Multiple biological activities of lactic acid in cancer: influences on tumor growth, angiogenesis and metastasis.

(Yoghart is a High lactic acid and calcium source)

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Abstract

High rate of glycolysis is a metabolic hallmark of cancer. While anaerobic glycolysis promotes energy production under hypoxia, aerobic glycolysis, the Warburg effect, offers a proliferative advantage through redirecting carbohydrate fluxes from energy production to biosynthetic pathways. To fulfill tumor cell needs, the glycolytic switch is associated with elevated glucose uptake and lactic acid release. Altered glucose metabolism is the basis of positron emission tomography using the glucose analogue tracer [18F]- fluorodeoxyglucose, a widely used clinical application for tumor diagnosis and monitoring. On the other hand, high levels of lactate have been associated with poor clinical outcome in several types of human cancers. Although lactic acid was initially considered merely as an indicator of the glycolytic flux, many evidences originally from the study of normal tissue physiology and more recently transposed to the tumor situation indicate that lactic acid, i.e. the lactate anion and protons, directly contributes to tumor growth and progression. Here, we briefly review the current knowledge pertaining to lactic acidosis and metastasis, lactate shuttles, the influence of lactate on redox homeostasis, lactate signaling and lactate-induced angiogenesis in the cancer context. The monocarboxylate transporters MCT1 and MCT4 have now been confirmed as prominent facilitators of lactate exchanges between cancer cells with different metabolic behaviors and between cancer and stromal cells. We therefore address the function and regulation of MCTs, highlighting MCT1 as a novel anticancer target. MCT1 inhibition allows to simultaneously disrupt metabolic cooperativity and angiogenesis in cancer with a same agent, opening a new path for novel anticancer therapies.

Lactate - A new frontier in the immunology and therapy of prostate cancer.

Prostate cancer, one of the most common male malignancies with an increasing incidence in the recent years, requires the development of new methods of treatment. One of the most debated subjects is the tumor-associated macrophages (TAM). Although, the pathophysiological mechanisms are still a subject of intense research, TAM acts as procarcinogenic factors. It was also demonstrated that hypoxia-inducible factor 1 (HIF1) induces the expression of TAM genes involved in prostate carcinogenesis. Furthermore, it should be noted that the stromal extracellular lactate, the result of tumoral glycolysis process is one of the HIF1 activators. In addition, lactate inhibits the differentiation of monocytes and dendritic cells and also induces the inactivation of the cytotoxic T-lymphocytes. Through an analysis of recent studies, we conclude that lactate is a vital component of several ways of modulating the immune response at the stromal prostatic adenocarcinoma including TAM activation and cytotoxic T lymphocytes immunosuppression. Our review focuses on the impact of lactate on prostatic adenocarcinoma progression in terms of its immunology, and how this influences the therapy of this condition and the clinical outcome.

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Does Cheese Increase Prostate Cancer Risk?

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As a lover of cheese, I was concerned at a recent analysis of 32 studies that showed a potential link between prostate cancer and dairy intake. Although I don't own a prostate myself, three

members of my household do – and they share my delight in a nice runny brie, a baked Camembert and a ploughman's slab of Cornish cheddar.

Researchers writing in the American Journal of Clinical Nutrition found an association between high intakes of various dairy foods, especially cheese, and an increased risk of prostate cancer. For cheese, the relative risk increased by 10% for every 50 grams consumed per day, although there was no significant association between cheese intake and fatal prostate cancer.

For men with the highest milk intake, the relative risk of receiving a diagnosis of prostate cancer was 11% greater than for those who drank the least milk, with the risk increasing by 3% for every 200 grams consumed per day. Oddly, whole milk seemed to offer slight protection, while low-fat milk increased the relative risk by 6% for every 200 grams consumed per day. Again, no link was found between drinking milk and fatal prostate cancer.

No association was found for skimmed milk, ice cream or butter either, although the number of studies available was limited.

So what would I do if I were male?

Milk and dairy products are an important source of vitamins and minerals, including calcium, phosphate, thiamin, riboflavin and vitamin B12, while full-fat dairy products are also good sources of the fat-soluble vitamins A, D, E and K. Rather than cutting them out entirely, it may make sense to cut back. I would continue to enjoy my regular cheese fests but I might swap some (but not all) of my mugs of black tea with milk for green tea which has a protective effect against prostate cancer. I would experiment with soy milk, yogurt and vegan cheeses, as well as increasing my intake of Asian-style foods associated with a lower risk of prostate disease, as described below, and which probably offer some benefits against other hormone-related cancers such as those of the breast and ovaries, too.

