH 6.2-7.0. If it is consistently below pH 6.2, you are probably too acid. Your buffering and elimination system cannot cope with the acidity of your food plus the acidity produced by your training.[1]

Also measure your fasting saliva in the morning by sticking a pHydrion strip briefly under your tongue . The pH should range between 6.5-7.5. If the saliva pH is consistently below 6.5, your body is likely too acid.[1]

Almost all baked goods, jams, jellies, and puddings are acid producing, because they consist predominantly of processed grains, processed sugar, and processed fats. Dairy products, especially cows' milk, cottage cheese, processed cheese, and ice cream are also acid-producing. Most legumes are acid-producing. Some scientists contend that legumes were only minor items in the pre-agricultural diet, therefore our system

is not programmed by evolution to deal with them. [8] I tend to agree with this view.

As you might reason from our human hunter-gatherer diet before agriculture, and from the human evolution of an alkaline physiology, all leafy green vegetables are highly alkaline. Most other vegetables are too. It might be nice if carrot cake and zucchini bread were vegetables, but no such luck.

Despite their acidic taste on the tongue, all citrus fruits produce a healthy alkaline effect on the body. Citrus fruits include (left to right) grapefruit, tangerine, mandarin, orange, lemon, lime, kumquat, and bergamot. Earl Grey tea is more alkaline because it is flavored with oil of bergamot.

Almost all fruits, are alkaline producing, even citrus. Though a lemon or lime may taste acidic, it produces a net input of alkaline bicarbonate inside you. Only the odd fruit is acidic, such as pomegranates and some tomatoes. Alkaline-producing nuts include almonds and chestnuts. Below is the Colgan Institute shortlist of acid and alkaline foods. For more information consult, **Nutrition for Champions.**[1]

To grow an anti-inflammatory body, your diet should have a ratio of four parts alkaline-forming foods to one part acid-forming foods. Three dinners that fill the bill are; a pound of mixed green salad with a quarter-pound filet mignon, a large pile of steamed asparagus with a salmon fillet, and wok-cooked green veges with a seafood medley.

Green tea is the most alkaline common beverage. Most bottled waters, including Perrier and Dasani, are acidic, but there are a few alkaline waters you can drink to boost alkalinity. Evian is one brand you can rely on. Some white wines are a lot less acid than sodas. A good Viognier is one of the best.

Colgan Institute Short Acid/Alkaline Foods Chart

For most people, including children, the ideal diet contains 75% alkalizing foods and 25% acidifying foods

ALKALIZING FOODS		ACIDIFYING FOODS	
VEGETABLES	**FRUITS**	**GRAINS**	**FATS & OILS**
Asparagus	Apple	Amaranth	Avocado oil
Beets	Apricot	Barley	Canola oil
Broccoli	Avocado	Buckwheat	Corn oil
Brussel sprouts	Banana	Corn	Lard
Cabbage	Cantaloupe	Kamut	Olive Oil
Carrot	Cherries	Oats (rolled)	Safflower oil
Cauliflower	Currants	Rice	**DAIRY**
Celery	Dates/figs	Rice cakes	
Chard	Grapes	Rye	All Cheeses
Chlorella	Grapefruit	Spelt	Milk (cow, goat)
Collard greens	Lemons	Wheat	Butter

Colgan Institute Short Acid/Alkaline Foods Chart

For most people, including children, the ideal diet contains 75% alkalizing foods and 25% acidifying foods

ALKALIZING FOODS		ACIDIFYING FOODS	
Cucumber	Limes	Wheat cakes	**PROTEIN**
Garlic	Honeydew melon	**NUTS & LEGUMES**	
Eggplant	Nectarine		Beef
Kale	Orange	Cashews	Clams
Kohlrabi	Peach	Brazil nuts	Lamb
Lettuce	Pear	Peanuts	Lobster
Mushrooms	Pineapple	Peanut butter	Mussels
Mustard greens	All berries	Pecans	Oyster
Onions	Tangerine	Tahini	Pork
Peas	Watermelon	Walnuts	Rabbit
Peppers	**PROTEIN**	All Legumes	Salmon
Pumpkin		**PASTA (WHITE)**	Shrimp
Rutabaga	Eggs		Scallops
Spirulina	Whey protein	Noodles	Tuna
Sprouts	Chicken breast	Macaroni	Turkey
Squash	Yogurt	Spaghetti	Venison
Maitake	Almonds	**OTHER**	
Daikon	Chestnuts		
Dandelion root	Tofu (fermented)	Beer	
Shiitake	Flax seeds	Wine	
Kombu	Pumpkin seeds	Spirits	
Reishi	Sunflower seeds	Distilled Vinegar	
Nori	Sprouted seeds	Wheat germ	
Umeboshi	**OTHER**	Potatoes	
Wakame		Most Tomatoes	

Colgan Institute Short Acid/Alkaline Foods Chart

For most people, including children, the ideal diet contains 75% alkalizing foods and 25% acidifying foods

ALKALIZING FOODS		ACIDIFYING FOODS	
Spices, Seasonings & Herbs	**Veggie juices** **Fresh fruit juice** **Fresh & Mineral water** **Green Tea**	**Sugar Substitutes**	

Reach your potential for that perfect swing with an alkaline, anti-inflammatory body.

4

Eat a Low-Gluten Diet

At the Colgan Institute, we see numerous cases of digestive disorder in athletes, involving acid stomach, cramping, bloating, and periodic constipation, or diarrhea, usually accompanied by fatigue and unexplained illness. These disorders often include inflammation of the small intestine. Most of these athletes have already tried antacids or antibiotics to little avail. Sometimes they have suffered intermittently for years. Our first step is to remove gluten from the diet. It is often the only step we have to take.

In our research for the sports nutrition program we recommend, we have found a great deal of recent genomic evidence that people of English, Irish, or Middle European ancestry, have a difference in their DNA code that makes it difficult for them to deal with a protein called **gliaden**, a component of the gluten found in wheat, rye, and barley.[1,2] This DNA difference probably evolved in the first wave of

humans that spread out of Africa, when the human diet was largely carnivorous, and included very little gluten.

Recent important discoveries, reviewed in 2011, support our view. Genomic researchers have discovered a protein, termed **zonulin**, which regulates the permeability of the small intestine. The two most powerful triggers of this protein are bacteria, and gliaden. Stimulation of expression of zonulin by gliaden, allows it and other unwanted substances to cross the intestinal barrier membrane and enter the bloodstream. Zonulin is now called the "biological door to inflammation", not only for chronic inflammation of the small intestine itself, but also as a door to chronic inflammation throughout the body.[3]

The descendents of the first wave out of Africa likely include the three million Americans already diagnosed with celiac and similar diseases. About another four to six million Americans will likely develop chronic digestive inflammation as they age. If you are of the ancestry that now populates most of North America, we advise you to limit the gluten in your diet, in order to reduce your potential for inflammation.

In one of the most recent studies, published in December 2010, researchers used magnetic resonance profiling to analyze the molecular biochemical profile in the blood and urine of 51 healthy people, 29 people whose symptoms suggested potential to develop celiac disease, and 61 patients with confirmed celiac disease. They found that those with potential for celiac disease had the same biochemical profile as those with confirmed celiac disease. Their biochemical markers differed significantly from those of the healthy individuals. The study, which also reviews similar recent research, concludes:

"Our results demonstrate that metabolic alterations may precede the development of small intestinal villous atrophy and provide a further rationale for early institution of a gluten-free diet in patients with potential celiac disease, as recently suggested by prospective clinical studies."[4]

The big three for gliaden caused inflammation; wheat, rye, and barley. Don't eat them.

Dump the Gluten

If you think you have the European, English, or Irish ancestry that may predispose you to digestive disorder from gluten, your doctor can order a simple blood test, which can detect high levels of certain antibodies found in people with celiac disease. If the test is positive, the diagnosis will almost certainly be potential celiac disease. The advised treatment is exactly what we are advocating for athletes to attain an anti-inflammatory body: - remove gluten from your diet.

If you have an intermittent digestive disorder like that described above, then following a low-gluten diet may be the simple solution. But it will do more than merely make you feel comfortable. It will have a large beneficial effect to reduce unwanted inflammation in your body, and thereby improve your sports performance.

Below is our shortlist of gluten-free foods. Note that we stress wild, organic, and naturally grown foods. This is not some quirky back-to-nature philosophy. It is because we are appalled that gluten is added to so many mass-produced foods, including beer, frozen vegetables, soups, even bologna, cold cuts, chicken nuggets, and whole turkeys.

