The Sugar and Cancer Connection

Sugar consumption trends over the past 300 years:

- In 1700, the average person consumed about 4 pounds of sugar per year.
- In 1800, the average person consumed about 18 pounds of sugar per year.
- In 1900, individual consumption had risen to 90 pounds of sugar per year.
- In 2012, more than 50% of all Americans consumed 1/2 pound of sugar per day — translating to a whopping 180 pounds of sugar per year!

In 1890, only 3 people out of 100,000 had diabetes. In 2012, almost 8,000 out of every 100,000 people was diagnosed with diabetes

Creating Our Addiction to Sugar - The "sugar rush"

American children are consuming about 10 times as much sugar as they were in 1900, especially in the form of high fructose corn syrup (HFCS), which is highly addictive and contains fructose and glucose, which is not bound together (as they are in table sugar) so the body doesn't need to break it down. Therefore, the fructose is absorbed immediately, going straight to the liver, which turns it into fat (VLDL and triglycerides).

According to Dr. Joseph Mercola: "Fructose also tricks the body into gaining weight by fooling your metabolism (it turns off the appetite-control system). Fructose does not appropriately stimulate insulin, which in turn does not suppress ghrelin (the "hunger hormone") and doesn't stimulate leptin (the "satiety hormone"), which together result in your eating more and developing insulin resistance." This process also suppresses the immune system.

"The real problem is added sugar that manufacturers put in food during the production process, either to sweeten it or enhance the flavor in some other way", says Michael Schwartz, M.D., director of the UW Medicine Diabetes Institute and the Nutrition Obesity Research Center. "There aren't really many sources of pure sugar in nature. And so what's different about table sugar is that we're getting a dose of it in a pure form. That is not something that we evolved to do."

Experiments conducted on rats by Dr. Serge Ahmed of Bordeaux, France, prove that sugar is more addictive than cocaine. It turns out that the sweet taste of sugar is more rewarding than the high of cocaine.

- Sugar produces dopamine in the brain. People get addicted to eating sugar, whereby they need it to feel "normal" and they undergo "withdrawal" if they cut sugar from their diets. If they go "cold turkey" for a few days, their brain will begin to produce dopamine on its own, but the discomfort of the withdrawal process keeps many "sugar addicts" trapped in their addiction.

According to Dr. Richard Jacoby, a regenerative medicine specialist out of Scottsdale, Arizona, **"The worst sugar, in my opinion, is high fructose corn syrup. The way it's made, genetically modified. The way it's processed. There's mercury used in it. It's neurotoxic.'**

Dr Jacoby believes that:

- Prior to 1974 in the literature, there were twelve cases of carpal tunnel. In 2019, there was over 500,000 surgical procedures in the United States on carpal tunnel. The reason for this increase is sugar.
- There were over 800,000 cases in 2018. Gallbladder, that's a branch in the vagus nerve going down to the gallbladder. If the sugar is affecting that nerve, that gallbladder, which is the muscle, it doesn't empty and a stone is formed.
- Sugar plus trauma equals nerve dysfunction.
- **"If you're eating a diet high in sugar, carbohydrates, and you're overweight, and you have itis, that's the cause. I know your doctor called it arthritis. I know your doctor called it multiple sclerosis. I know your doctor called it autism, Alzheimer's. No, it's sugar. It's the same disease"**

According to Dr. Mark Hyman, 11 time number one New York Times bestselling author and the director of the Cleveland Clinic Center for Functional Medicine, "**The pathway to keep cancer going is sugar.** In fact, when they do diagnostics for cancer, they do this thing called a pet scan, which is where they basically tell you to starve yourself from carbohydrates and sugar for a few days. They inject sugar into you, radioactive sugar. They can see it goes right to the cancer. That's how the cancer lights up because a cancer loves sugar and starch, I would say as well…. **Cancer cells can only run on sugar. You cut off their food source, they die. That's the theory, and it's been shown to be, often, very effective in many difficult to treat cancers, which is now undergoing a lot of research"**

- **Sugar is highly acidic**. With a pH of about 6.4, it is 10 times more acidic than the ideal alkaline pH of blood at 7.4. Maintaining a preventative pH level may require reducing or eliminating dietary sugar.

- **Sugar suppresses a key immune response known as phagocytosis** – the Pac-Man effect of the immune system. Consuming 10 teaspoons of sugar can cause about a 50% reduction in phagocytosis.
- **Not only the amount of sugar, but also the frequency of ingesting sugar is relevant to immune function**. In one study, research subjects were found to have nearly a 38% decrease in phagocytosis one hour after ingesting a moderate amount of sugar. Two hours later, the immune system was suppressed 44%; immune function did not recover completely for a full five hours.

