Cold Exposure and Immune Function

We have lots of choices to make about our diet and to that doing the right thing when it comes to treating a chronic disease or fighting a virus or losing weight and suddenly our nutrition choices can seem almost overwhelming. Well, I'm here to help. Welcome to the NutritionFacts podcast. I'm your host Dr. Michael Greger. Today we look at the different ways we can improve immune function and we start with one that might surprise you. >> Several studies have demonstrated that cold temperatures may be a potential risk factor for cancer development. For example, this study compared the 50 countries with the highest cancer rates to the countries with the lowest cancer rates and conclude that people living in cold environments may have a higher risk of getting and dying from cancer.

A similar study within the United States found that colder counties were associated with a greater cancer incidence. But couldn't something like vitamin D exposure better explain these findings?

Patients diagnosed with cancer during summer months may have a better prognosis than those diagnosed during the winter, but again this could be because of the sunshine vitamin, vitamin D. Evidently an animal colony had less cancer when they moved from a colder country to a warmer country based on some observation published in 1939. That seems a bit of a stretch. But then this study was published. Standard housing temperatures for laboratory mice in research facilities is mandated to be between 20 and 26°C unlike typical room temperatures in the 70s Fahrenheit.

But that's chilly for mice causing chronic mild cold stress. When that stress is alleviated by housing at warmer temperatures like in the 80s Fahrenheit, researchers observed a striking reduction in tumor formation, cancer growth rate, and metastasis. Warmer was better.

They They that the cold stress results in a suppression of anti-tumor immunity. Then why do they keep mice at that lower temperature? It reduces the frequency of cage cleaning and helps ensure the thermal comfort of the staff. The proposed mechanism is the activation of the fight or flight response at least through the release of the stress hormone norepinephrine, also known as noradrenaline.

Take a dip in a typical cold plunge and there can be a doubling of norepinephrine levels in the blood within minutes. And we don't seem to habituate, meaning we get that same bump in norepinephrine after each cold water immersion, even after 3 months of regular plunges.

Might that be suppressing immune function? Or might it instead be hormesis, that which doesn't kill us makes us stronger? Cold water swimmers claim to suffer fewer and milder infections as a result of the practice. Even if that's true, cold water swimmers are swimming. Maybe it's the exercise, not the cold. How would we figure this out? To control for any effect of swimming, researchers compared cold water swimmers to indoor heated pool swimmers and found no difference in upper respiratory tract susceptibility between swimmers in cold water and heated pools. Therefore, cold water swimming appears to have no protective effect. What about regularly taking cold showers? Cold showers were first designed for the purpose of {quote} treating the insane and then used as an instrument of torture in prisons before it started killing too many people. Rather than being abandoned, however, the shower was transformed by the use of warm water to actually clean people. No idea. If you randomize people to short daily cold showers versus hot showers for a few months, regular cold shower exposure does appear to put the immune system on high alert. Does that actually translate into less sickness?

Vegetables, Fruits, and Infection Risk

There's only been this one randomized trial on the effect of cold showering on health and work, a randomized controlled trial. Participants were randomized to shower as normal, but end their showers with 0, 30, 60, or 90 seconds of cold water. And compared to the no cold group, the different cold water groups collectively had a 29% reduction of self-reported sick leave from work, but no fewer self-reported days of sickness.

Uh so, maybe the cold showering made them less sick even though they were sick for the same duration. The [clears throat] problem, of course, is that while there was a control group, there was no placebo control. So, maybe the cold showering groups chose to skip work less for some reason.

It's not clear, but at least it didn't seem to show cold showering was harmful to immune function, at least in the short run in healthy [music] adults.

In our next story, we look at which vegetables boost immune [music] function the most. What we eat or don't eat can affect [music] our immune system. This study was conducted to determine the effect of the consumption of brightly colored vegetables on the immune system.

The first 2 weeks, basically no fruits and veggies. Then 2 weeks drinking a cup and a half of tomato juice every day. Then carrot juice. Then spinach powder.

Within just 2 weeks of a fruit and veggie deficient diet, immune function plummets. But just a cup and a half of tomato juice and can bring us back from the ashes. Not five servings a day, just that one tall glass of tomato juice. But the carrot juice alone didn't seem to help as well. Nor did the powder equivalent of about one serving of spinach. This says to me two things. One, how remarkably we can affect our immune function with simple dietary decisions.