Colgan Institute: Shortlist of Gluten-Free Foods

Wild fish and shellfish	Grass-fed meats	Organic poultry
Organic nuts	Organic cheese	Organic eggs
Virgin olive oil	Organic flax seeds, flax oil	Wild rice
Organic rice	Organic rice cakes, rice crackers	Organic rice flour (and other gluten-free flours)
Organic vegetables	Organic Fruits	Peppercorns
Tamari sauce	Yoghurt	Cider vinegar
Organic millet	Organic quinoa	Organic jelly, jams, marmalade
Organic Honey	Tea (check herb teas)	Coffee

Bernard Lagat from the Nandi District of the Great Rift Valley wins the Millrose Mile for the seventh year in 2008.

5

Eat a High Allium Diet

The importance of the ***Allium*** vegetables, onions, garlic, and leeks, for athletes needs a little explanation. By natural selection of genetic traits, our ancestors gradually developed the capacity to convert a precise mixture of the environmental chemicals of the Earth into bones, muscles, glands, organs, and brain. For construction of the body during evolution, our genetic design could use only the chemicals that were available at the time. Evolution takes eons. The human body has had sufficient time to build into its design only the ancient chemicals that were abundant before man-made chemicals came along.

Evolution used the most abundant chemicals to construct almost all the structure and functions of the human body. The composition has not changed since our evolution into Homo sapiens, about 200,000 years ago.[1] Many athletes are surprised to learn that more than 75% of

their flesh is made of gas. Our bodies are 65% oxygen, 10% hydrogen, and 3% nitrogen. We are mostly hot air.[1]

Our carbon base accounts for another 18.5%. Add these together and you will see from the figure below, that 96.5% of your body and brain is made from the four most common and most ancient elements in the universe. Physicists call them **CHON**: carbon, hydrogen, oxygen, and nitrogen.[1] Fortunately, most of the hydrogen and oxygen that make up three-quarters of the body, combine to make very weighty water. Otherwise, we would float about in the wind.

After CHON, in order of percentage of body composition, come calcium, phosphorus, potassium and **sulfur**. This ancient macronutrient is the essential element of interest when we consider Alliums in the diet. It gets into your body through the sulfur cycle. The biggest source, ocean plankton, releases millions of tons of sulfur compounds into the air every day. The refreshing and healthful scent of sea air comes mainly from breathing in that sulfur.

These sulfur compounds rise from the oceans into the ozone layer where ultra-violet light turns them into methyl-sulfonyl-methane (MSM). The MSM then falls to the surface of the Earth in rain.[2] Plants, especially the Alliums, concentrate MSM from the soil, and provide sulfur for the body. Your body cannot make sulfur. You have to get it from your diet.

Alliums, including onions, garlic, shallots, leeks, scallions, and chives, are potent food sources of sulfur. Sulfur amino acids in eggs, in meat and fish, including cysteine and methionine also provide sulfur, but it

Composition of the Human Body	
Carbon	18.5%
Hydrogen	10%
Oxygen	65%
Nitrogen	3%
Total CHON	96.5%
Calcium	1.2%
Phosphorus	1 .0%
Potassium	0.4%
Sulfur	0.3%
Magnesium	0.1%
53+ 0ther Nutrients	0.5%
TOTAL	100%

Many athletes are surprised to learn that they are more than three-quarters gas. Our bodies are 65% oxygen, 10% hydrogen, and 3% nitrogen. Mostly hot air.[1] Our carbon base accounts for another 18.5%. Add these together and, you will see that 96.5% of your body and brain is made from the four most common elements in the universe.

is not as bioavailable as from plant sources. Research shows consistently that the average American gets insufficient sulfur in their diet.[3]

Sulfur Combats the Inflammation of Exercise

Athletes need a lot more sulfur than the average. Whenever you stress muscles and joints with intense exercise, the first chemical compounds formed to combat the inflammation and damage are **sulfenic acids** and **thiosulfinates**. The sulfur for these compounds has to come from your food.

The biochemistry shows that our anti-inflammatory sulfur defence system functions in two important ways for athletes. First, it limits the production of reactive oxygen species (free radicals) during exercise. Second, it acts long-term to prevent the degeneration of soft tissues, especially joint tissues.[3]

There are numerous studies, but a recent trial of MSM with sport horses is representative of the evidence for the first function of sulfur. Researchers gave 24 competition jumpers doses of MSM at 8 mg/kg, roughly 8 grams per horse, or a placebo, and tested them over a week of competition. They measured multiple indices of oxidative stress and muscle damage. Results showed that jumping causes damage in horses, likely because of an increase in oxidative stress and pro-inflammatory molecules. MSM supplements reduced free radical formation and inflammation during jumping, and protected the horses against most of the oxidative and inflammatory injury.[4]

Make all the Alliums, onions, shallots, garlic, leeks, scallions, and chives, a regular part of your diet to provide the sulfur for combating muscle and joint inflammation.

Sulfur Protects Your Joints

The second effect of sulfur is to maintain the joints. That is why MSM has become popular as a supplement to treat osteoarthritis. Osteoarthritis is mostly a wear-and-tear syndrome. It affects almost everyone as they age beyond 45. It causes pain and disability in many masters athletes, mainly by affecting the joints of the hips, knees, and spine. In investigating use of Alliums for athletes, we reasoned that we would be on the right track if alliums are effective in treating osteoarthritis.

In excellent twin studies, giving great control of the data, researchers at King's College London have shown that women who consume a diet high in allium vegetables, mainly garlic, onions, and leeks, have lower levels of hip osteoarthritis. The study examined over 1,000 female twins, many of whom had no symptoms of arthritis. The team did a detailed assessment of the diet patterns of the twins and analysed these alongside x-ray images, which captured the extent of early osteoarthritis in their hips, knees, and spine. This is the first large scale study of diet and arthritis in twins, a strategy that makes the matching of subjects much more accurate. The twin of each pair who ate more allium vegetables had less development of early arthritis.[6]

To investigate the potential protective effect of alliums further, the researchers studied the sulphur compounds in garlic. In separate research, they found that that **diallyl disulphide** inhibits cartilage-damaging enzymes, when introduced to a human cartilage cell-line in the laboratory.[6] These well-controlled studies are an exciting confirmation of our recommendation of a high-allium diet for runners. One tip. Sulphur compounds in onions and garlic break down in the

body within a few hours. ***For maximum benefit, eat some Alliums every day.***

If you cannot get your Alliums, use supplements of MSM. They are cheap and effective, and there is sturdy research that they work with athletes.[7] ***We recommend 2,000 mg of MSM per day***, taken with food. We have found that it prevents a lot of inflammation in runners and triathletes in heavy training.

Australia's Craig Alexander winning the 2009 World Ironman Championship in Hawaii. Even to complete the Ironman, you have to have an anti-inflammatory body.

6

Capsaicin Is Anti-inflammatory

Certain plant foods naturally regulate human inflammatory pathways. They are all plants that were part of our environment when the human body evolved. Only the plants available at that time could provide evolution with the chemicals from which it developed our anti-inflammatory genes.[1]

The first of these chemicals occurs in a variety of plants but is concentrated in cayenne pepper. Cayenne, from the Greek "to bite", comes from capsicums, the hot, red peppers used for flavouring foods. The most important chemicals in cayenne are a group collectively called **capsaicins**.

Capsaicin content of hot peppers is measured in parts per million, which is then converted into what are called **Scoville Heat Units (SHU)**. Sounds complicated but it is merely the number of dilutions you have to make until the liquid is no longer hot to taste. The hotter the pepper the more capsaicin it contains, and the higher its Scoville number.

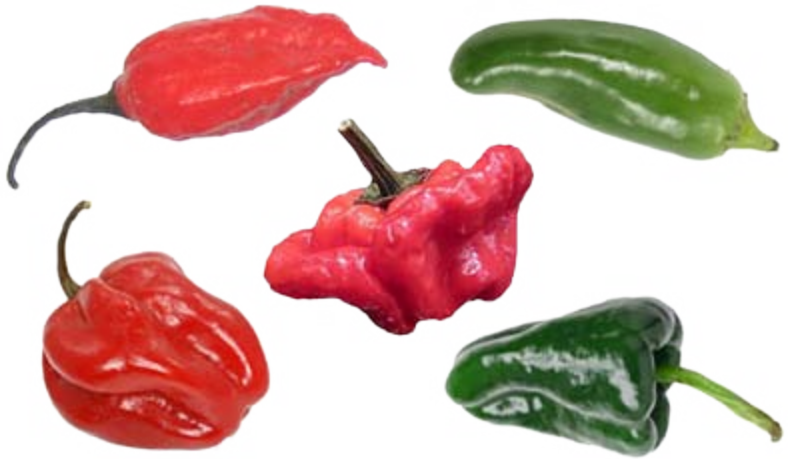
The hottest peppers commonly available are **habaneras** with a score of 100,000–400,000 SHU. Even the mildest habaneras are too hot for most people to eat. Then come Scotch bonnets and Jamaican peppers at 60,000–250,000 SHU. To understand how hot that is, cayenne pepper scores 30,000–50,000 SHU. The usual bell peppers you see in the supermarket come from cultivars that are so in-bred they no longer contain capsaicin. Only hot peppers are of any use in our anti-inflammatory strategy for athletes.