The Warburg effect:

The 1931 Nobel laureate in medicine, German Otto Warburg, PhD, discovered that cancer cells have a fundamentally different energy metabolism compared to healthy cells. **He found that malignant tumors exhibit increased glycolysis -- a process whereby glucose is used as a fuel by cancer** -- as compared with normal cells.

The Warburg Effect refers to the fact that cancer cells, somewhat counter intuitively, prefers fermentation as a source of energy rather than the more efficient mitochondrial pathway of oxidative phosphorylation (OxPhos)

- Fermentation of sugar to lactic acid produces about 15 times less energy than respiration of sugar, yet cancer cells grow much more rapidly than normal cells; and yeast actually grows the fastest when they ferment
- According to him, “Cancer, above all other diseases, has countless secondary causes. But, even for cancer, there is only one prime cause. Summarized in a few words, the **prime cause of cancer is the replacement of the respiration of oxygen in normal body cells by a fermentation of sugar**.”

Johan Thevelein, Wim Versées and Veerle Janssens conducted a 9 year long research to investigate sugars link to cancer, and to try and better understand the Warburg effect.

In their research, they found that a compound in sugar stimulates aggressive cancer cells and helps them to grow faster-

- Johan Thevelein, senior author of the study and a professor at KU Leuven in Belgium, explained that “The direct significance of our work is that patients have to be careful with sugar,” he said, “because we have identified a mechanism by which **high sugar activates the aggressiveness of cancer**.”
- Dr Thevelein said, he and his colleagues found a clear link between fructose 1,6-bisphosphate and activation of oncogenic Ras proteins. “Cancer cells multiply faster

than normal cells and require more energy, that's why they need the rapid sugar breakdown. We found a molecular connection: **there's an intermediate compound in the sugar pathway that acts as a direct activator of Ras, a cancer-causing protein**. Our discovery reveals a vicious cycle where the Ras protein stimulates the sugar breakdown and the overactive sugar breakdown stimulates the Ras protein."

- Although Thevelein maintains that this research does not necessarily conclude that sugar causes cancer, he does state that it could be beneficial to cancer patients to avoid consuming sugars like glucose and fructose, which are rapidly broken down by the body
- According to Thevelein, "**Reducing sugar intake during cancer treatment might help the system to overcome the cancer and it might facilitate the action of chemotherapy** because it's difficult to kill the cancer cells if they're always activated [by sugar]. Providing sugar to cancer cells carries a greater risk of stimulating their aggressiveness."

The Metabolic Theory of Cancer

Boston College biology professor Dr. Thomas Seyfried is a leading proponent of the metabolic theory of cancer. He proselytizes Warburg's findings and in 2012 published an academic book called Cancer as a Metabolic Disease that lays out the evidence behind his beliefs.

- Seyfried argued that decades of research, including his own, supported the idea that aberrant metabolism can somehow induce malignancy. Further, he believes that research supports at the idea that **limiting the fuels available for fermentation — that is, the sugar glucose and the amino acid glutamine — is an overlooked approach to aid treatment.**
- Seyfried's colleague Dominic D'Agostino, a biology professor at the University of South Florida, also subscribes to the idea that the primary driver of cancer is mitochondrial dysfunction, which can be induced by any number of carcinogens — genetic predilections, radiation, chemical exposures and **diet** among them.
- "**Seyfried is skeptical that medicines alone will cure cancer**. Instead he and many of his colleagues — including Dr. Eugene Fine from the Albert Einstein College of Medicine and University of Pittsburgh neurosurgeon Dr. Joseph Maroon — are **focusing on the potential of dietary approaches to contain the disease.**
- "The drugs we have now are so toxic and there's no reason people should have to be poisoned to be healthy. There are a number of studies, including those we've published, showing **a direct relationship between the ketogenic diet and slowed tumor growth**," says Seyfried, also citing the work of Dr. Valter Longo, of the University of Southern California's Davis School of Gerontology. That work shows that low-calorie diets are linked with slowed tumor growth and improved response to chemotherapy. "Why spend all this money going after all these different pathways involved in cancer when you can simply go after the key fuels?" Seyfried asks
- Mayo's Thompson points out that data supporting the ketogenic diet in cancer are limited — and further that rigorous dietary studies are incredibly hard to pull off. **"The**

drug companies aren't going to fund these types of trials," he says. "They can't make money marketing a diet."