The link between prostate cancer and diet

Prostate cancer is the second most common cancer in men worldwide. The highest rates are reported in the US and Sweden, while the lowest rates are in Japan, India and China. Yet, just as many Asian men appear to develop early prostate cancer as Western males; the difference is that these tumours are more likely to remain small, slow-growing and clinically insignificant in those who follow a traditional Asian diet.

When native Japanese or Chinese men migrate to the West and adopt a more Western-style diet, their risk of clinically significant prostate cancer quickly increases. Among Japanese men in the US, for example, the incidence of prostate cancer is four times higher than for men still living in Japan; for Chinese men living in America, the incidence is seven times higher than for men still living in China. This strongly suggests that dietary and lifestyle habits are involved. Researchers have identified many foods that appear to offer some protection against prostate diseases in general, including BPH, prostatitis and the progression of prostate cancer.

Cancer's Favorite Food - Found in Everything You Eat?

Pancreatic tumor cells use fructose to divide and proliferate, according to a study that challenges the notion that all sugars are the same.

Tumor cells fed both glucose and fructose used the two sugars in two different ways. This could explain why other studies have previously linked fructose intake with pancreatic cancer, one of the deadliest cancer types.

According to MSNBC:

"Americans take in large amounts of fructose, mainly in high fructose corn syrup, a mix of fructose and glucose that is used in soft drinks, bread and a range of other foods. Politicians, regulators, health experts and the industry have debated whether high fructose corn syrup and other ingredients have been helping make Americans fatter and less healthy."

Dr. Mercola's Comments:

Are all sugars equal in terms of the health effects they produce?

Sooner or later, science *will* put this debate to rest once and for all. It's already been conclusively shown that fructose, most commonly consumed in the form of high fructose

corn syrup (HFCS), is FAR more hazardous to your health than regular sugar, but the [corn industry still vehemently denies such claims](#).

Through successful PR campaigns, industry has managed to pull the wool over your eyes for some time now, but eventually even they will have to surrender to the scientific evidence...

Until then, propaganda machines like the Corn Refiners Association's site, [SweetSurprise.com](#), will continue telling you that "research confirms that high fructose corn syrup is safe and no different from other common sweeteners like table sugar and honey. All three sweeteners are nutritionally the same," and that "though the individual sugars are metabolized by different pathways, this is of little consequence since the body sees the same mix of sugars from caloric sweeteners, regardless of source."

But are these metabolic differences of little consequence?

Far from it!

Fructose Speeds Up Cancer Growth

Research just published in the journal *[Cancer Research](#)* shows that the way the different sugars are metabolized (using different metabolic pathways) is of MAJOR consequence when it comes to feeding cancer and making it proliferate.

According to the authors:

*" Importantly, fructose and glucose metabolism are quite different... These findings show that cancer cells can readily **metabolize fructose to increase proliferation**."*

In this case, the cancer cells used were [pancreatic cancer](#), which is typically regarded as the most deadly and universally rapid-killing form of cancer.

The study confirms the old adage that sugar feeds cancer because they found that tumor cells do thrive on sugar (glucose). However, the cells used *fructose* for cell division, speeding up the growth and spread of the cancer.

If this difference isn't of major consequence, then I don't know what is.

Whether you're simply interested in preventing cancer, or have cancer and want to live longer, you ignore these facts and listen to industry propaganda at your own risk.

How Does Sugar Feed Cancer?

Controlling your blood-glucose and insulin levels through diet, exercise and emotional stress relief can be one of the most crucial components to a cancer recovery program. These factors are also crucial in order to prevent cancer in the first place.

It may surprise you, but the theory that sugar feeds cancer was born nearly 80 years ago. Even more shocking, most conventional cancer programs STILL do not adequately address diet and the need to avoid sugars.

In 1931 the Nobel Prize was awarded to German researcher Dr. Otto Warburg, who first discovered that cancer cells have a fundamentally different energy metabolism compared to healthy cells.

Malignant tumors tend to use a process where glucose is used as a fuel by the cancer cells, creating lactic acid as a byproduct.[i] The large amount of lactic acid produced by this fermentation of glucose from cancer cells is then transported to your liver. This conversion of glucose to lactic acid generates a lower, more acidic pH in cancerous tissues as well as overall physical fatigue from lactic acid buildup.[ii] [iii]

This is a very inefficient pathway for energy metabolism, which extracts only about 5 percent of the available energy in your food supply. In simplistic terms, the cancer is "wasting" energy, which leads you to become both tired and undernourished, and as the vicious cycle continues, will lead to the body wasting so many cancer patients experience.