We first became interested in capsaicin from studies in the 80s that began to show its complex and unique effects on both the brain and body. To summarize some highlights, research has discovered a new neural receptor in the human system dubbed the **capsaicin receptor**, or more recently the **transient-receptor-potential vallinoid receptors (TRPV)**.[2] These receptors allow capsaicin to act as a unique anti-inflammatory, and to uniquely affect the brain, and also to help regulate fat oxidation in the body.

By the 90s, controlled studies were showing that red pepper in meals dramatically increases thermogenesis (production of heat), and energy use.[3] In order to produce the extra heat, red pepper specifically mobilizes lipids from adipose cells and increases the use of bodyfat as

fuel.[4-6] It is so effective that various pharmaceutical companies are now racing each other to produce the first capsaicin drug for fat loss.[7-9]

In the brain, capsaicin causes stimulation of catecholamines and release of endorphins.[10] In the rest of the body it causes increased activity of the sympathetic nervous system that regulates heart rate, blood pressure, and breathing.[11] Capsaicin energizes the body in a variety of ways, and also reduces body fat in healthy, active people of normal weight.[12]



Five great sources of capsaicin: Top left is the hottest pepper in the world, the bhut Jolokia, Bottom left is the habanero, very hot. Center is the scotch bonnet. Top right is the medium hot jalapeno and bottom right is the mild poblano.

The weight loss and energy enhancement effects are a bonus of capsaicin use. Almost all the athletes we have persuaded to adopt hot peppers and cayenne into their everyday diet, have lost 4-5 lbs of bodyfat over about one year, before the effect plateaus. But the anti-inflammatory effects of capsaicin seem to continue indefinitely.

Anti-inflammatory effects of capsaicin are linked to expression of ancient parts of our genome. The most recent studies come from research on the world's hottest pepper, Bhut Jolokia. Rare in Westernized supermarkets, Ayurvedic medicine has used Bhut Jolokia for thousands of years. At about 5% pure capsaicins, it is 18 times hotter than a hot habanera. Oral preparations of capsaicin from Bhut Jolokia have high anti-inflammatory activity throughout the body. They work through what are called, the transient-receptor-potential vallinoid (TRPV) channels, completely different to the action of NSAIDs and opioid drugs.[13] The recently discovered TRPV channels, and the ancient food capsaicin, are now the focus of a race by drug companies to get new painkillers on the market.

The best way to get capsaicin is from food. Capsaicin works to grow an anti-inflammatory body when eaten as hot peppers, chilli dishes, curries, and cayenne pepper. A cayenne supplement also works. For athletes who have no gastrointestinal problems with cayenne, chilli dishes, or coffee, we advise a 1000 mg cayenne supplement along with coffee, on an otherwise empty stomach. But if you have a touchy gut, start low and easy. A normal gut will learn to produce the enzymes to deal with a high-capsaicin diet within 2-3 months. After that, ***follow a high capsaicin diet for life.***

Ice hockey success requires a particularly anti-inflammatory body, well developed with capsaicin because of the continual heavy body checks. Seen here at the 2010 Olympics, with Ovetchkin on top.

7

Turmeric Beats NSAIDs

Numerous plant foods are anti-inflammatory. Evolution had the length of time required, at least 150,000 years, to build mechanisms into our DNA to use and regulate the chemicals in these plants. Consequently, they do not have the detrimental side effects of NSAIDs, or other man-made drugs, but are equally or even more anti-inflammatory than the drugs. We will examine only the strongest.

Strong concentrations of natural, non-toxic, anti-inflammatories occur in families of plants that contain the pungent spices. For athletes, this research is cutting edge. ***The top anti-inflammatory spice we recommend is turmeric.*** Ayurvedic and Chinese medicine have used

turmeric, from the rhizome of the Curcumin plant, Curcuma longa, for treatment of inflammatory diseases for 4,000 years. But chemists identified the active component of turmeric, **curcumin**, only two centuries ago.

Recent genomic science shows that curcumin works by stimulation of precise molecular targets to control inflammation. Because curcumin can modulate the genetic expression of these targets very effectively, it is now being used experimentally to treat the inflammation of cancer, arthritis, diabetes, cardiovascular diseases, osteoporosis, and other pathologies.[1]

Just recently, researchers have begun testing curcumin against the inflammation caused by sport. The research design usually used in these cases is downhill running because it is so hard on the legs. Downhill running causes inflammation, delayed-onset muscle soreness, muscle damage, and various functional deficits. In long training on mountain trails, we often get runners to run backwards down steep hills to save their legs from these problems. If you have ever tried hills like the Devil's Thumb in the Western States 100-Mile Race, you will know what I mean.

In a study representative of the evidence, researchers at the Department of Exercise Science at the University of South Carolina tested mice with and without feedings of curcumin. Downhill endurance running without curcumin reduced both treadmill time to fatigue and voluntary activity. Curcumin feedings eliminated these effects on running performance. Downhill running also caused increases in cytokines and creatine kinase, potent markers of inflammation. These markers were

much reduced by curcumin feedings.[2] There is other similar research that curcumin assists human endurance athletes.[3]

Curcumin is especially relevant to endurance athletes, such as marathon runners and triathletes, because most of them develop some inflammation of the gastrointestinal tract during long endurance exercise. New research shows that curcumin inhibits gastrointestinal inflammation readily when taken orally, and is protective of the gut.[4]

Curcumin also has precise gene-regulatory effects no man-made drug can match. Despite its reliable action in down-regulating inflammatory chemicals of the immune response, including the kingpin controller, **nuclear factor- kappaB (NF-KB)**, curcumin up-regulates white cells. These include T cells, B cells, macrophages, neutrophils, and natural killer cells. Through this action, curcumin allows the immune system to work efficiently, but at a lower inflammatory load.[5]

Turmeric is the pungent orange-yellow spice grated from the rhizome of the plant. It is a premium aid to developing an anti-inflammatory body.

We advise athletes to use turmeric frequently in cooking to help build the anti-inflammatory body. You can use it on every kind of Indian curry dish and on many vegetable dishes. It even goes well into cookies. You can also use curcumin as a nutrient supplement. Three extracts from turmeric shown to be effective against inflammation are, **curcumin** from Curcuma longa L, **xanthorrizol** from Curcuma xanthorrhiza Roxh, and **beta-turmerone** from Curcuma zedoaria Roscoe.[6-8]

As an oral supplement, however, curcumin is poorly absorbed. To overcome the absorption problem, we use all three extracts combined with **piperine**, which increases absorption by as much as 70%. Piperine comes from black peppercorns, the fruit of the pepper vine, Piper nigrum.[1] Anywhere you put curcumin, put black pepper along with it.

Daily dosage of a curcumin supplement is hard to specify because herbal supplements are poorly regulated, and vary widely in potency between products. The best available is an 8% extraction of curcumin from the rhizome. From the research, we estimate that a daily dose of 900 mg of curcumin extract, together with 50 mg of piperine, is likely effective. In any sensible amounts, curcumin shows no evidence of toxicity. If you grind your own peppercorns at home, and like pepper on your food, it is an excellent way to get the piperine.

Kenyan Edna Kiplagat of the famous Kimbia team in the Great Rift Valley, trained by Dieter Hogan, winning the 2010 New York Marathon in 2:28:20. To be able to run like this you have to be very resistant to inflammation.