- Even Seyfried acknowledges, despite his zeal for treating cancer by tinkering with calories, that in all likelihood **diet and nutrient-based cancer treatments will serve as adjuncts to existing therapie**s. But what would be wrong with that? "We're slowing the tumor down and making it extremely vulnerable to lower, less-toxic doses of available drugs," he says, "When people are locked into an ideology created by a dogma they tend not to focus on rational alternatives."

The Cover up - 'Project 259'

'Project 259' was born in 1968. This was a study to compare "the nutritional effects of [bacterial] organisms in the intestinal tract" in rats fed sucrose versus those fed starch."

W.F.R. Pover, from the Department of Clinical Biochemistry at the University of Birmingham in the United Kingdom was given a substantial funding grant, to get to the bottom of this phenomenon.

- Beta-glucuronidase is an enzyme that helps to break down large molecules. It is also plays a role in cancer. At the time of Project 259, **a link between beta-glucuronidase and bladder cancer** had already been implied. But since Pover's findings were only preliminary, and he was running behind schedule to finish his work, when he asked for a 3-month extension to conclude his experiments, the SRF — which had, by then, become the International Sugar Research Foundation (ISRF) — stopped the funding.
- "Based on ISRF's interpretation of preliminary results," explained Prof. Glantz in the paper, "extending Project 259's funding would have been unfavorable to the sugar industry's commercial interests. In addition, **publication of results suggesting an association between sucrose consumption and bladder cancer would likely have had further adverse regulatory implications to the sugar industry**."
- He suggested that the Food and Drug Administration (FDA) should have taken a close look at sucrose and its possible link to cancer. "Had ISRF disclosed Project 259's findings, it is likely that sucrose would have received scrutiny as a potential carcinogen."

Project 226

In an analysis published in JAMA Internal Medicine, a team of researchers from the University of California outlined how they **unearthed documents and evidence busting the sugar industry for funding Harvard research**. Despite emerging evidence back in the 1950s that sugar caused coronary heart disease, **the sugar industry paid Harvard to downplay that link and instead focus saturated fat's link to heart disease**.

- To save sugar's reputation the sugar industry funded **Project 226**, which resulted in a literature review from the Harvard University School of Public Health Nutrition Department. The sugar industry funded this study, which **blamed cholesterol and saturated fat for heart disease, not sugar**. And it was published in the New England Journal of Medicine, one of the world's premiere medical journals, in 1967. Back then, researchers weren't required to disclose funding when publishing studies like they are today.
- The Harvard study concluded there was "no doubt" that the only dietary intervention required to prevent coronary heart disease was to eat less cholesterol and to eat polyunsaturated fat instead of saturated fat.

Sugar, Cancer and Insulin

Much research shows that it is sugar's relationship to higher insulin levels and related growth factors that may influence cancer cell growth the most, and increase risk of other chronic diseases. **Many types of cancer cells have plenty of insulin receptors, making them respond more than normal cells to insulin's ability to promote growth**.

Diabetes and cancer occur together more often than would be expected by chance alone. Insulin has been shown to stimulate cell division, supporting the growth and spread of cancer cells and making them more difficult to eliminate

In addition, **higher levels of insulin and blood glucose can contribute to inflammation in your body**. In the long term, this can lead to the growth of abnormal cells and possibly contribute to cancer

According to cancer researcher **Lewis Cantley,** (PhD, Director of the Meyer Cancer Center at Weill Cornell Medicine in New York), some cancers may start with high levels of insulin, the hormone that controls the amount of sugar in your blood.

- His research shows that "**having high levels of insulin is likely to drive cancer. And what drives insulin levels is sugar.**"

He doesn't eat any sugar himself because he believes the link between sugar and cancer is clear

- In the 1980s, Cantley discovered how insulin, which is released by the pancreas and tells cells to take up glucose, influences what happens inside a cell. Cantley refered to insulin and a closely related hormone, IGF-1 (insulinlike growth factor 1), as "the champion" activators of metabolic proteins linked to cancer
- In the words of Dr Cantley, "Eating large amounts of sugar over several years almost invariably leads to accumulation of fat in the liver, which causes insulin resistance. The state of insulin resistance is dangerous because the pancreas secretes very high levels of insulin into the serum in an attempt to bring glucose levels back to normal. These high levels of serum insulin can drive the growth of micro-cancers in a variety of tissues, especially breast and endometrial cancers that typically have high levels of the insulin receptor. **The insulin receptor activates PI3K, which drives tumor cell growth and allows tumors to survive in inappropriate locations**."
- He further adds," The high consumption of sugar over the past 40 years and the connection between obesity, elevated serum insulin and oncogenesis is almost certainly responsible for the increased rates of a variety of cancers in the developed world. **It is far better to prevent cancers than to attempt to cure them after they are established. So I avoid sugar whenever possible**."