Additionally, carbohydrates from glucose and sucrose significantly decreases the capacity of neutrophils to do their job. Neutrophils are a type of white blood cell that help cells to envelop and destroy invaders, such as cancer.

In a nutshell, ALL forms of sugar are detrimental to health in general and promote cancer, but in slightly different ways, and to a different extent. Fructose, however, clearly seems to be one of the overall *most* harmful.

Connecting the Dots: Fructose—Uric Acid—Cancer and Chronic Disease Risk

One particularly interesting tidbit I noticed in this latest study is the mention of how fructose metabolism leads to increased uric acid production along with cancer cell proliferation.

In my first interview with Dr. Johnson, he explained just how detrimental the impact of fructose is on your uric acid level. Interestingly, ONLY fructose, NOT glucose, drives up uric acid as part of its normal metabolic pathways

And, the connection between fructose, uric acid, hypertension, insulin resistance/diabetes and kidney disease is so clear that your uric acid level can actually be used as a marker for toxicity from fructose -- meaning that if your levels are high, you're at increased risk of all the health hazards associated with fructose consumption and you really need to reduce your fructose intake.

For more information about this topic, please see this link.

Dr. Richard Johnson has written one of the best books on the market on the health dangers of fructose, called [The Sugar Fix](), which explains how fructose causes [high blood pressure, heart disease, obesity, diabetes and kidney disease](). As I've mentioned previously, he does promote the use of artificial sweeteners in this book, which I cannot recommend. His research on fructose, however, is unsurpassed in my opinion.

Now it's safe to say that cancer, at least pancreatic cancer, is also definitely on the list of diseases that are directly linked to excessive fructose consumption.

So are Fruits Good or Bad for You?

This recommendation has created much controversy among many who regularly consume fruit and believe this recommendation does not apply to them.

Many who eat large amounts of fruit have no symptoms, just as those with high blood pressure may not have any symptoms. However lack of symptoms is no assurance you are not exposing yourself to some danger.

Please remember that over three-quarters of the population has insulin resistance.

How do you know if you have insulin resistance? If you have any of the following conditions it is a safe bet you have it:

• Diabetes
• High blood pressure
• Overweight
• High Cholesterol
• Cancer

If you have insulin resistance it would be strongly recommended to limit your total grams of fructose from fruit to below 15 grams per day (see the table below). If you believe you are very healthy and are an exception to this recommendation, then you can easily confirm if this is true for you by measuring your uric acid level.

If your uric acid level is greater than 5.5 than you have a risk factor and should limit your fructose consumption. The higher over 5.5, the stronger the risk factor is.

Keep in mind that fruits also contain fructose, although an ameliorating factor is that whole fruits also contain vitamins and other antioxidants that reduce the hazardous effects of fructose.

Juices, on the other hand, are nearly as detrimental as soda, because a glass of juice is loaded with fructose, and a lot of the antioxidants are lost.

It is important to remember that fructose alone isn't evil as fruits are certainly beneficial. But when you consume high levels of fructose it will absolutely devastate your biochemistry and physiology. Remember the AVERAGE fructose dose is 70 grams per day which exceeds the recommend limit by 300 percent.

So please BE CAREFUL with your fruit consumption. You simply MUST understand that because HFCS is so darn cheap, it is added to virtually every processed food. So even if you consumed no soda or fruit, it is very easy to exceed 25 grams of hidden fructose in your diet if you are consuming anything processed.

If you are a raw food advocate, have a pristine diet, and exercise regularly, then you could be the exception that could exceed this limit and stay healthy. But in my experience that is certainly the exception and not the norm.

So please, carefully add up your fruits based on the table below to keep the total fructose from fruit below 15 grams per day.