8

Ginger: Great Anti-inflammatory

Since agriculture began 11,000 years ago, the pressure of human cultural development is accelerating the evolution of the human genome.[1] Nevertheless, this period represents less than one percent of human history. To date, very few of our DNA sequences (alleles) have changed since we migrated out of Africa. [2-5]

Some changes are very visible, so they predispose us to think that there were equal changes throughout our genome. I have written previously of the loss of skin pigmentation for example, which occurred by natural selection as humans migrated from Africa to more northern latitudes that have weaker sunlight. To put the genetic change in simple terms, only those born with progressively fewer pigment cells protecting the

skin, could make sufficient Vitamin D from the weaker ultra-violet light to maintain health. The fittest survived and, as humans migrated further north, they changed from black to white.[6]

The effect of light levels, however, is a massive selection pressure that will kill whole populations that fail to adapt. But most of the changes wrought by humans, have little effect on the genome. Despite education, a strong cultural force, many Americans eat junk food every day, and still survive long enough to produce another generation that survives on junk food. Consequently, although we continue creating food that is increasingly hostile to health, against everything that science has to teach us, it has little effect on the genome. We still have more than 99.9% of genes selected during the pre-agricultural hunter-gatherer existence of Homo sapiens.[7]

When you realise that we are made of the chemicals that existed in our ancestral environment, it becomes clear that these chemicals offer the best strategies for optimum health and performance. Thus it makes sense to select foods that evolution used for particular purposes in creating our biochemistry. One of those foods is the ancient plant **ginger**, (Zingiber officinale) which occurred in many forms in the wild throughout Africa, Europe, Asia and India. At least 5,000 years ago, ginger was recorded in Sanskrit as smagaveram (horn root), The ancient Greeks called it zingiberis, and used it as a treatment for inflammation of the joints.

Widely and effectively used today to treat motion sickness, nausea, and vomiting, new research has now identified the potent anti-inflammatories in ginger. The main bioactive chemicals are **gingerols** and related chemicals called **shogaols**. Scientists have been able to

study their molecular effects only since human genomic research accelerated with the publication of the human genome in 2003. So there is still a long way to go.

Before the human genome breakthrough, studies on gingerols focused on arthritis patients. Effects were modest at best.[8] At the Colgan Institute, we stated then that it was the wrong model to test anti-inflammatory effects of ginger, because irreversible damage had already occurred to the joints. Because of the chemistry of gingerol, we wanted to see controlled trials on inflammation in insulin and lipid metabolism, what is now termed **the metabolic syndrome**, in which the inflammatory markers are reversible, and are closer to some of the chronic inflammatory effects of heavy exercise in athletes.

The first good evidence came in 2000. In animal studies, Bianca Fuhrman and colleagues at the Rappaport Institute in Haifa, Israel, showed that gingerol reduced LDL cholesterol levels, and LDL oxidation, by over 50%.[9] This huge effect from well-controlled research spurred many new studies throughout the world. By 2005, there were numerous research reviews, including research showing that gingerol is a major antioxidant, and a strong regulator of cyclooxygenase-1 (COX-1), and cyclooxygenase-2 (COX-2). These are the main inflammatory pathways targeted by NSAIDs. To confirm that a non-toxic food has such an effect was big news.[10,11]

For equivalently matched doses, gingerol is more effective than aspirin, and has no adverse gastrointestinal effects. On the contrary, gingerol is protective of the gut,[11,12] and we use it freely for athletes with gastrointestinal problems. It also works by different, additional

Ginger is the most potent of a large family of anti-inflammatory spice plants that are especially protective of the gastrointestinal tract. You can grow your own easily in the average kitchen. More potent if you do.

mechanisms. We now know that gingerol inhibits formation of both oxygen and nitrogen free radicals, and regulates expression of multiple genes that activate inflammatory cytokines.[13,14]

There are no standardized gingerol medicinals yet. But you can buy a 5% extract of 6-gingerol from Oriental suppliers. There are also no standard doses. Ginger, like other spices, is on the Food and Drug Administration GRAS list, (Generally Recognized As Safe), so toxicity is not a worry. From amounts used in many studies, we have zeroed in on a daily dose rage of 2.0–4.0 grams of ground fresh ginger rhizome to use in salads, chicken dishes, and seafood. You can also use a daily supplement of 400–800 mg of 5% extract of 6-gingerol. It provides a naturally occurring, non-toxic food that will help you build an anti-inflammatory body.

Ginger grows easily in a pot at home. You can buy a plant or simply use some of the rhizome you buy for cooking. It has to be organic though, or it may have been treated with growth retardant. Look for parts of the rhizome that are plump, with little horns on the end. Cut off that bit and plant it.

When it grows, and it almost always will, you can cut off parts of the rhizome to dry and use without killing the plant, and it will grow back. Ginger loves a sheltered spot, filtered sunlight, warmth, humidity, and rich, moist soil. In other words, a pot on the average kitchen windowsill. What ginger can't stand is frost, direct sun, wind, and, waterlogged soil. A few months, and you will have a foot high, aromatic plant, providing some of Nature's most sophisticated anti-inflammatories, that are directly linked to your genes.

Legendary Aussie runner Keith Bateman has maintained the anti-inflammatory body. He broke the Australian 3000 meters record at age 55.

9

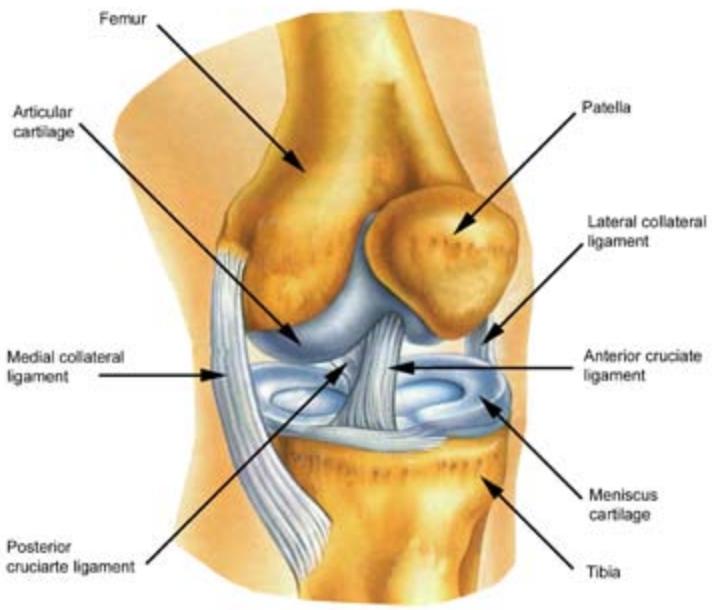
Protect Your Joints

The more complex a joint, the more likely it will get injured in sport. Knees are the most complex. They consist of a rolling cam that also rotates as it moves. No surprise that knees are the most subject to injury. There are more than three million knee injuries in young athletes in the US alone every year, in every sport played on the feet.[1]

Close in vulnerability to the knee is the ankle, with its simultaneous hinge, gliding, and rotating action. Next in vulnerability is the shoulder, with its hard ball head of the humerus bone sliding precariously on the soft tissue of a shallow socket. Then come the hinge and gliding joints of the elbow and wrist. The hard bone ball and socket hip joint is the most robust. All these **synovial joints** rely for healthy movement on

the integrity of their cartilage, the soft tissue layer that cushions the ends of the bones, and their synovial fluid system that lubricates the moving parts and enables them to slide freely.

Sport is tough on cartilage, continually creating rough spots and wearing it out. Sport is also tough on the synovial fluid. Whenever the intensity of your exercise causes the rate of wear and tear to exceed the maximum rate at which you can produce new cartilage and synovial fluid, you get inflammation, pain, and stiffness of the joints.[2] This chapter tells you how to increase your maximum rate of renewal of cartilage and synovial fluid and maintain it indefinitely.

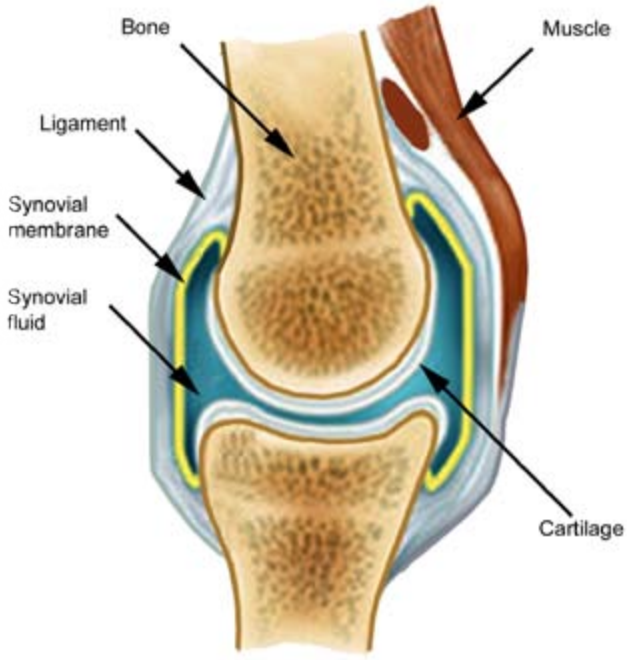


Left knee. Being the most complex joint, the knee is also the most subject to injury and inflammation in sport. This chapter shows you how to protect your joints from inflammation by providing them with the materials for rapid renewal of the cartilage and synovial fluid.