And two, not all veggies are alike. Though this study was repeated looking at other immune markers and the tomato versus carrot appeared more evenly matched, there is one family of vegetables we definitely don't want to miss out on. Inflammation, leaky gut, all because of an absence of AHR ligands. In other words, an absence of cruciferous vegetables in our diet. Cabbage, collards, cauliflower, kale, brussels sprouts, broccoli.

So, do people who eat healthier actually get sick less? Those who eat more fruits and vegetables appear to have a lower risk of getting an upper respiratory tract infection like the common cold, whether they're otherwise vegetarian or not. Even just one added apple a day may help keep the doctor away. Uh the common cold is so innocuous, though. Why not test against something stronger?

One can also look at more serious respiratory infections like influenza. Looking at the relationship between various risk factors and influenza-related hospitalizations in the United States, they found that a 5% increase in the prevalence of obesity was bad, associated with 6% increased hospitalization rate, but physical inactivity was worse, 7%. But just that tiny bump in the rates of low fruit and vegetable consumption may increase flu-related hospitalization rates even more. And the common cold isn't always innocuous. A common cold during the first trimester of pregnancy is associated with a number of birth defects, including one of the worst, um anencephaly, a fatal malformation of the brain.

More recent data suggests it's the fever, as anti-fever drugs appeared able to prevent the possible birth defect-causing effect of the common cold. But But better to not get sick in the first place. A thousand women in their diets were followed before and during pregnancy, and women who consumed more fruits and vegetables had a moderate reduction in risk of upper respiratory tract infection during pregnancy, and this benefit appears to be derived from both fruits and vegetables instead of either alone. Whole fruits and vegetables provide a natural balance of all sorts of things that may improve our immune function in a complementary, combined, or synergistic manner that could account for the protective effect observed from high consumption of both fruits and vegetables. Or maybe that's the only way they got enough. The women who appeared protected in the study were eating nearly nine servings of fruits and vegetables a day compared with only five servings of fruits or four of veggies. That may fulfill some arbitrary five or six a day minimum, but may be insufficient for effective immunity.

For example, in that famous study I profiled previously, elderly individuals randomized into a five a day group did have an improved antibody response to their pneumonia vaccination compared to just two servings of fruits and veggies a day, an 80% increase.

Exercise, Vaccines, and Infection Prevention

But only 30% reached their target levels, 12 out of 40. Six times better than the two a day group, but maybe eight, nine, or 10 a day would have worked even better.

Did you know that exercising may make our immune system more than five times better at fighting infection? Exercise [music] can boost our immune system by so much that we can reduce the number of symptom days by 25 to 50%.

Imagine if there was some drug that could do that. Would rake in billions, whereas exercise is free and tends to only have good side effects. It doesn't even take much of a workout to get results. Studies find that if you let kids run around for just 6 minutes, the levels of immune cells circulating their blood can increase by 50% as they pour from the bone marrow and redeploy throughout the body. Even moderate exercise can also boost IgA production, protective antibodies that coat all of our moist membranes.

Compared to a sedentary control group, those who performed aerobic exercises for 30 minutes three times a week for 12 weeks had a 50% increase in the levels of IgA in their saliva and reported significantly fewer flu-related symptoms. Salivary IgA levels are associated with lower overall mortality risk over time, particularly cancer mortality, perhaps as a proxy for immune function more generally, and you can boost those levels with exercise. Exercise may also boost the activity of natural killer cells, our immune soldiers that focus on eliminating both tumor cells and virus-infected cells. Here are five different types of cancer growing in a petri dish, mostly leukemias and lymphomas. Draw blood from people and drip on some of their natural killer cells into the dish and they start killing off the cancer cells. Okay, but that was blood taken from someone before exercise. Draw blood after 30 minutes of cycling and drop on the same number of natural killer cells and they each kill cancer about 60% better. This may be one of the reasons why exercise seems to help both prevent cancer and improve cancer survival.

Might it improve vaccination responses? If aerobic exercise gets your immune cells to spill out from your bones, can't you just flouch on the couch all year and just jump up and take a brisk walk right before getting the jab?