Fruit	Serving Size	Grams of Fructose
Limes	1 medium	0
Lemons	1 medium	0.6
Cranberries	1 cup	0.7
Passion fruit	1 medium	0.9
Prune	1 medium	1.2
Apricot	1 medium	1.3
Guava	2 medium	2.2
Date (Deglet Noor style)	1 medium	2.6
Cantaloupe	1/8 of med. melon	2.8
Raspberries	1 cup	3.0
Clementine	1 medium	3.4
Kiwifruit	1 medium	3.4
Blackberries	1 cup	3.5

Star fruit	1 medium	3.6
Cherries, sweet	10	3.8
Strawberries	1 cup	3.8
Cherries, sour	1 cup	4.0
Pineapple	1 slice (3.5" x .75")	4.0
Grapefruit, pink or red	1/2 medium	4.3

Restricting Fructose Consumption is Crucial Part of a Comprehensive Cancer Treatment Plan

Reducing (or preferably eliminating) fructose and other added sugars, as well as limiting grain carbohydrates from your diet, is usually a primary priority on my list of cancer reducing strategies, and for good reason.

This dietary strategy should also be part of your comprehensive cancer treatment plan.

By severely reducing your intake of fructose and carbs in your diet, you help stave off any potential cancer growth, and "starve" any tumors you currently have.

It also bolsters your overall immune function, because sugar decreases the function of your immune system almost immediately.

Unfortunately, few cancer patients undergoing conventional cancer care in the US are offered any scientifically guided nutrition therapy beyond being told to "just eat healthy foods." I believe many cancer patients would see major improvement in their outcome if they controlled the supply of cancer's preferred fuel, glucose, and stayed clear of fructose to significantly reduce tumor proliferation.

Starving Cancer – Another Up-and-Coming Strategy

Before I go into further cancer prevention strategies, I'd like to remind you of another recent cancer research development I recently wrote about, namely 'starving' cancer by eating foods that prevent angiogenesis.

Angiogenesis (too many blood vessels) is a hallmark of cancer as the tumor actually needs blood in order to grow (this is how it feeds on the glucose in your bloodstream).

But angiogenesis appears to be preventable by consuming foods that are natural inhibitors of excessive blood vessel growth.

When you regularly consume these foods, you can effectively starve any microscopic cancerous growths, effectively preventing them from growing further and becoming dangerous.

According to Dr. Li, who is currently leading this research, resveratrol from red grapes, for example, have been shown to inhibit abnormal angiogenesis by 60 percent. Even more potent is the ellagic acid found in strawberries.

Other potent anti-angiogenetic foods include:

Green tea	Berries: strawberries, blackberries, raspberries, blueberries	Cherrie
s: oranges, grapefruit, lemons	Kale	Turmer
Nutmeg	Artichokes	Parsle
Garlic	Tomato	Maitake mus

Logically, different foods contain different potencies of anti-angiogenetic compounds. Some foods have even been found to be more potent than current anti-angiogenetic drugs! These include parsley and garlic.

But interestingly, when researchers evaluated a combination of two of the LEAST potent teas, for example, they discovered that this combination tea had greater potency than any given tea by itself.

"There's *synergy*," Li states, which should come as no surprise to those of you who are well-versed in holistic nutrition.

It is this synergy that makes fresh, whole foods so potently nutritious!

The sum is far greater than the individual parts, and this is why it's far more important to focus on eating a diet of whole, organic foods, rather than obsessing about individual nutrients.

Other Cancer Prevention Strategies

Aside from avoiding fructose and other added sugars (which means cutting out not only soda and sugary beverages, but also processed foods since most are loaded with

HFCS), and incorporating more anti-angiogenetic fare into your diet, here are several additional strategies you can incorporate to virtually eliminate your cancer risk:

1. Normalize your vitamin D levels with safe amounts of sun exposure. This is one of the most effective, and least expensive, cancer prevention strategies available to most people. Ideally, you'll want to monitor your vitamin D levels to make sure your levels stay within a therapeutic range year-round.
2. Get appropriate amounts of animal-based omega-3 fats.
3. Exercise. One of the primary reasons exercise works is that it drives your insulin levels down. Controlling insulin levels is one of the most powerful ways to reduce your cancer risks.
4. Have a tool to permanently erase the neurological short-circuiting that can activate cancer genes. Even the CDC states that 85 percent of disease is caused by emotions. It is likely that this factor may be more important than all the other physical ones listed here, so make sure this is addressed. My particular favorite tool for this purpose, as you may know, is the Emotional Freedom Technique.
5. Only 25 percent of people eat enough vegetables, so by all means eat as many vegetables as you are comfortable with, preferably fresh and organic.

NEXT Paper:

DOES YOGURT CAUSE PROSTATE CANCER?

Does Yogurt Cause Prostate Cancer?

A European research published seven years ago, had stated that the more you consumed yogurt, the more risk you had of becoming a sufferer of prostate cancer.
It has been several years that researchers have questioned if dairy really did cause prostate cancer. Out of 23 epidemiological analyses, 16 documented that males that ingested the most dairy products carried a greater risk than those who consumed little.