There are four essential components of a synovial joint that you can influence by what you eat. First are **collagen** fibrils. Second, are structures like small feathers called proteoglycans. Third, are chondrocytes, the only cells in cartilage. Chondrocytes manufacture the mix of collagen and **proteoglycans** that form the **cartilage**.

Fourth is **synovial fluid** a complex mixture that contains a high level of hyaluronan (hyaluronic acid), a viscous gel. Hyaluronic acid is the water-holding molecule of the body. One gram will hold more than a thousand grams of water. Its gel structure retains the water that cushions nerves and joints, and also provides the shape and form to the human eye and skin. A 70kg (154 lbs) athlete has about 15 grams of hyaluronan in the body, one-third of which is degraded and replaced every day. The harder you exercise the more hyaluronan you use. Decline of hyaluronan with aging, and not collagen as frequently claimed, is the main cause of wrinkles and lines.

Medical scientists have been trying for the last 100 years to produce drugs that will grow new cartilage and synovial fluid in human joints, because their loss with aging is the main cause of osteoarthritis, the most debilitating disease in Western Society. To date we are unsuccessful. But, along the way, science has discovered natural substances that speed the body's processes of cartilage renewal, and inhibit its decline. Here we cover only the best of those substances that research shows improve cartilage and lubrication of joints in controlled trials.



Main components of a synovial joint.

Cartilage Renewal: Collagen

Your body rebuilds cartilage continuously, as the chondrocytes manufacture long strands of collagen, and feather like proteoglycans. Although collagen is a protein which is broken down in digestion, researchers have increased collagen production in knee joints, and relieved arthritis, by feeding subjects fish and chicken collagen.[3]

There is also evidence supporting a diet high in collagen-rich free-run poultry, wild fish, and shellfish, especially the usual black-lipped mussels, and the New Zealand green-lipped mussels.[4,5] But these foods all include omega-3 fats, the super anti-inflammatory covered in the next chapter, and other anti-inflammatory chemicals. So the benefits may be due to those as much as the collagen.

As with any other adaptive responses of the body, the best way to stimulate collagen synthesis is to stress the collagen system moderately. Endurance running produces a reliable increase in collagen levels in the knee.[6] It is likely that a diet including the above high-collagen foods every week, will work to augment joint collagen if combined with rhythmic endurance exercise. But no one has yet done the studies to prove it.

Athletes certainly need the extra collagen in their joints, and should do everything that can maintain it. One of the big reasons we advise strongly against NSAIDs use, especially before exercise, is that these drugs abolishes the rise in adaptive collagen that occurs to rhythmic exercise such as running.[6] ***We recommend that all athletes eat a diet high in free-run poultry, wild fish and shellfish to maintain collagen levels in joints.***

Cartilage Renewal: Proteoglycans

Proteoglycans production is easy to improve. A major component of proteoglycans is the chemical **glucosamine**. Supply of this chemical is the rate-limiting step that largely controls proteoglycans renewal, and thus the rate of cartilage renewal.[2]

Your body makes glucosamine from glucose and the amino acid glutamine. When joints are placed under high stress, however, as occurs in most sports, the rate of glucosamine production often falls below the rate of wear, and the cartilage of knees, ankles, shoulders, wrists, and hips, gets thin and uneven, and becomes inflamed. This is the major process by which arthritis begins, even in some athletes in

New Zealand marathon champion, Sam Wreford, showing great form winning the Dunedin marathon in 2010. You have to use cartilage renewal components in your diet to successfully run marathons.

their 20s.[2] To become the anti-inflammatory athlete, your aim here is to avoid this degeneration altogether.

Preformed glucosamine taken as a dietary supplement increases glucosamine levels in joints. Many controlled studies since 1980 have shown, in both animals and humans, that supplements of **glucosamine sulfate** are well absorbed, and significantly increase cartilage production. In doing so, they reduce osteoarthritis inflammation, and the progression of the disease.[7-13]

Cartilage Renewal: Chondroitin

The second major component of proteoglycans is **chondroitin**, which gives the cartilage much of its resistance to compression. Taken as a supplement, chondroitin sulfate has been successful in increasing the quality and volume of new cartilage in numerous controlled trials over the last 20 years. So much so, that it is now approved as a prescription slow-acting drug for arthritis in Europe and some other countries.[13-17] We became impressed with chondroitin when it beat the NSAID diclofenac in a controlled trial with knee osteoarthritis in 1996.[14]

Nevertheless, we remained cautious about recommending the routine use of glucosamine and chondroitin for protection of cartilage in athletes, because most human studies used sedentary patients with confirmed arthritis. Then we read an article by Runner's World editor Amby Burfoot in the August 2004 issue. The article drew our attention to a study of Navy Seals with knee pain and confirmed cartilage degeneration, who were treated with these supplements.[9] These were just the sort of fit and active folk that we could relate to athletes, so we studied that piece of research extensively.

The Seals were given 1500 mg of glucosamine sulfate, and 1200 mg of chondroitin sulfate, daily for 16 weeks. The treatment was highly successful measured by reduction in pain, improvement in movement, and repeated medical examinations.[9] We contacted the Navy Amphibious Base in Virginia Beach where the study originated, and were able to contact two of the subjects months later who had continued to use glucosamine and chondroitin after the study. They were still able to run freely without pain.

Football is one of the toughest sports on your joints. The Colgan Institute has done specific joint nutrition programs for numerous pro footballers.

Since then there have been numerous studies with athletes. A recent study typical of the molecular research today, examined the effects of glucosamine sulfate on knee cartilage in soccer players, athletes whose knees are subject to excessive eccentric motion and loading, and are the site of most frequent injury. Researchers compared levels of biomarkers for cartilage synthesis and degradation between soccer players and non-athlete controls, and in soccer players before and after glucosamine treatment.

Both cartilage growth and degradation were much greater in the soccer players than in controls, reflecting the higher levels of cartilage wear in the athletes. The rate of collagen degradation was also significantly higher in the athletes, indicating that their knees were under considerable stress. After treatment with 1,500 mg or 3,000 mg of glucosamine for

three months, the rate of collagen degradation significantly declined, indicating that the treatment reduced the stress on knee cartilage.[10]

Further convincing are recent meta-analyses of glucosamine research with arthritis patients. In a 2009 review of eight studies, researchers at the University of Aberdeen, concluded that glucosamine sulfate reduced the narrowing of joint spaces, which is a strong marker of the progression of osteoarthritis. The researchers found,

> *"significant improvements in joint space, pain, and function for glucosamine sulfate".*

In two follow-up studies, glucosamine sulfate supplements reduced the need for knee replacement by more than half, from 14.5% to 6.3% at 8 years' follow-up.[11]

From the research overall, we recommend that athletes ***routinely use 1,000 mg of glucosamine sulfate, and 1,000 mg of chondroitin sulfate per day. We recommend 2,000 mg of each daily when doing intense training,*** such as runs longer than 15 miles in preparation for a marathon, or the four weeks before a big game.

CARTILAGE RENEWAL: HYALURONIC ACID

Hyaluronan is a major component of the synovial lubricating system of joints. For fifty years, researchers have been using various formulations of hyaluronic acid to determine if it will increase production of synovial fluid. The big problem has been absorption, because hyaluronic acid is usually a monster molecule, seemingly too big to pass through the

gut wall. So the usual therapy used with patients involves injecting the hyaluronan directly into the joints.

Some oral formulations now offer small molecule hyaluronan to overcome the absorption problem. Recent reviews of the evidence, however, indicate that even large molecule hyaluronan taken by mouth does increase synovial fluid in joints.[7] In a representative double-blind placebo-controlled trial, researchers used an extract from cocks' combs (the usual source of large molecule hyaluronan). They gave subjects with knee osteoarthritis oral supplements of 80mg per day with for 8 weeks. Results showed significant improvements in pain and physical function on the standardized WOMAC arthritis tests. for the hyaluronic acid group. [18] ***From this research, we recommend supplementation of 100 mg per day of hyaluronic acid for athletes.***

New Cartilage

This chapter covered three strategies to protect your joints from inflammation and damage. First, eat a diet high in free-run poultry, wild fish and shellfish to maintain collagen levels in joints. Second, use 1,000 mg of glucosamine sulfate, and 1,000 mg of chondroitin sulfate per day to increase proteoglycans production. Third, use 100 mg of hyaluronic acid per day to increase production of synovial fluid, the lubricating system of your joints.