According to Weil Cornell Medicine, an accumulating body of research by Dr. Cantley and his team has found that excess sugar helps many types of cancer to grow more rapidly.

- **They have found that certain tumors may respond directly to dietary sugar** (colorectal and endometrial cancers) and fat (prostate cancer) or indirectly to the obese state (breast cancer)

Dr. Cantely also hypothesized that insulin spikes from excess sugar consumption may counter the effects of common cancer treatments by reactivating the PI3K pathway in cancer cells. **He suggested that diets low in carbohydrates may help cancer patients overcome the disease by starving cancer cells**, and this hypothesis was tested using a PI3K inhibitor on mice that were genetically engineered to have various types of cancer

- Results from this testing has revealed that causing insulin spikes in the mice can indeed reactivate the PI3K pathway in tumors, despite the mice being treated with a PI3K inhibitor. **The research also found that putting the mice on a low-carbohydrate diet along with the inhibitor caused their tumors to shrink. It was noted that dietary changes in conjunction with the medication resulted in greater effects than the inhibitor alone**
- The findings have implications for cancer prevention, and they could help unlock the potential of new drugs to shrink and destroy tumors. **An evolving understanding of how sugar feeds cancer may also lead to a new approach to treatment: alongside chemotherapy, radiation or surgery, a cancer patient could be prescribed a diet plan that might help those treatments work better**

According to a review of studies regarding a connection between insulin and cancer, many cancer cells require insulin for optimal in vitro growth. Recent data indicate that:

- Insulin stimulates growth mainly via its own receptor and not the IGF-1 receptor;
- In many cancer cells, the IR is overexpressed and the A isoform, which has a predominant mitogenic effect, is more represented than the B isoform.

These characteristics provide a selective growth advantage to malignant cells when exposed to insulin.

- For this reason, all conditions of hyperinsulinemia, both endogenous (prediabetes, metabolic syndrome, obesity, type 2 diabetes before pancreas exhaustion and polycystic ovary syndrome) and exogenous (type 1 diabetes) will increase the risk of cancer. Cancer-related mortality is also increased in patients exposed to hyperinsulinemia but other factors, related to the different diseases, may also contribute. The complexity of the diseases associated with hyperinsulinemia and their therapies does not allow a precise evaluation of the cancer-promoting effect of hyperinsulinemia, but its detrimental effect on cancer incidence and mortality is well documented

According to a study, **The risk of individuals with diabetes to develop colorectal cancer is 1.22 times higher than that of individuals without diabetes**. Evidence thus indicates that high levels of insulin can stimulate the growth of cancer cells and enhance tumor growth, plus, cancer cells have more insulin receptors, so those cells will thrive off of our sugar consumption.

Hyperglycemia

Hyperglycemia (high blood sugar levels) may increase DNA mutations, increase tumor survival, increase proliferation and increase invasion and migration of cancer cells. The indirect effects of this may be from increased insulin and IGF. Insulin is an especially powerful growth stimulant for breast, prostate and colon cancer cells. **This may be because some types of cancer cells (e.g., breast cancer cells) have more insulin receptors** on their surface allowing them to respond more than normal cells to insulin's ability to promote growth. IGF-1 has been shown to encourage the growth of tumors of the prostate, colon, lung, pancreas and breast through promoting angiogenesis and metastasis.