Since 2006, a fresh research has been put into these unpleasant data. Research released by the British Journal of Nutrition covered roughly 2,800 men. The researchers found an increased risk of cancer in men with the highest intake of dairy products and calcium compared to those who consumed less.

So does yogurt cause prostate cancer? For all dairy products, the risk is moderately high (35%), in contrast to calcium, with which the risk is multiplied by 2.5. Among dairy products, it is the yogurt that seems to present most problems, with the risk of cancer rising by 59% every time they consume more yogurt (120 g).

Courtesy of Danilo Rizzuti at FreeDigitalPhotos.net

The National Nutrition and Health Programme recommended to consume daily 3-4 dairy products in order to promote bone health. In a 2003 article designed to make reference to the connection between diet plan and cancer, and the spokesperson says "We certainly can not put the blame on milk and milk products for increased cancer risk". To suggest otherwise would promote false pseudoscientific ideas and it is especially crucial to get ahead.

Milk products are the main theme of an enormous agro-food industry promotion campaign. From their point of view, yoghurt is introduced as a healthy food that helps promote good digestive tract bacteria, which is true, and assists the body's defenses, which is very likely. Many research projects have discovered that people who ingested dairy products, including yogurt and others, had a colon cancer risk marginally less than people who didn't.

Other studies suggest that dairy foods can help prevent non-insulin-dependent diabetes. However the three to four servings of dairy daily according to the health recommendations in effect in the western world, the risks may actually outdo the benefits. Dairy products provide large amounts of calcium and they think it reduces the amount of active vitamin D in the body, that is among the tools available to the body to avoid the likelihood of cancer.

Harvard School of Public Health was the first to attract the interest of scientists on the potential risk of cancer linked to a high consumption of dairy products: It seems irresponsible to promote dairy products the way it is in many countries. Harvard School of Public Health advises you to get one or two good sources of calcium per day which includes calcium containing mineral water, cruciferous vegetables, sardines, almonds

Natural Sugars Found in Apples

All fruit contains a variety of natural sugars in different proportions and ratios. Fructose -- also called fruit sugar -- is the most prevalent, although some sucrose and glucose are typically present, especially in sweeter fruits. Compared to other fruit, apples contain a little more natural sugar than average, although not nearly as much as ripe bananas or sweet grapes. Natural sugars are a good source of energy, but they can quickly raise blood sugar levels, so diabetics and people watching their weight need to be cautious.

Fructose

Fructose is a monosaccharide, or simple sugar, which means it isn't metabolized by enzymes before it's absorbed in the small intestine. However, fructose is further processed in the liver before it enters the bloodstream, so it does not trigger insulin release as much as glucose does. Fructose is also the sweetest tasting of all natural sugars. Fructose exists by itself in fruit -- called free fructose -- but it also combines with glucose to make sucrose. Apples are a relatively high source of fructose, as 100 grams contain almost 6 grams of free fructose, which represents about 57 percent of the total sugar content. The fructose content of apples is similar to pears.

Sucrose

Sucrose is a disaccharide sugar made from fructose and glucose molecules. Sucrose needs an enzyme called sucrase to cleave it in half before its components can be absorbed. Sucrose tastes sweet -- which is why it's used to make granulated table sugar -- but not as sweet as fructose. Apples are only a fair source of sucrose, as 100 grams contain a little more than 2 grams of it, which represents about 20 percent of the total sugar content. For comparison, 100 grams of pineapple contains 6 grams of sucrose -- three times more.

Glucose

Glucose is the simple sugar that's carried in the blood and delivered to virtually all cells with the help of insulin. Cells use glucose to make energy molecules called ATP. Pure, or free, glucose is not nearly as sweet tasting as fructose or sucrose. Apples are an average source of glucose, as 100 grams contain almost 2.5 grams of free glucose, which represents nearly 25 percent of the total sugar content. In terms of free glucose content, apples are on par with apricots and sweet onions.

Considerations

Due to their relatively high proportion of fructose, apples have a lower glycemic index compared to other sweet fruits, which means they have less impact on blood glucose levels and insulin release. Consequently, apples are an allowable snack for diabetics if eaten in moderate amounts and portions. On the other hand, most types of apple juice are significantly sweeter than fresh fruit because they have more sugars added. The natural sugar content of apples varies depending on type, growing conditions and ripeness, among other factors.