A final point. In order to make new cartilage, the body also needs a lot of sulfur, which is likely why the sulfate form of glucosamine is the most successful. Combined with alliums in the everyday diet, as recommended in Chapter 5 to increase availability of sulfur, we have

had great success with runners, especially for knee pain. If you are not getting sufficient alliums, that is some onions, garlic, or leeks every day, then we recommend daily supplements of basic sulfur as, **2,000 mg methyl-sulphonyl-methane (MSM)** per day As covered in Chapter 5, there is considerable evidence supporting MSM supplementation. [11,19]

Ryan Hall was born at altitude in Big Bear California, and trains at altitude in Mammoth, California. He holds the American Record in the half-marathon: 59:43:00, and is gunning for the marathon title. For that, your joints have to be perfect.

10

DHA: Premium Anti-Inflammatory

Docosahexaenoic acid (DHA) is the main omega-3 fat built into your body. It is essential for the cell membranes of your muscles and organs that enable them to resist inflammation. It is the major component of the fat that composes your brain. Without DHA you could not even think. But your body cannot make a molecule of omega-3 fats. You have to get it from your diet every day.[1] It is so important to your goal of building an anti-inflammatory body that it needs a chapter to itself.

If you get insufficient DHA, then your body pinch-hits with other, inferior lipids, and both your physical and cognitive function are sub-optimal and chronic inflammation is a certainty.[1] Many athletes know this science already, and take DHA, and its anti-inflammatory partner

eicosapentaenoic acid (EPA). But most of those we see at the Colgan Institute take less than half the amounts found effective in research. I want to sketch the science briefly, to convince you that you will never reach your potential as an athlete unless you eat sufficient DHA and EPA every day. No other food or supplement is as important for an anti-inflammatory body, and no other food or supplement can work properly without them.[1]

To show you, I have to take a very rapid and compressed glance into evolution. Scientists have known for a century that DHA is one of the earliest signalling systems used by evolution to build animal structure. Some 500 million years ago, DHA was the main structural lipid of ancient cephalopods, such as the ammonite shown below.[1] It was conserved across evolution right up to the living descendent of the ammonite, the paper nautilus shown below, and through all shellfish and fish, amphibians, and mammals, right up to us. New insights about where we came from, confirmed only in 2010, underline the importance of DHA and EPA for human performance.[3-7]

Ammonites, like the fossil pictured, used DHA 500 million years ago to provides the structures of their eyes and brain, and evolution passed them down to the living fossil, the Paper Nautilus (right), and through fish and amphibians to mammals and to us.

I have space for only a few examples. The 20-meter thick Klasies Estuary shell and fish bone middens found on the eastern South African coast in 1967, are now dated definitively up to 120,000 years ago, and the human remains there are dated to 100,000 years ago.[3] In 1991, the Blombos Cave on the southern tip of Africa provided evidence of middens up to 140,000 years old.

More recently, in 2007, Curtis Marean of Arizona State U, and colleagues found middens, tools, and symbolic carvings made by humans dated definitively to 164,000 years ago at Pinnacle Point cave in South Africa.[4,5] These new discoveries show sizeable groups of humans living much earlier than previously believed. They also show the marine source of the abundant DHA required to allow the human body and brain to evolve. These findings have solved two major questions in anthropology. First, the human cerebral cortex had sufficient time (150,000 years) it required to develop. Second, marine life provided the massive amounts of DHA and EPA required to develop it.

Archeologists excavating a rock shelter in Jebel Faya, in the United Arab Emirates in 2010, found a cache of hand axes and other tools that date to 125,000 years ago. At that time the Arabian Peninsula had sufficient rainfall to support lush vegetation and multiple fauna and seafood.[6] Early Homo sapiens skulls and tools from Skhul and Qafzeh caves in Israel are also dated to 100,000-130,000 years ago. The Jebel Faya tools, shown in examples below, are of a precise and particular construction, using pressure and heat-knapping techniques that match tools found in the Pinnacle Point (shown below) and Blombos caves.[7]

Hand-knapped and heat treated stone axes made by early humans from Pinnacle Point cave on the coast of South Africa dated 164,000 years ago, and similar design axes from Jebel Faya in the United Arab Emirates, dated 125,000 years ago. These tools provide some of the evidence for the coastal evolution of modern humans on diets high in DHA, and their coastal migration to the Arab peninsula, before they spread into Europe.

The savannah theory of human origins is now seriously in doubt. The mass of new evidence supports Sir Alex Hardy's 1972 theory of our coastal origin, and Michael Crawford's extension of it at London University in 1989.[2] It is likely that the groups of Homo sapiens who migrated out of Africa to become our ancestors, evolved on the coastal fringe of South Africa, eating abundant marine DHA. Then they gradually migrated north along the coast. They crossed the Red Sea, which was shallow and only 2.5 kilometres wide at that time, into the Arabian Peninsula, and from there spread to Europe.[6]

Made From DHA

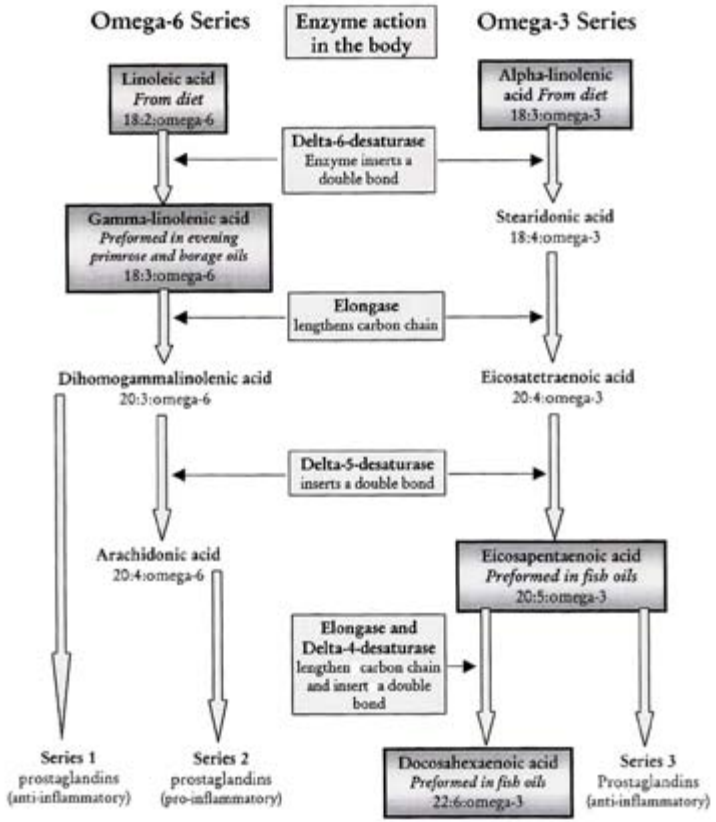
The key conclusion from all the recent evidence is: humans evolved on DHA as our major structural lipid and EPA as our main anti-inflammatory lipid. We are designed to absorb and use omega-3s of marine origin more than 10 times more efficiently that their precursor

in plants, the omega-3 fat, alpha-linolenic acid (ALA).[8] The ALA commonly used by athletes, from flax, canola, and walnut oils, is insufficiently convertible to DHA by humans to support DHA and EPA functions in the human body.[9] There is now overwhelming evidence, reviewed in numerous journals, that the long-chain omega-3 fats, DHA and EPA create a strong anti-inflammatory barrier.[1,10]

We used to have plentiful omega-3 fats in our food. Anthropological and epidemiological studies show that humans evolved on a diet with a ratio of omega-6 to omega-3 of 1:2. But omega-3 fats, especially marine omega-3s, are so biologically active, they are mostly destroyed by food processing. Manufacturers also often deliberately remove omega-3 fats during food processing because their biological activity is incompatible with long shelf life. The result is that Westernized diets today contain an unbalanced ratio of omega-6 to omega-3 fats of 15:1. This imbalance develops a body with chronic inflammation because of over-production of Series 2 inflammatory prostaglandins.[1,10,11] The conversion of fats in the body is shown below. From the diagram, you can see what a great advantage it is to get your DHA and EPA preformed.

Without sufficient DHA and EPA, inflammation becomes a lot worse in athletes for two reasons. First, even slow running stimulates inflammatory cytokines.[12,13] Second, exercise vastly increases generation of oxygen and nitrogen free radicals that impair cellular function.[14] Repeating training the next day, before the inflammatory response has subsided, leads to chronic inflammation.[16]

You can overcome these problems by restoring the balance of omega-3 fats in your diet, to gradually increase your resistance to inflammation.



Conversion of essential fats in the human body.