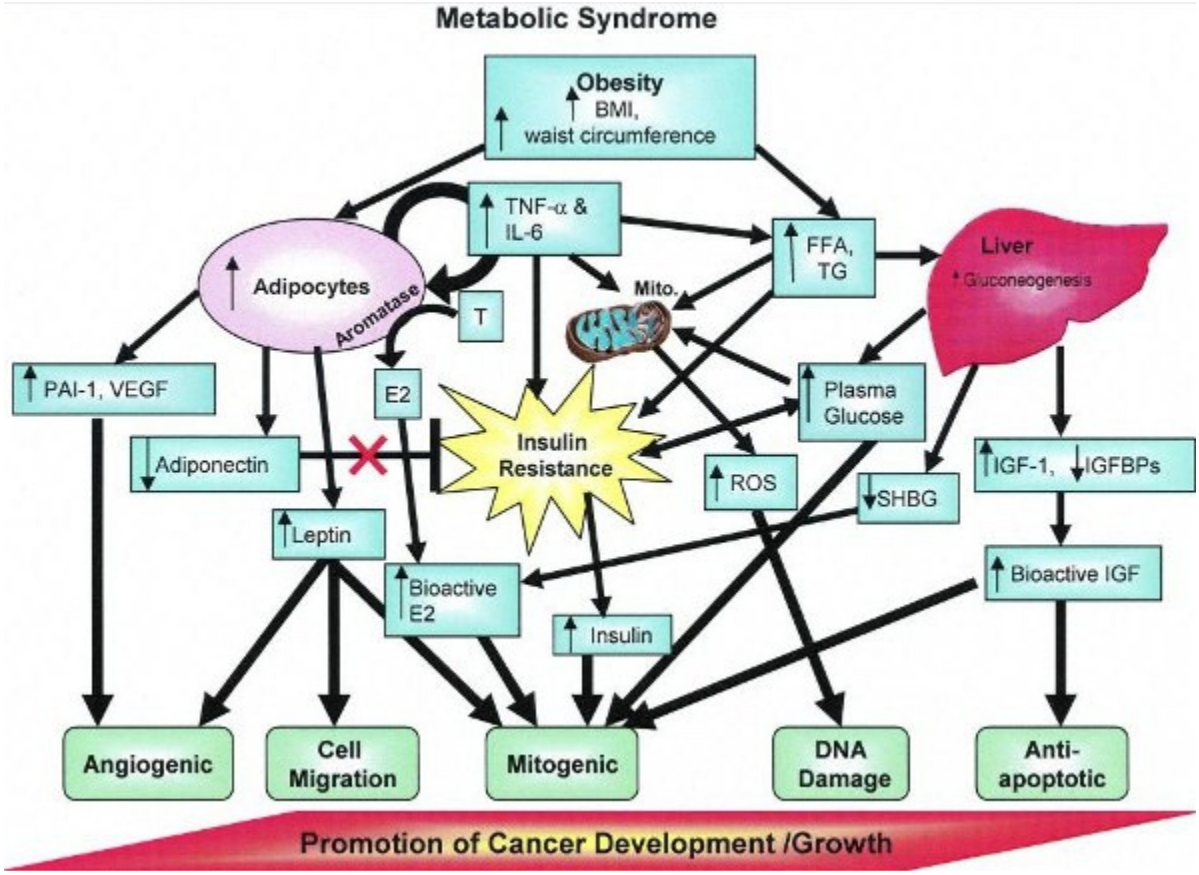
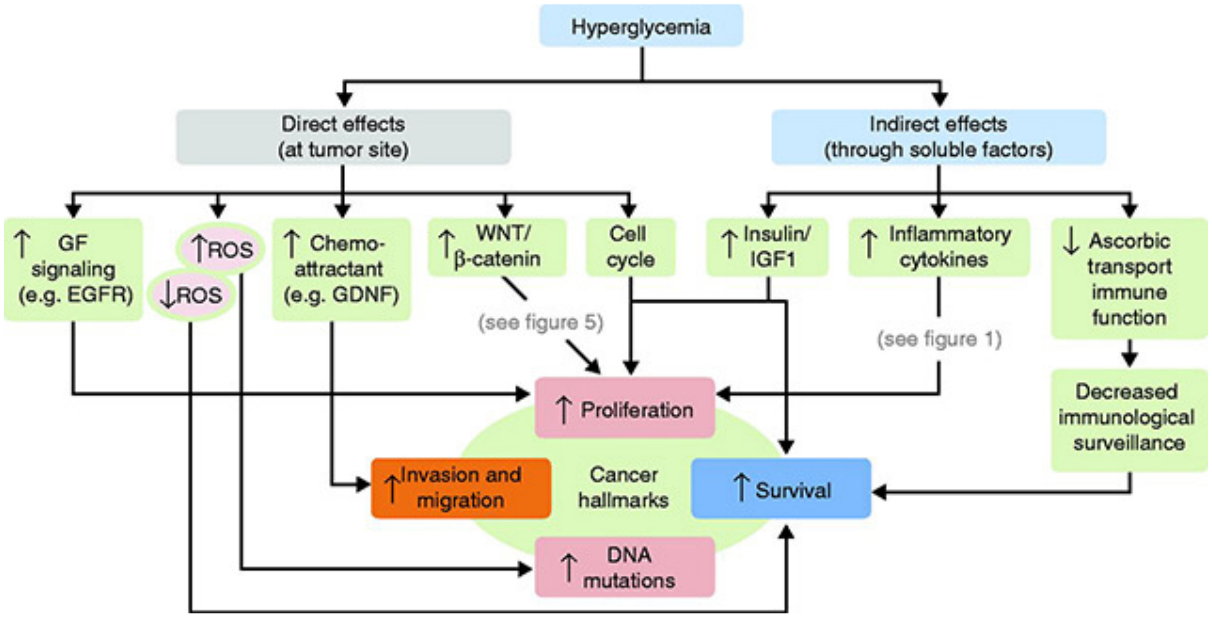