Studies to this effect performed on young adults had inconsistent results. For example, improving the antibody response to a flu vaccine in women but not men or to a meningitis vaccine in men but not women.

Against half doses or weaker vaccines, acute exercise interventions appeared to work better suggesting perhaps a ceiling effect whereby their immune responses were normally so robust, exercise might not improve them further. But maybe it would work more consistently in older adults.

Sadly, 45-minute moderate-intensity aerobic exercise right before flu or pneumonia vaccinations didn't seem to help in older adults. Even 2 [clears throat] months of 45-minute moderate-intensity daily activity 6 weeks before and 2 weeks after vaccination appeared insufficient to make a difference. Eccentric resistance exercise, for example, slowly lowering heavy dumbbells after bicep curls or lateral raises to inflame the muscles right before the vaccine goes in also doesn't seem to be a viable strategy. What about exercise to reduce infection risk directly? In a study entitled moderate exercise protects mice from death due to influenza virus, mice exercised for 20-30 minutes 4 hours after flu virus exposure and then each of the next 3 days had nearly twice the survival rate, 18% dying compared to 57% dead in the sedentary group. There's nothing so dramatic in the human literature, but based on a study that followed more than a thousand adults through flu season, those who exercised even just a few days a week were sick about 40% fewer days than sedentary individuals. Randomized controlled interventional trials back this up. For example, one study found that while elderly sedentary women randomized to a mild range of motion and flexibility calisthenics control group had a 50% chance of getting an upper respiratory illness during the fall season. Those randomized to begin a half hour a day walking program dropped their risk down to 20%. For conditioned athletes though, the risk was just 8%. Exercising could potentially make our immune systems more than five times better at fighting infection.

In a year-long study, sedentary postmenopausal women randomized to 45 minutes of moderate intensity exercise five days per week were experiencing three times fewer colds by the end of the study compared to the control group who instead randomized to weekly stretching sessions. Even though the exercise group only ended up exercising around four times a week.

A similar study of younger overweight women found that 15 weeks of daily walking cut the number of days sick from upper respiratory tract infection symptoms in half. Though [clears throat] this was due to cutting the duration of each episode in half rather than cutting down on the frequency of illness.

In terms of more serious infections, randomizing older men and women to one hour exercise classes twice a week for two years did not unfortunately cut down the risk of coming down with pneumonia. Although yoga training can improve lung function in the elderly, it has yet to be shown to help prevent pneumonia either. There was however a treatment trial of yoga breathing exercises for pulmonary tuberculosis performed in India.

Compared to a mindfulness meditation breathing awareness control group, those randomized to a yoga group cleared their active infections faster. Even laughter yoga might help. The evolution of laugh is thought to have been as an antidote to stress, the release of nervous energy. Within 60 minutes of people watching a comedy video complete with Gallagher's classic Sledge-O-Matic finale, levels of the stress hormone cortisol in their bloodstreams were cut by more than half.

Since cortisol acts as an immunosuppressant, which is why cortisol-like steroids like prednisone are used for inflammatory autoimmune diseases, the drop in cortisol with laughter may explain why those laughing heartily at a humorous video had improvements in natural killer cell function compared to those randomized to a control group watching tourism videos.

Replicating these results today might [music] be difficult given the choice of comedic stimulus, Bill Cosby. Visit nutritionfacts.org/audio to see all the podcast episodes with descriptions that include links to [music] their associated videos. Sources cited and other details are available on each video's page. Information about my books, How Not to Die, How Not to Diet, and How Not to Age is all at nutritionfacts.org/books, [music] including some of the newer titles, including Lowering LDL Cholesterol Naturally [music] with Food. All proceeds from all book sales uh that I get go to charity. And I've got a new book in the publication pipeline, How Not to Hurt. It's going to be available on December 15th of this year, 2026. And don't forget to sign up for our free newsletter, nutritionfacts.org/subscribe, to stay updated on the latest bite-size [music] videos and articles. Nutritionfacts.org is a science-based nonprofit, and everything on the website is free. There are no ads, no corporate sponsorship, no kickbacks, strictly non-commercial, not selling anything.

Just put it up as a public service, as a labor of love, as a tribute to my grandmother, whose own life was saved [music] with evidence-based nutrition.

Thanks for listening.