Numerous recent studies show that eating omega-3 fats, especially from wild fish, increases the serum levels of these fats dramatically, and also reduces the levels of inflammatory markers caused by exercise.[17] In studies with human subjects, 2.0-5.0 grams of EPA/DHA substantially reduces both oxidation and inflammation.[18-20]

New research is also showing some unexpected additional effects for sport. DHA/EPA supplementation increases stroke volume of the heart and cardiac output. It also relaxes the vascular walls, and increases

blood flow to exercising muscles.[21, 22] For those benefits alone, it is more than worth doubling your intake.

We advise all athletes to eat plentiful marine omega-3 fats, from wild fish and shellfish. A 100 gram (3.5 ounces) serving of fresh salmon contains 750-1000 mg of DHA/EPA. Halibut, green-lipped mussels and northern black-lipped mussels contain about the same. Fresh herrings, sardines, and krill contain even more.

We also advise fish oil supplements. ***To develop the anti-inflammatory body, your total intake of DHA/EPA should be a minimum of 2.0 grams per day.*** We also advise all athletes to reduce the amount of omega-6 fats in the diet, and never to take omega-6 supplements.

To achieve the spring and flexibility for a great jump shot like Kobe Bryant, start packing away the DHA today.

11

The Anti-Inflammatory Athlete

Our ancestors evolved by using the chemicals in their food environment. Almost 100% of this evolution was completed prior to agriculture and the development of man-made foods that began 11,000 years ago in the Fertile Crescent of the Middle East. Some of these ancient chemicals are natural anti-inflammatories that our DNA recognizes and uses to control unnecessary inflammation, and to rebuild tissues damaged by inflammation. We have focussed on these chemicals herein.

No man-made chemicals can achieve these benefits, because our DNA code has had insufficient time exposed to them for their incorporation into the genome. Major adaptation of the genome to changes in

chemicals in the food supply takes at least 50,000 years. Paleontologists call it the "genetic lag".

When you increase your use of foods that contain the ancient anti-inflammatories that were in the environment when we evolved, your genome responds by up-regulating expression of specific gene sequences. These sequences increase the levels of the particular enzymes required for efficient use of these anti-inflammatories by your body. This miraculous adaptation does not happen overnight. First, it requires the turnover of blood cells and the growth of new cells in the presence of the anti-inflammatories, so that they can be recognised, absorbed, and distributed around the body more efficiently. This process of turnover takes 90-120 days.[1]

Responding to the increased presence of the anti-inflammatories in the blood, the muscle and organ cells increase levels of specific enzymes, as the normal cycle of turnover replaces the cells. They can then make use of these natural chemicals, because they are already recognised by our DNA code. This process of cell turnover takes a minimum of six months.[1] After that, if you continue to follow the strategies herein, and combine them with diligent training, you will see an unprecedented improvement in your performance in the second six months.

DON'T USE NSAIDS

In Chapter 1, we advised all athletes ***NOT*** to use non-steroidal anti-inflammatory drugs (NSAIDs). The severe gastrointestinal damage they cause is only one of the problems.[2] The major adverse effect of NSAIDs for athletes is inhibition of what is called the nuclear-factor

You need to be incredibly anti-inflammatory to stand the rigors of championship soccer

Kappa-B system, which is critical for the normal inflammatory process and for recruitment of the immune system in healing [3].

By interfering with the healing process, NSAIDs delay removal of tissue damaged during sport. They also delay collagen deposition, and inhibit muscle and other soft tissue regeneration. With habitual use, NSAIDs cause malformed reconstruction of cartilage, tendons, ligaments, and muscles in athletes.[4] If you want a short and painful sports career, these drugs provide a sure-fire route. ***Don't use NSAIDs.***

EAT AN ANTI-INFLAMMATORY DIET

In Chapter 2, we outlined five principles of the anti-inflammatory diet. Avoid foods that spike your insulin. Avoid acidic foods. Avoid foods that did not exist while humans evolved, and are therefore not part of our genetic heritage. Eat a diet high in specific, ancient, anti-inflammatory foods. And eat a diet high in ancient foods that support joint and tissue repair.

Today, despite all the advertising hype, about 70% of supermarket stock consists of artificial processed foods, containing chemicals that never existed in our environment before agriculture. The human body cannot respond optimally to these foods, as they do not act as healthy triggers for our genome. Remember it is the expression of your genome that makes every protein and lipid that composes your body.[1]

Of course, ***every*** food claims to be healthy with all the hyperbole and mendacity that advertisers can muster. Fast food restaurants never rave about, "Slivers of potato covered with thick layers of recycled fat". No one says, "Eat our sublime cookies to keep your blood sugar elevated". Ads do not proclaim "Amazing High Calorie Treats" or "Increased Salt Goodness". Only the government admits that our food supply builds bodies like Fat Bastard, rather than Usain Bolt.

It is not difficult to avoid these foods. Simply ask yourself three questions. First, did this food exist before agriculture? Second, is this food free of man-made chemicals? Third, am I training for worse performance? Answer "No" to any of these questions and you leave the food on the shelf. Remember, a moment in your mouth, but forever flopping around in your tracksuit. ***Aim for a diet of 80% anti-inflammatory foods.*** For more detailed information on the right foods, see my book **Nutrition for Champions.**[5]

No one advertises French fries as "Healthy slivers of potato covered in a thick layer of recycled fat that increase your risk of diabetes by 25%".

EAT AN ALKALINE DIET

Chapter 3 explained how humans evolved on an alkaline diet to yield blood and tissue that is naturally alkaline when in a resting state.[6-7] The usual American diet, however, has become increasingly acidic, yielding low-level chronic acidity in the average American - all the time. You can measure your own state easily with pHydrion strips, as detailed in Chapter 3. Chronic acidosis yields chronic inflammation, a state that prevents athletes from developing to their potential, and leads to chronic disease.[8]

Baked goods, jams, jellies, and puddings are all acid producing, because they consist predominantly of processed grains, processed

sugar, and processed fats. Dairy products, especially cows' milk, cottage cheese, processed cheese, and ice cream are also acid producing. Most legumes are acid producing. Some scientists contend that legumes were only minor items in the pre-agricultural diet, therefore our system is not programmed by evolution to deal with them.[8] I tend to agree with this view.

All leafy green vegetables are highly alkaline. Most other vegetables are too. Almost all fruits, are alkaline producing, even citrus. Though a lemon or lime may taste acidic, it produces a net input of alkaline ash inside you. Alkaline-producing nuts include almonds and chestnuts

To grow an anti-inflammatory body, aim for a diet of 80% alkaline foods. Three delicious dinners that fill the bill are; a pound of baby spinach, almond, and mandarin salad with Thai dressing, with a quarter-pound bison streak; a large pile of steamed asparagus with a grilled wild sockeye fillet; and wok-cooked green veges and water chestnuts with a tiger shrimp, scallop, and snapper medley. Great food!

Green tea is the most alkaline common beverage. Most bottled waters, including Perrier and Dasani, are acidic. Evian is the only big brand alkaline water. ***Eat alkaline every day to grow the anti-inflammatory body.***

Most athletes we ask seem unaware that sodas are highly acidic drinks. Avoid them.

EAT A LOW GLUTEN DIET

Chapter 4 explained how the migrations out of Africa that became the ancestors of the English, Irish, and European races, (and by immigration, most Americans), harbour differences in their DNA codes which make it difficult for them to thrive on grains that contain gliaden. Gliaden is the offending protein in gluten, found mainly in wheat, rye, and barley. For all these races of people, eating a diet high in such foods causes chronic inflammation. We strongly advise athletes of such ancestry to avoid gliaden.[9,10]

If you do eat grains stick to organic whole rice, flax, wild rice, millet and quinoa. Wild fish, grass-fed meats, organic poultry, organic vegetables and fruits, organic honey, teas and coffee, are all fine. See Chapter f for a full list. If you have a touchy gut during long exercise, ***you should see rapid improvement on a low–gluten diet.***

Eat a High Allium Diet

Sulfur is a macro-element of the human system, with a primary task of controlling inflammation. Alliums, the many different species of onions, garlic, shallots, and leeks were a major source of sulfur during our evolution, and remain so today.[11] In Chapter 5 we cover how sulfur not only combats the inflammation of exercise but also protects and rebuilds the soft tissue of your joints. Athletes need abundant sulfur for these purposes, yet the average person gets woefully insufficient in their diet.[12]

There is considerable evidence that supplements of **2000 mg of methyl-sulphonyl-methane** (basic sulfur) improve athletic performance by combating inflammation. These supplements also inhibit the degeneration of joints with aging, and reduce the damage of intense exercise [13-15]. Because sulfur compounds degrade within a few hours and have to be renewed constantly for optimum results, ***aim to get ample sulfur every day.***

Capsaicin Scores

Over millions of years of evolution, the human body developed genes that respond specifically to capsaicins, the active chemicals in hot peppers and related species. Evolution used these chemicals to develop a unique anti-inflammatory system, now called the transient-receptor-potential-vanilloid (TRPV) system. It is highly potent, both to inhibit inflammation and to stop pain.[16-17]

Capsaicin offers additional unique benefits for the athlete. Groups of athletes we have put on a high capsaicin diet for one year ***all lost body fat***. Numerous studies have now confirmed this phenomenon.[18,19] As a further benefit, capsaicin causes release of endorphins during exercise.[20] It is a feel good food that combats inflammation and keep you leans and exuberant.