Diagram of factors linking Metabolic Syndrome with cancer development. Plasma glucose, BMI/waist circumference, and triglycerides/FFA affect different complementary processes that can work together to promote cancer development/growth. Additional characteristics of the MS, such as increased HDL and hypertension, are also correlated with cancer growth, but a direct mechanism for these associations has not been confirmed. Abbreviations: E, estrone; E2, estradiol; A, androgens; mito, mitochondria; ROS, reactive oxygen species;

SHBG, sex hormone-binding globulin; FFA, free or nonesterified fatty acids; TG, triglycerides; IGFBPs, insulin-like growth factor-binding proteins



The many mechanisms by which hyperglycemia may feed cancer cells. Hyperglycemia may have direct effects on the tumor site, or indirect effects through soluble factors. To view the additional figures listed in the diagram refer to the Garcia-Jimenez study. Both direct and indirect effects converge on cancer hallmarks (increased proliferation, survival, invasion, and migration and accumulation of mutations in the DNA).

Scientists Yasuhito Onodera, Jin Min Nam and Mina J Bissell report in the Journal of Clinical Investigation (2014, Jan 2, 124(1), 367 - 384), **that increased sugar uptake actually promotes cancer via two pathways - EPAC/RAP1 and O-GicNAc.**

- They showed that the theory that increased glycolysis was a result of cancer was actually wrong and that increased glycolysis (caused by the use of glucose as a fuel) actually caused cancer to form.

There are more than six research studies in the last few years which show that

- **People with the highest levels of blood glucose develop more cancers**
- **People with cancer, who also have the highest blood levels of glucose, survive least**
- **Johns Hopkins scientists have shown starving patients of sugar is crucial in colorectal cancer**

Patrick Quillin, PHD, RD, CNS, former director of nutrition for Cancer Treatment Centers of America in Tulsa, OK, wrote: "It puzzles me why the simple concept 'sugar feeds cancer' can be so dramatically overlooked as part of a comprehensive cancer treatment plan" (Nutrition Science News, April 2000). **I agree. Sugar is cancer's favorite food**. There are at least five reasons that cancer and sugar are best friends."

- Affinity - Cancer cells love sugar. That is why refined carbohydrates like white sugar, white flour, high fructose corn syrup (HFCS) and soft drinks are extremely dangerous for anyone trying to prevent or reverse cancer.
- Sugar essentially feeds tumors and encourages cancer growth. Cancer cells uptake sugar at 10-12 times the rate of healthy cells. In fact, that is the basis of PET (positron emission tomography) scans use radioactively labelled glucose to detect sugar-hungry tumor cells. When patients drink the sugar water, it gets preferentially taken up into the cancer cells and they light up

Sugar, Obesity and Cancer

One of the elephants in the room when talking about sugar and cancer is obesity. According to the American Cancer Society and National Cancer Institute, the real problem is obesity, which is associated with high sugar intake.

- **Overconsumption of added sugar has been singled out by many experts as the most direct causal factor to the long-term development of obesity**
- Epidemiologic analyses have shown numerous associations between consumption of added sugars and higher rates of obesity and diabetes

Obesity alters hormone levels in the body which are associated with a greater risk of both developing cancer and having cancer recur or progress. One of the best things one can do both to prevent cancer in the first place, and prevent recurrence, is to be as lean as possible without being underweight.

- According to a report by Icahn School of Medicine at Mount Sinai, **individuals with obesity and type2 diabetes are at greater risk of developing and dying from multiple cancers**. There are multiple potential metabolic abnormalities that occur in obesity and type 2 diabetes that may explain the increased risk. The report also states that intentional weight loss may protect against cancer development, and therapies for diabetes may prove to be effective adjuvant agents in reducing cancer progression.
- University of Tennessee Health Science Center has concluded that **Fat cells release inflammatory proteins called adipokines. Adipokines can damage DNA and**

eventually cause tumors. The more fat cells an individual has, the more of these proteins he/she is likely to have

- As identified in a 2016 review from a working group assembled by the International Agency for Research on **Cancer being overweight or obese is linked to a higher risk of 13 different types of cancer**, as identified in a 2016 review from a working group assembled by the International Agency for Research on Cancer.