Super capsaicin foods include all sorts of Indian curries, and Thai dishes. My favorite is Madras curry which includes coriander, cumin, cinnamon, bay leaves, fenugreek, allspice, black pepper, and turmeric. With a mix of 12 veges and added tamarind, onions, garlic and ginger. It is not only great food, but also a premium mix of anti-inflammatories to build in to your body. ***Eat curry dishes or a supplement of 1000 mg cayenne every day.***

Eat a high–curry diet to get your capsaicin.

Turmeric Beats NSAIDs

Unlike NSAIDs, curcumin, the active anti-inflammatory in turmeric, is protective of the gastrointestinal tract. By precisely regulating genes in ways no man-made drug can match, curcumin permits the immune response to work properly, but with a lower inflammatory load.[21] There are now hundreds of research studies on the anti-inflammatory effects of curcumin, as pharmaceutical companies use the new molecular techniques to zone in on how it works. By last count, from January to April 2011 there were 106 new studies published on curcumin.

Curcumin is especially useful to endurance athletes because, in addition to reducing muscle inflammation, it inhibits inflammation of the gut during exercise. At the Colgan Institute, we advise all athletes to use turmeric freely in cooking. It is great with Middle Eastern and Asian dishes, duck, and shrimp.

Turmeric is very sensitive to light, which is why the gourmet turmeric is sold in opaque containers. For best anti-inflammatory effects use it in recipes with black pepper, as it needs the piperine from pepper to

make it reasonably bioavailable.[22] You can also get a supplement of 900 mg of curcumin with 50 mg of piperine. ***Get curcumin every day to build an anti-inflammatory body.***

Ginger Rocks

Scientists have been able to study the molecular effects of ginger only since genomic science took off at the beginning of this century. Now we are finding out that this ancient plant, which grows in myriad forms worldwide, holds keys to the amazing strength and endurance recorded for ancient humans. Our ancestors were far stronger and faster than even out best athletes today. Australian paleoanthropologist Peter McAllister and colleagues have studied ancient humans extensively. They conclude from a mass of evidence that the average cavewoman would have considered Arnold Schwarzenegger somewhat puny, and even our champion runners slowcoaches.[23]

In one study, McAllister analysed the tracks made 20,000 years ago by six male Australian Aborigines chasing prey. They left footprints in a muddy lakeshore that fossilized. The footprints show them running at 37 kph (23 mph) and accelerating near the end of the prints.[15] Unlike modern runners, the ancient hunters were running barefoot on slippery mud, carrying their weapons. They had no modern training, no spiked shoes, and no springy rubberized track. Plants containing gingerols, however, were likely one of their dietary staples.

Like curcumin, gingerol beats NSAIDs for relief from inflammation. It is also protective of the gut, but by different molecular routes than curcumin, and is a strong antioxidant. [24-27] Use it freely in cooking.

My favorites are ginger lime salmon, and ginger coconut chicken. You can also take ginger as a supplement of ***800 mg of 8%, 6-gingerol.*** Whatever way you do it, ***add some ginger to your life every day.***

Savour ginger in your food, such as this ginger lime wild sockeye with sweet chilis.

Saving Your Joints

Sport is tough on the cartilage of your knees, shoulders, ankles, elbows, wrists and hips, continually creating rough spots and wearing it out. Sport is also tough on the synovial lubricating fluid that allows the joints to slide freely. Whenever the intensity of your exercise causes the rate of wear and tear to exceed the maximum rate at which you can produce new cartilage and synovial fluid, you get inflammation, pain, and stiffness.[28]

There are four essential components of a synovial joint that you can influence by what you eat. First are collagen fibrils. Second, are structures like small feathers called proteoglycans. Third, are chondrocytes, the only cells in cartilage. Chondrocytes manufacture the mix of collagen and proteoglycans that form the cartilage. Fourth is

synovial fluid, a complex mixture that contains a high level of a viscous gel called hyaluronan (hyaluronic acid).

Collagen is a protein that is broken down in digestion. Nevertheless, researchers have increased collagen production in knee joints, and relieved arthritis, by feeding subjects fish and chicken collagen.[29] The mechanism by which this occurs is still unknown. There is also evidence of increased collagen in joints from a diet high in collagen-rich foods. These include, free-run poultry, wild fish, and shellfish, especially the usual black-lipped mussels, and the New Zealand green-lipped mussels.[30,31] ***We recommend that all athletes eat a diet high in free-run poultry, wild fish and shellfish to benefit collagen levels in joints.***

The chemical **glucosamine** is a major component of cartilage. Supply of this chemical is the rate-limiting step that largely controls the rate of cartilage renewal.[28] Your body makes glucosamine from glucose and the amino acid glutamine. When joints are under high stress, however, as occurs in most sports, the rate of glucosamine production often falls below the rate of wear. The cartilage then becomes thin and uneven, and inflamed. Chapter 9 reviewed solid evidence that pre-formed glucosamine taken as a dietary supplement of glucosamine sulfate increases glucosamine levels and cartilage in joints, and reduces inflammation.[32-35]

The second major component of proteoglycans is chondroitin, which gives the cartilage much of its resistance to compression. Taken as a supplement, chondroitin sulfate has been successful in increasing the quality and volume of new cartilage in numerous controlled trials.[36-39] ***For athletes, we recommend 1,000 mg of glucosamine***

sulfate, and 1,000 mg of chondroitin sulfate every day to protect the joints.

Hyaluronan is a major component of the synovial lubricating system of joints. The big problem with supplementation has been absorption, because hyaluronic acid is usually a monster molecule, seemingly too big to pass through the gut wall. Recent reviews of the evidence, however, indicate that even large molecule hyaluronan taken by mouth does increase synovial fluid in joints.[32,40] From this research, ***we recommend supplementation of 100 mg per day of hyaluronic acid for athletes.***

DHA Reigns Supreme

Docosahexaenoic acid (DHA) is the main omega-3 fat built into your body. It is essential for the cell membranes of your muscles and organs that enable them to resist inflammation.[41,42] Many athletes know this science already, and take DHA, and its anti-inflammatory partner, eicosapentaenoic acid (EPA). But most of those we see at the Colgan Institute take less than half the amounts found effective in research.

DHA and EPA come mainly from ocean fish and shellfish. We are designed to absorb and use these omega-3s of marine origin more than 10 times more efficiently that their precursor in plants, the omega-3 fat, alpha-linolenic acid (ALA).[41] The ALA commonly used by athletes, from flax, canola, and walnut oils, is insufficiently convertible to DHA by humans to support DHA and EPA functions in the human body.(9)

There is now overwhelming evidence that the marine omega-3 fats, DHA and EPA create a strong anti-inflammatory barrier.[42,43] They work by different genetic mechanisms to the other anti-inflammatory foods covered in this book, and are synergistic with them in building an anti- inflammatory body.[44-47]

We advise all athletes to eat plentiful marine omega-3 fats, from wild fish and shellfish. A 100-gram (3.5 ounces) serving of fresh salmon contains 750-1000 mg of DHA/EPA. Halibut, green-lipped mussels, and northern black-lipped mussels contain about the same. Fresh herrings, sardines, and krill contain even more. We also advise fish oil supplements. Y***our total intake of DHA/EPA should be a minimum of 2.0 grams per day.*** Don't leave home without them.

The above strategies will develop a body that is highly resistant to the inflammation of exercise. They are simple and straightforward, and can be followed by any athlete. But they do have to be continued consistently for at least one turnover of most muscle and blood cells, that is, at least 6 months. I am confident that if you adopt the strategies herein for that period, you will find them of so much benefit to your sport, and to your general health, that you will maintain them as a permanent part of your lifestyle. Let me know of your progress at drcolgan@colganinstitute.com.

Michael Colgan with a 25lb chinook salmon caught off Salt Spring Island where he lives in Canada. Superb source of DHA.

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