Some evidence linking sugar to specific cancers:

According to results from several cohort studies looking at Glycemic Index (GI), Glycemic Load (GL) and Cancer Risk, higher dietary GI and dietary GL are associated with an increased risk of certain digestive and hormonally related cancers: colorectal, endometrial, breast, and pancreatic in particular

1. **Prostate Cancer:**
   - Mario Negri - Institute of Pharmacological Research conducted a research to find relations between nutrient-based dietary patterns and prostate cancer risk. The findings of the research concluded that **a diet which was high in refined cereals and sugars has an unfavorable role on prostate cancer**.
   - The American Journal of Clinical Nutrition found **that eating refined carbohydrates such as added sugar could increase the risk of prostate cancer**
   - **Sugar also increases levels of estradiol in men**, which has been found to contribute to the development of prostate cancer
   - An Italian study concluded that **refined cereals and sugars boosted prostate cancer risk**

2. **Ovarian Cancer:**
   - Montclair State University's research concluded that **foods that have a high glycemic load may boost the risk of ovarian cancer.**
   - Inflammatory foods have also been linked to a risk of ovarian cancer, and sugar certainly comes under the inflammatory category

3. **Breast Cancer:**
   - Centers for Disease Control and Prevention's study to evaluate the associations of dietary macronutrients, food groups, and eating patterns with risk of breast cancer, suggested a relationship between intakes of sweet items with risk of in-situ and

localized breast cancer in young women. This relation is consistent with the link of **high insulin exposure and risk of breast cancer**.

- University of Texas examined the effect of sucrose enriched diet in the development of primary and metastatic breast tumor and relevant molecular mechanism primarily focusing on 12-LOX pathway and concluded **that dietary sugar induced 12-LOX signaling may play an important role in increased incidence for breast cancer**
  - "We found that sucrose intake in mice comparable to levels of Western diets led to increased tumor growth and metastasis, when compared to a non-sugar starch diet … Prior research has examined the role of sugar, especially glucose, and energy-based metabolic pathways in cancer development. However, the inflammatory cascade may be an alternative route of studying sugar-driven carcinogenesis that warrants further study." — Peiying Yang, PhD, assistant professor of palliative, rehabilitation and integrative Medicine.
- **The researchers pinpointed fructose, a component of table sugar and high-fructose corn syrup, as the responsible sugar facilitating lung metastasis in the breast tumors studies**. Previous epidemiological studies have shown **that dietary sugar intake has an impact on breast cancer development, with inflammation thought to play a role.**
- In 2016, Medical News Today reported on a study that showed that **over half of mice fed a sucrose-rich diet developed breast cancer. The breast cancer was more likely to spread to the lungs in mice fed the sucrose- or fructose-enriched diet compared to the starch-control diet.**
- In an editorial in Nutrition, Dr. Undurti N. Das highlighted the fact that fructose, a constituent of table sugar, or sucrose, changes cell metabolism and raises the activity of cancer-promoting proteins.
- An epidemiological cohort study with over 60,000 Swedish women (part of the Swedish Mammography Cohort) found that **women consuming high glycemic load diets were more likely to develop breast cancer**; particularly estrogen-receptor positive cancer
- A case-controlled population study, conducted in Malaysia, with 382 breast cancer patients and 382 controls showed a **2-fold increased risk of breast cancer among both pre and post-menopausal women who had the highest intake of sugar** (more than 61 grams, or 15 tsp, per day). There was no association observed between total carbohydrate intake and cancer risk. The investigators concluded that this was most likely due to the fact that the Asian Diet is typically high in carbohydrates.

4. **Pancreatic Cancer:**
   - National Cancer Institute's investigation into whether **diets high in foods that increase postprandial glucose levels are associated with an increased risk of pancreatic cancer**. It was found that impaired glucose metabolism may play a role in pancreatic cancer etiology. A diet high in **glycemic load may increase the risk of pancreatic cancer in women** who already have an underlying degree of insulin resistance
   - American Journal of Clinical nutrition's prospective analysis into consumption of sugar and sugar-sweetened foods and the risk of pancreatic cancer observed a significantly greater risk of pancreatic cancer associated with high consumption of added sugar, soft drinks, and sweetened fruit soups or stewed fruit than low consumption of those items
   - A research by University of Texas also indicated a link between diabetes and pancreatic cancer
   - Research conducted at the University of California in Los Angeles (UCLA) found that **pancreatic tumor cells use fructose to divide and proliferate**. In research that challenges the common wisdom that all sugars are the same, the scientists grew pancreatic cancer cells in lab dishes and discovered that tumor cells fed both glucose and fructose metabolized the two sugars in different ways.
     - According to Dr. Anthony Heaney of UCLA's Jonsson Cancer Center, tumor cells thrive on sugar but they use fructose to proliferate. These findings, he said, "have major significance for cancer patients given dietary refined fructose consumption, and indicate that efforts to reduce refined fructose intake or inhibit fructose-mediated actions may disrupt cancer growth"

5. **Gastric Cancer:**

   - In a controlled study of 92 people in France, **consumption of cakes, pastries and candy was associated with an increased risk for gastric cancer**

6. **Biliary Cancer**:

   - Institute of Environmental Medicine in Sweden conducted a large **study** on 70 832 men and found that **high consumption of sweetened beverages may increase the risk of BTC, particularly gallbladder cancer**
   - Another **study** of 477,206 people from **10 European countries discovered a link between soft drinks and hepatocellular carcinoma**
   - Military Medical University of Shanghai explored the relationship between blood glucose concentration and risk of liver cancer by conducting a meta-analysis of

prospective studies. The anlaysis found evidence **that elevated blood glucose increases risk of liver cancer across the range of prediabetes and diabetes**

7. **Endometrial cancer**

- Consumption of high-sugar foods stimulates insulin production, which has been associated with endometrial cancer. In a study conducted on "Sucrose, High-Sugar Foods, and Risk of Endometrial Cancer—a Population-Based Cohort Study" by Emilie Friberg, Alice Wallin and Alicja Wolk concluded that **sucrose intake and consumption of sweet buns and cookies may be associated with increased risk of endometrial cancer**
- According to Dr. Marcus Goncalves, an assistant professor of medicine at Weill Cornell Medicine and an endocrinology fellow in the Cantley Lab, "Endometrial cancer is one of the most insulin-sensitive tumors, and that's because over 90 percent of those tumors have some genetic alteration in PI3K signaling. **Even a small amount of insulin will drive tumor growth**."

8. **Glioblastoma**

- A retrospective study of newly diagnosed patients with **Grade 4 Glioblastoma showed a direct correlation between survival time and blood glucose levels**. The study was conducted between the years 1999-2004 with 191 patients. Patients were untreated except for biopsy and glucocorticoid administrations. Patients received radiation during the study. Results were adjusted for mean daily glucocorticoid dose, age and baseline performance score. The researchers found that higher blood glucose levels were associated with shorter survival times

9. **Colon cancer**

- A team led by Jeffrey Meyerhardt, MD, a medical oncologist with Dana-Farber's Center for Gastrointestinal Oncology, found that stage III colon cancer patients undergoing chemotherapy with high GL and higher total carbohydrate intake were more likely to experience worse overall survival than those with low GL, especially in those who were overweight. "**Higher dietary glycemic load and total carbohydrate intake were statistically significant associated with an increased risk of recurrence and mortality in stage III colon cancer patients**"

- One study of over 35,000 US residents found that sucrose consumption was linked to colon cancer. Similarly, another investigation concluded that **dietary sugars – especially foods high in simple carbohydrates – boosted the risk of colon cancer**

10. **Lung Cancer**

    Jung-whan Kim, Ph.D. of the University of Texas at Dallas hopes to improve lung cancer treatments, particularly targeted therapies, by studying the connection between glucose (sugar) and squamous cell carcinoma, a type of lung cancer that accounts for 25 to 30 percent of all lung cancers.

    - Kim and his team have found that **sugar serves as an energy supply for this kind of lung cancer, aiding in the tumor's growth and survival.**
    - Upon further investigation, their research suggests that this "addiction" of squamous cell carcinoma to sugar could lead to treatment strategies by interrupting the body's process of metabolizing sugar or possibly even restricting the amount of sugar in a person's diet.
    - Kim's findings, "The distinct metabolic phenotype of lung squamous cell carcinoma defines selective vulnerability to glycolytic inhibition," were published in Nature Communications

11. **Head and Neck cancers**
    - According to a study by Anna E. Arthur, a professor of food science and human nutrition at the University of Illinois, **consuming high amounts of carbohydrates and various forms of sugar during the year prior to treatment for head and neck cancer may increase patients' risks of cancer recurrence and mortality**
    - However, eating moderate amounts of fats and starchy foods such as whole grains, potatoes and legumes after treatment could have protective benefits, reducing patients' risks of disease recurrence and death

Conclusion

Research is still underway to determine if sugar directly causes cancer, or if sugar is a contributing factor only after cancer cells have developed. What is certain however is that sugar is bad for cancer prevention and treatment

Controlling sugar intake will help create the best environment for a healthy immune response and prevent causative risk factors for cancer, which are still being discovered